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Network Data Management Protocol (NDMP) User Guide

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Preface

As part of an effort to improve its product lines, EMC periodically releases revisions of its software and hardware. Therefore, some functions that are described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

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Note

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Purpose

This document describes how to use the NetWorker software to provide data protection for NDMP filers.

Each filer-specific chapter contains an end-to-end workflow that describes how to configure NetWorker to use the NDMP protocol to protect the filer data.

Audience

This guide is a part of the NetWorker documentation set, and is intended for use by system administrators who are responsible for setting up and maintaining backups on a network, and Network Attached Storage (NAS) filer administrators.

Revision history

The following table presents the revision history of this document.

Table 1 Revision history

Revision	Date	Description
04	June 29, 2016	Updated this document for EMC NetWorker 9.0.1. with the following information: • Support for Isilon Multi-Streaming. • Ability to enable the "NDMP log successful file recovery" option. • Support for Token Based Backup.
03	April 13, 2016	Updated the section "Performing schedule backup and clone operations" in each filer chapter with the following changes: • Modified the order in which you create data protection policy resources. • Added a new section "Default data protection policies."
02	December 14, 2015	Minor updates of this document for EMC NetWorker 9.0.

Table 1 Revision history (continued)

Revision	Date	Description
01	September 24, 2015	First release of this document for EMC NetWorker 9.0.

Related documentation

The NetWorker documentation set includes the following publications, available on EMC Online Support:

- *EMC NetWorker Online Software Compatibility Guide*
  Provides a list of client, server, and storage node operating systems supported by the EMC information protection software versions. You can access the Online Software Compatibility Guide on the EMC Online Support site at https://support.emc.com. From the Support by Product pages, search for NetWorker using "Find a Product", and then select the Install, License, and Configure link.
- *EMC NetWorker Administration Guide*
  Describes how to configure and maintain the NetWorker software.
- *EMC NetWorker Network Data Management Protocol (NDMP) User Guide*
  Describes how to use the NetWorker software to provide data protection for NDMP filers.
- *EMC NetWorker Cluster Integration Guide*
  Contains information related to configuring NetWorker software on cluster servers and clients.
- *EMC NetWorker Installation Guide*
  Provides information on how to install, uninstall, and update the NetWorker software for clients, storage nodes, and servers on all supported operating systems.
- *EMC NetWorker Updating from a Previous Release Guide*
  Describes how to update the NetWorker software from a previously installed release.
- *EMC NetWorker Release Notes*
  Contains information on new features and changes, fixed problems, known limitations, environment and system requirements for the latest NetWorker software release.
- *EMC NetWorker Command Reference Guide*
  Provides reference information for NetWorker commands and options.
- *EMC NetWorker Data Domain Boost Integration Guide*
  Provides planning and configuration information on the use of Data Domain devices for data deduplication backup and storage in a NetWorker environment.
- *EMC NetWorker Performance Optimization Planning Guide*
  Contains basic performance tuning information for NetWorker.
- *EMC NetWorker Server Disaster Recovery and Availability Best Practices Guide*
  Describes how to design and plan for a NetWorker disaster recovery. However, it does not provide detailed disaster recovery instructions. The Disaster Recovery section of the NetWorker Procedure Generator (NPG) provides step-by-step disaster recovery instructions.
- *EMC NetWorker Snapshot Management Integration Guide*
  Describes the ability to catalog and manage snapshot copies of production data that are created by using mirror technologies on EMC storage arrays.
- *EMC NetWorker Snapshot Management for NAS Devices Integration Guide*

Describes how to catalog and manage snapshot copies of production data that are created by using replication technologies on NAS devices.

- *EMC NetWorker VMware Integration Guide*
  Provides planning and configuration information on the use of VMware in a NetWorker environment.
- *EMC NetWorker Error Message Guide*
  Provides information on common NetWorker error messages.
- *EMC NetWorker Licensing Guide*
  Provides information about licensing NetWorker products and features.
- *EMC NetWorker REST API Getting Started Guide*
  Describes how to configure and use the NetWorker REST API to create programmatic interfaces to the NetWorker server.
- *EMC NetWorker REST API Reference Guide*
  Provides the NetWorker REST API specification used to create programmatic interfaces to the NetWorker server.
- EMC NetWorker Management Console Online Help
  Describes the day-to-day administration tasks performed in the NetWorker Management Console and the NetWorker Administration window. To view the online help, click **Help** in the main menu.
- EMC NetWorker User Online Help
  The NetWorker User program is the Windows client interface. Describes how to use the NetWorker User program which is the Windows client interface connect to a NetWorker server to back up, recover, archive, and retrieve files over a network.

Special notice conventions that are used in this document

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NOTICE

Identifies content that warns of potential business or data loss.

Note

Contains information that is incidental, but not essential, to the topic.

Typographical conventions

EMC uses the following type style conventions in this document:

Table 2 Style conventions

Bold	Used for names of interface elements, such as names of buttons, fields, tab names, and menu paths (what the user specifically selects or clicks)
Italic	Used for full titles of publications that are referenced in text
`Monospace`	Used for: • System code • System output, such as an error message or script • Pathnames, file names, prompts, and syntax • Commands and options
Monospace italic	Used for variables

Table 2 Style conventions (continued)

`Monospace bold`	Used for user input
[ ]	Square brackets enclose optional values
|	Vertical bar indicates alternate selections - the bar means “or”
{ }	Braces enclose content that the user must specify, such as x or y or z
...	Ellipses indicate non-essential information that is omitted from the example

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CHAPTER 1

Introduction

This chapter includes the following topics:

- Overview of NDMP 16
- Components in a NetWorker NDMP environment 16
- Configurations in a NetWorker NDMP environment 16
- Pre-configuration requirements for NDMP data operations 22

Overview of NDMP

The network data management protocol (NDMP) is a TCP/IP-based protocol that specifies how network components talk to each other for the purpose of moving data across the network for backup and recovery.

The NDMP protocol addresses the problems associated with backing up data in heterogeneous environments when you use different operating system vendors, backup developers, and Network Attached Storage (NAS) devices.

NDMP enables disparate vendors to use a common NDMP protocol for the backup architecture. With the NetWorker NDMP interface, you can connect to hosts that have an active NDMP Service or an NDMP data module installed. You do not install the NetWorker software on the NDMP host. NDMP allows a NAS device to back up data to other NDMP-controlled tape or disk devices that are on the network. NDMP passes control of the data and the file metadata to and from the NetWorker software.

The NetWorker server by default attempts to establish communications with a NAS filer by using NDMP version 4. If the NAS does not support or use NDMP v4, communications are autonegotiated to use the highest version that the NAS filer supports. NetWorker supports NDMP v3 and later however, there are some NetWorker features that require a specific version of NDMP on the NAS.

The *EMC NetWorker Hardware Compatibility Guide* on the EMC Online Support web site provides a list of NAS filers that the NetWorker software supports.

Components in a NetWorker NDMP environment

Three main components support NDMP data operations with the NetWorker software.

- NDMP Data Server—The system that contains the NDMP data. The NDMP Data Server is also known as the datamover, the NDMP client, or the NAS filer. The NAS transfers the data to the primary storage devices though a data connection. You configure the NAS as a client of the NetWorker server; however, you do not install the NetWorker client software on the NAS.
- NDMP Tape Server—The host with the backup device to which NetWorker writes the NDMP data.
- Data Management Agent(DMA)—The NetWorker server is the DMA.
  The DMA:
  - Initiates the NDMP backup.
  - Monitors the NDMP backup and recover operations.
  - Maintains the media database and the client file index entries for NDMP backups.
  - Maintains the resource database information for the NAS and NDMP Tape Server.

Configurations in a NetWorker NDMP environment

You can use three methods to configure the NDMP Data Server and the NDMP Tape Server to perform backups and recoveries. You can customize the NetWorker environment to support NDMP data operations in each scenario:

- NDMP local backup on page 17—The NDMP Data Server and the NDMP Tape Server reside on the same physical host.

- NDMP backups to non-NDMP devices (NDMP-DSA) on page 18—An NDMP Data Server Agent (NDMP-DSA) sends the NDMP data from the NDMP Data Server to the non-NDMP devices.
- Three-party backup with NDMP devices on page 21—The NDMP Data Server and the NDMP Tape Server reside on different physical hosts. The NAS passes NDMP metadata to the NetWorker server. The NetWorker server sends the data to an NDMP tape device attached to another NDMP Server.

The following table summarizes the differences between the NDMP Tape Server and NDMP-DSA.

Table 3 Distinctions between NDMP Tape Server and NDMP-DSA

NDMP Tape Server	NDMP-DSA
Supports only the NDMP type of tape device.	Supports any type of device that the NetWorker software supports.
Does not support backup to disk.	Supports backup to disk.
Does not support multiplexing.	Supports multiplexing.

NDMP local backup

In an NDMP local backup (Direct-NDMP), the NDMP Data Server (NAS) sends data to a locally attached tape device or library. The `nsrndmp_save` program runs on the NetWorker server, and only the metadata and the NDMP control information traverse the network between the NetWorker server and the NDMP host.

Advantages:

The NDMP data does not traverse the network, this prevents network congestion.

Disadvantages:

- The `nsrndmp_save` program queries the NDMP Tape Server at consistent intervals to determine the status of a backup. These queries have an impact on backup performance.
- The NetWorker software does not multiplex NDMP save sets and writes NDMP data serially to the local device. As a result, backups are faster, but recoveries are slower.
- NDMP local backups are not suitable when there are many large file systems to back up on a NAS filer.
- You cannot archive NDMP save sets.

The NetWorker server, or data management application (DMA), performs these tasks:

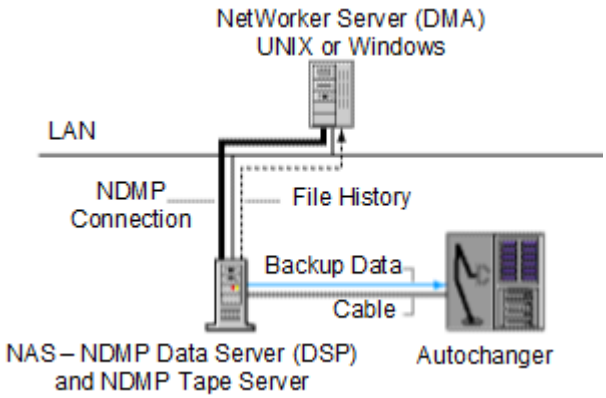
- Starts the backup or the recovery request through the NDMP connection.
- Receives the file history information from the data server.

During a backup, the NAS filer is the NDMP Tape Server and the NDMP Data Server. The NAS filer performs the following tasks:

- Receives the backup requests.
- Reads the backup data on the NAS disks.
- Produces a data stream for the backup.
- Writes the data stream to the tape or file device.

The following figure illustrates a local backup configuration.

Figure 1 NDMP local backup configuration



NDMP backups to non-NDMP devices (NDMP-DSA)

In this scenario, the NetWorker software writes NDMP data to non-NDMP devices, including tape, virtual tape, AFTD, and Data Domain devices. NDMP-DSA backups are more flexible than backup to NDMP devices, since NDMP devices must be tape (physical or virtual).

Use NDMP-DSA backups when any of the following scenarios are true:

- There are many small file systems to backup, and network throughput is not a concern.
- There is no autochanger (physical or virtual) available for backups.
- The NAS system is not attached to a SAN for communication with an autochanger (physical or virtual).

Also, directing NDMP staged and cloned data to a non-NDMP device is faster than sending the data to an NDMP device.

The NetWorker software uses the NDMP Data Server Agent (DSA) and the `nsrndmp_save` command to send NDMP data to a non-NDMP device. The process that is associated with DSA is `nsrdsa_save`.

The benefits of using NDMP-DSA include the ability to:

- Write NDMP data to devices that also contain non-NDMP data.
- Multiplex NDMP save sets to improve backup speeds. Recovery speeds are slower.
- Stage save sets from the disk to tape.
- Archive NDMP save sets.

You can back up NDMP data to a non-NDMP device in one of two ways:

- NDMP data sent to non-NDMP devices that are local to the NetWorker server.
- NDMP data sent to non-NDMP devices that reside on a NetWorker storage node.

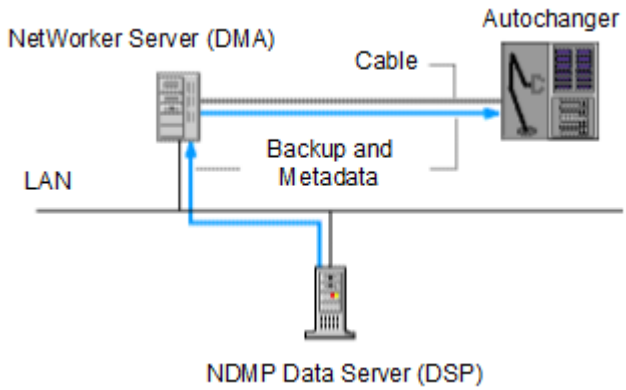
NDMP data sent to non-NDMP devices that are local to the NetWorker server

When you send NDMP data to non-NDMP devices that are local to the NetWorker server:

- The backup data traverses the network between the NetWorker server and the NDMP Data Server.
- The metadata, the NDMP control information, and the FH remain local to the NetWorker server and still traverse the network.

The following figure illustrates a NetWorker storage device that is directly attached to the NetWorker server. The NetWorker server starts an NDMP-DSA backup. The `nsrmmd` process on the NetWorker server processes the data and metadata. The `nsrndmp_2fh` and `nsrdmpix` processes on the NetWorker server process the file history (FH) data and then pass the FH data to the `nsrindexd` process.

Figure 2 Backup started from a NetWorker server with an attached storage device



To configure NDMP data sent to non-NDMP devices local to NetWorker server, set NetWorker server to the Storage Nodes field on the NDMP client properties, or set the non-NDMP devices to the media pool.

NDMP data sent to non-NDMP devices that reside on a NetWorker storage node

You can configure NDMP backups to write data to a NetWorker storage node in one of two ways.

Immediate save (nsrdsa_save runs on storage node)

When you configure an NDMP backup with immediate save, the following actions occur:

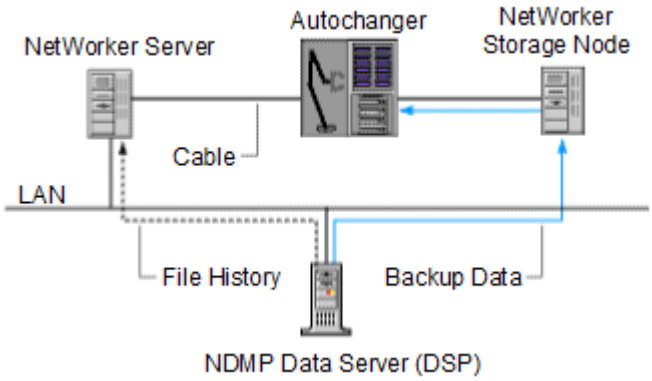
- The `nsrdsa_save` backup command runs on the NetWorker storage node.
- The NetWorker software uses TCP/IP and shared memory to communicate between the `nsrdsa_save` and `nsrmmd` processes.
- The NetWorker server processes the backup data and sends the data to the non-NDMP device directly through the `nsrmmd` process on the storage node.

When the NetWorker software uses immediate save to send the NDMP data, the following actions occur:

- The `nsrindexd` process on the NetWorker server processes the file history.
- After the data backup completes and the sessions with the NDMP Data Server and the NetWorker server close, the NetWorker software commits the file history to the client file index associated with the NDMP client.

The following figure illustrates a NetWorker configuration that uses immediate save.

Figure 3 NDMP backup that uses immediate save



To configure immediate save:

1. Add the DSA host which runs `nsrdsa_save` to the remote access list of the NDMP client resource.
2. Add the `-M -P <proxy-host>` option for the `nsrndmp_save` command, or add **`NSR_DSA_NODE=<proxy-host>`** in the Application Information attribute in the Client Resource configuration. Here the proxy-host is the DSA which runs `nsrdsa_save`. If both options are configured, the second one takes precedence.
3. Set the storage node attached with the non-NDMP devices to the **Storage Nodes** field on the NDMP client properties, or set the non-NDMP devices on the target storage node to the media pool. Please note the storage node here could be same with or different from the DSA which runs `nsrdsa_save` configured in the previous steps.

Examples

Below are two examples displaying the configuration for NDMP backup with DSA which is not on a NetWorker server.

Example 1: DSA and storage node on the same host

Host Type	Name	IP
NDMP filer	ndmp-server	10.0.0.1
NetWorker server	nw-server	10.0.0.2
DSA host/ Storage node	sn-server	10.0.0.3

1. Create an NDMP client *ndmp-server*.
2. Add storage node *sn-server* and the non-NDMP devices attached on it.
3. Add *sn-server* to the Remote Access list of the client properties of *ndmp-server*.
4. Add sn-server to the **Storage Nodes** field of the client properties of ndmp-server.
5. Add **`-M -P sn-server`** to the option of the backup command `nsrndmp_save` for the client *ndmp-server* or add **`NSR-DSA-NODE=sn-server`** to the application information of the client ndmp-server.

Example 2: DSA and storage node on different hosts

Host Type	Name	IP
NDMP filer	ndmp-server	10.0.0.1
NetWorker server	nw-server	10.0.0.2

Host Type	Name	IP
DSA host	dsa-server	10.0.0.3
Storage node	sn-server	10.0.0.4

1. Create an NDMP client *ndmp-server*.
2. Add storage node *sn-server* and the non-NDMP devices attached on it.
3. Add *dsa-server* to the Remote Access list of the client properties of *ndmp-server*.
4. Add *sn-server* to the Storage Nodes field of the client properties of *ndmp-server*.
5. Add **`-M -P dsa-server`** to the option of the backup command `nsrndmp_save` for the client *ndmp-server* or add **`NSR-DSA-NODE=dsa-server`** to the application information of the client *ndmp-server*.

Non-immediate save (nsrdsa_save runs on NetWorker Server)

By default, NDMP backups to a non-NDMP device uses non-immediate save.

When you configure an NDMP backup to use non-immediate save, the following actions occur:

1. The `nsrdsa_save` backup command runs on the NetWorker server.
2. The `nsrdsa_save` process uses TCP/IP to read the data in a local buffer.
3. The `nsrdsa_save` process transmits the data to the `nsrmmd` process on the storage node.
4. The `nsrmmd` process writes the data to the storage device.

This approach is inefficient and has slow performance for the following reasons:

- Backup data traverses the network between the NetWorker server, the NDMP host, and the NetWorker storage node.
- Metadata and the NDMP control information traverse the network between the NetWorker server and the storage node.
- FH traverses the network between the NetWorker server and the NDMP Data Server.

To configure Non-immediate save, set target storage node to the Storage Nodes field on the NDMP client properties or set the non-NDMP devices on the target storage node to the media pool.

Three-party backup with NDMP devices

A three-party backup, or three-way backup, sends NDMP data to an NDMP Tape Server, but the NDMP Data Server and the NDMP Tape Server are not the same physical host.

In addition to the NetWorker software sending the NDMP data to non-NDMP devices type of three-party backup, the NetWorker software sends NDMP data to NDMP devices. In this scenario, the data flows from the NDMP Data Server to the NDMP Tape Server, and then to a library locally attached to the NDMP Tape Server. In this configuration, you cannot archive the NDMP save sets.

In addition to using a NetWorker server or storage node as the NDMP Tape Server, you can also use a DinoStor Tape Server, which is a third party NDMP Tape Server. This hardware connects one or more libraries to the network and allows you to back up any NDMP host to one location instead of requiring a local backup device for each server.

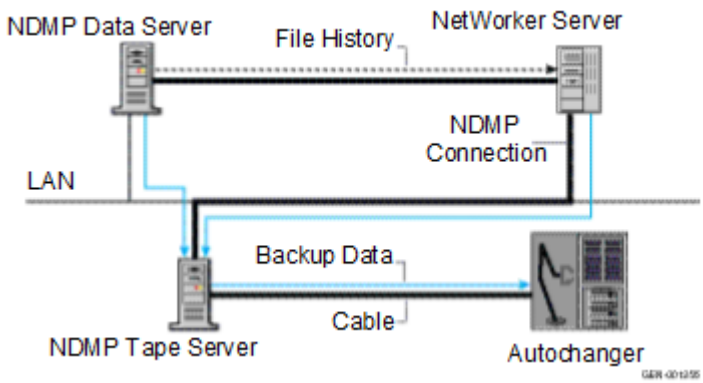
The following figure shows a three-party configuration, which enables backup and recovery operations on an NDMP device attached to another NDMP server.

In this example:

- One server is the data server.
- The second server is the tape server.
- The third party is the NetWorker server (DMA).

This configuration is similar to the flow of data between a NetWorker client and a NetWorker server or storage node, except that it is not necessary to install the NetWorker software on either of the NDMP hosts. Data flows from the NDMP Data Server over the network to the NDMP Tape Server and then to tape. The NDMP Data Server sends the metadata to the NetWorker server.

Figure 4 Three-party NDMP backup to NDMP devices



Pre-configuration requirements for NDMP data operations

This section provides the requirements to review before you configure the NetWorker software for NDMP data operations.

Note

The *EMC NetWorker Security Configuration Guide* describes how to determine port requirements for NDMP backups and recoveries when a firewall exists in the NetWorker datazone.

Locale requirements with NDMP

When running NDMP backups, ensure that you use consistent locale settings in the environment.

- NetWorker supports the UTF-8 format with CIFS clients. NetWorker only supports NFS clients of a NetApp filer when the NFS clients can generate UTF-8 encoded data. If you set the *UTF8=Y* variable during an NDMP backup and the backup contains path names with non-ASCII characters, then index-based recoveries of the backup fail with an error message similar to the following:

  ```
  RESTORE: could not create path pathname
  ```

- If you use *UTF8=Y* variable and perform a backup, then you must recover path names that contain non-ASCII characters by using either a save set recovery from the command line or an NDMP Directory restore.
- All UNIX locale settings on the NAS filer, including UTF-8 are the same.
- Configure the NAS filer to use UTF-8 character sets. Contact the NAS vendor for configuration requirements.

- Use only UNIX NMC clients that have the same locale setting as the NAS filer.
- You can perform backup and recovery operations in any locale. However, if you try to browse in a locale that is different from the original locale, then the file names appear as random characters.
- A single save set supports data that belongs to only one code set. If you have data in multiple code sets, you must create multiple save groups.
- A save set can contain file names that belong to different languages if all characters in those languages belong to the same code set. For example, ISO 8859-1 and ISO 8859-15 include most Western European languages, such as French, Spanish, and Portuguese. NetWorker can back up file names from these languages in a single save set.

Memory and space requirements for NDMP FH updates

During an NDMP backup, the NDMP Data Server sends the FH metadata information to the NetWorker server. The NetWorker software does not verify or modify FH metadata received from the NAS. The NetWorker software uses the FH information to maintain appropriate indexes and media database entries for the NDMP client backups.

The `nsrndmp_2fh` and `nsrdmpix` binaries interact with the raw database, instead of virtual memory, to process the FH metadata. As a result, memory requirements for this process are minimal. The NetWorker server stores metadata updates in the `\nsr\tmp` directory and commits the metadata to the client file index after the NDMP client backup completes.

Use the following formula to determine the required physical space for the default `\nsr\tmp` directory:

2 * (144 + average file name length) * number of entries in the file system

Note

This formula must be used for non-multi-streaming only.

For example:

For one million file entries with an average file name length of 128, use this formula to compute the required temporary swap space:

2 * (144 + 128) * 1,000,000 = 544 MB approximately

Performance Considerations

Volume loading and positioning operations do not occur during a volume selection process because an information exchange occurs between the `nsrmmd` process and the `nsrndmp_save` or `nsrndmp_recover` command. Backing up to a filetype device avoids the overhead associated with the exchange of information.

On NetApp filers with Data OnTap 6.4 and later, NetWorker reads all metadata from tape before recovering the files. For large save sets with 20 million files or more, the recovery time for a file can exceed 3 hours. This also applies to backups because NetWorker records the metadata for the whole volume onto the tape during a single file backup.

NDMP licensing requirements

NetWorker with NDMP requires an additional license, separate from the NetWorker base product according to a tiered or capacity-based licensing structure. The *EMC NetWorker Licensing Guide* provides more information.

NDMP feature requirements

Before you implement the IPv6, Checkpoint restart, SMTape, iSCSI, vbb, and DAR/DDAR features in NetWorker, review the information in the following table.

Table 4 NDMP features

Feature	Information
Concurrent streaming	NetWorker supports concurrent streaming of node-based FH streams. NetWorker automatically enables concurrent filesystem streaming for Isilon, up to 32 streams. NetWorker uses the client parallelism value defined for an Isilon client, to determine how many backups run concurrently. When a backup with multiple save sets start, NetWorker sends one stream to each available device. If the number of streams is greater than the number of devices, then NetWorker will distribute the remaining save streams evenly amongst the devices.
IPv6	NetWorker storage nodes support IPv6 communications with a NetWorker server. By default, NDMP backup and recovery operations use IPv6 to create the data connection between the NDMP data server and mover server, when the following requirements are met: • NDMP data server and mover server support the Connection Address Extension (CAE). • NDMP data server and mover server use NDMP v4. • NDMP data server and mover have a configured IPv6 interface. • In an NDMP-DSA configuration, you use of an 8.2 SP1 or later storage node.
CAB extension support	NetWorker support for NetApp c-mode requires the NDMP v4 Cluster Aware Backup (CAB) extension.
Checkpoint restart	The NetApp and Isilon filers create a snapshot of the filesystem before the backup. The save set is generated from the snapshot. Checkpoint restart: • Requires NDMP v4 restartable backup extension. • Results in slower backups because NetWorker writes the checkpoint files at defined intervals. The more frequently NetWorker writes checkpoint files, the slower the backup. • Supports the creation of partial save sets from a snapshot when the backup is interrupted, and later restarted. As a result, the partial backups provide an image of the filesystem from the point-in-time that the snapshot is taken. **Note** Checkpoint restart backups do not support concurrent streaming on Isilon filers.

Table 4 NDMP features (continued)

Feature	Information
	The *EMC NetWorker Administration Guide* provides more information about checkpoint restarts.
Snapmirror to tape (SMTape)	• Performs block-level backup of SnapMirror volumes on NetApp filers. • Reduces the backup window when millions of files reside on the NetApp filer. Use the SMTape feature in instances where NDMP full backups become impractical. SMTape: • Copies large NetApp file systems to secondary storage instead of using the standard NDMP full or differential backups. • Supports a 240 KB block size. • Allows mirroring of backups to disk and tape devices. • Supports full volume backups and recoveries only. You cannot use SMTape for file indexes or file restores. • Supports save set recoveries, only. • Does not support incremental and differential backup levels. The NAS generates a snapshot of the file system at the beginning of the SMTape operation. Use environment variables to control the conditional call to retain or delete the snapshot. Creating and configuring the NDMP client resource on page 67 describes how to configure an NDMP client by using SMTape.
iSCSI	NetWorker supports iSCSI LUNS on EMC Celerra and NetApp filers. EMC Celerra and VNX filers do not support NDMP based backups and recoveries of iSCSI LUNS. NetApp filers support NDMP-based backups and recoveries of iSCSI LUNS but you cannot perform an index-based recovery. To perform a full save set recover to another volume, use a destination volume that is at least two and a half times as large as the source volume. NetApp recommends using SnapMirror to safeguard iSCSI LUNS instead of backups.
vbb	vbb supports: • EMC DART version 5.5 and later. • Index-based recoveries of a Celerra or VNX block level to the same volume or another location. Use:

Table 4 NDMP features (continued)

Feature	Information
	▪ Checkpoint configuration utility to configure checkpoint file systems on the EMC Celerra or VNX before you perform a backup. ▪ Full Destructive Restore (FDR) to perform a full save set recovery of a raw volume of equal or greater size than the backup. NetWorker performs a file-by-file recovery when you: • Recover data from a Celerra or VNX block-level backup. This recover requires disk space in the root directory of the target filesystem to store temporary recovery files. • Perform save set recoveries and NDMP Directory Restores to an existing file system. When you backup a volume that uses native Celerra deduplication, you cannot perform an index-based or NDMP Directory Restore of the backup. You can only perform an FDR restore from a level FULL save set. Configuring NDMP backups on Celerra and Using Celerra Data Deduplication documentation on EMC Support Online provides detailed information about how to prepare the filer before you perform FDR.
DAR and DDAR	DAR and DDAR sends file information from the NAS filer to the NetWorker server. This allows a single file recovery or a directory recovery to position to the exact location of the data on the tape media. NetWorker does not read the file and record numbers sequentially to locate the data. You cannot use DDAR when you enable vbb. DAR and DDAR support EMC DART version 5.5 or later and NetApp with OnTap version 6.4 and later. DAR and DDAR require NDMP version 3 or later. Recoveries on earlier NDMP versions fail.

About partial save sets

The backup sequence of partial save sets is not the same as the backup sequence for complete backups. Each partial save set provides protection for part of the file system, but the completeness and consistency of the coverage of the whole file system cannot be guaranteed.

The checkpoint restart window is user-defined and can be large. If restarted hours apart, the partial backups might provide an image of the file system that is different from the state of the file system at any fixed point in time. The resulting file system backup is not guaranteed to be consistent.

NetWorker performs file and directory backups in alphabetical order. If a failure occurs, and you restart the backup, the backup operation starts alphabetically with the next file or folder that was not backed up. NetWorker does not review files or folder that were previously backed up for changes. If a previously backed up file or folder was edited or added after the backup failure, NetWorker does not back up the file or directory again.

Consider the following example where a backup is interrupted while saving a directory and restarted after the directory contents have changed:

1. A save set contains `/disk1/dir` with files `file_a`, `file_c` and `file_d`.
2. A point of interruption occurs in the backup of the save set during the back up of `file_d`.

   As a result, the first partial save set includes only `file_a` and `file_c`.
3. A user adds `file_b` to the file system.
4. The checkpoint restart is initiated for the save set.

   The second partial save set contains `file_d` and `/disk1/dir`, which includes `file_a`, `file_b`, `file_c` and `file_d`. However, `file_b` is not in the save set.

Partial save sets and cloud backup devices

The Checkpoint Restart feature does not support cloud backup devices by default because partial save sets are not retained on cloud backup devices. To keep partial save sets when you use a cloud backup device, select the **Keep Incomplete Backups** attribute on the **Configuration** tab of the **Server Properties** dialog box for the NetWorker server.

CHAPTER 2

EMC Celerra, VNX, and VNXe

This section includes the following topics:

- Configuring devices for NDMP operations 30
- Configure NetWorker for NDMP backup and clone operations 40
- Monitoring NetWorker server activities in the Administration window 78
- Reporting NDMP Data 93
- Performing NDMP recoveries 94

Configuring devices for NDMP operations

Review this section for information about how to configure the NetWorker environment for NDMP data operations.

The *EMC NetWorker Hardware Compatibility Guide* on the EMC Online Support web site provides a list of NDMP devices that the NetWorker software supports.

NDMP device limitations

Review these limitations before you configure NDMP devices.

- The timeout of the NetWorker server resource attribute, `nsrmmd`, does not apply to NDMP devices, but it does apply to storage nodes devices.
- You cannot use the `jbexercise` utility with an NDMP autochanger.
- You cannot configure NDMP devices on a dedicated storage node.
- You must use a non-rewind device handle for the NDMP media device handle.
- You cannot configure Advanced file type devices and file type devices as an NDMP device.
- You cannot configure an NDMP Autochanger when the NDMP protocol is before version 3. You must determine the NDMP device handles, then use the `jbconfig` command to configure the autochanger.

Determining NDMP device path names

To configure an NDMP standalone device or NDMP jukebox, you must first determine the path names of the media devices. If the NAS filer does not support the NDMP_CONFIG interface or uses NDMP version 3, you must also determine the library device handle.

To determine the NDMP device path names and the library handle, use the `inquire` command or vendor-specific commands.

Determining the NDMP device path names by using inquire

Use the `inquire` command to determine the path names and library handle.

Procedure

1. From a command prompt on the NetWorker server, type:

   ```
   inquire -N NAS_hostname -T
   ```

2. When prompted, specify the NAS username and password.

   NOTICE

   Use the `inquire` command with caution. When you run `inquire`, the command sends the `SCSI inquiry` command to all devices detected on the SCSI bus. If you use the `inquire` command during normal operations, then unforeseen errors can occur, resulting in possible data loss.

Determining the NDMP device path names for EMC Celerra and VNX

Before you begin

Before you configure an NDMP autochanger, determine the device path names of NDMP devices and the robotic arm.

Use the Celerra or VNX Administrator program or manually query the `scsidevs` file.

Procedure

- To manually query the `scsidevs` file, log in to the filer with the NDMP account and type the following command:

  `server_devconfig` ***`data_mover_name`*** **`-p -s -n`**
  The host responds with a list of media device names, for example:

  ```
  server_2 :
  Scsi device table
  name addr type info
  jbox1 c1t0l0 jbox ATL P1000 62200501.21
  tape2 c1t4l0 tape QUANTUM DLT7000 245Fq_
  tape3 c1t5l0 tape QUANTUM DLT7000 245Fq_
  ```

- To avoid tape drive issues, set the *ntape* parameter for every tape drive discovered on a particular Data Mover. For example, if a Data Mover has five configured tape drives, set the parameter to `NDMP ntape=5`
- To modify the `NDMP ntape` parameter, edit the `/nas/server/`*`slot_#`*`/param` file, where *slot_#* correlates directly to the server number and reboot the filer.

  You cannot specify a value greater than 8 for ntape. Configuring NDMP on EMC Celerra documentation on the EMC Online Support website provides detailed information about configuring an EMC Celerra filer.

Dynamic drive sharing

Dynamic Drive Sharing (DDS) is a feature that provides NetWorker software with the ability to recognize shared physical tape drives. DDS enables NetWorker software to perform the following operations:

- Skip the shared tape drives that are in use.
- Route the backups or recoveries to other available shared tape drives.

Introduction to DDS

DDS controls application requests for tape media and allows the NetWorker server and all storage nodes to access and share all attached devices.

A system administrator can configure DDS by setting a sharing policy for devices that are accessible from multiple storage nodes.

There are two terms that are central to the use of DDS are drive and device. Within the context of DDS, these terms are defined as follows:

- Drive—The physical backup object, such as a tape drive, disk, or file.
- Device—The access path to the physical drive.

Note

NetWorker only supports DDS in a storage area network (SAN) Fibre Channel environment and not in a direct-connect SCSI environment.

Benefits of DDS

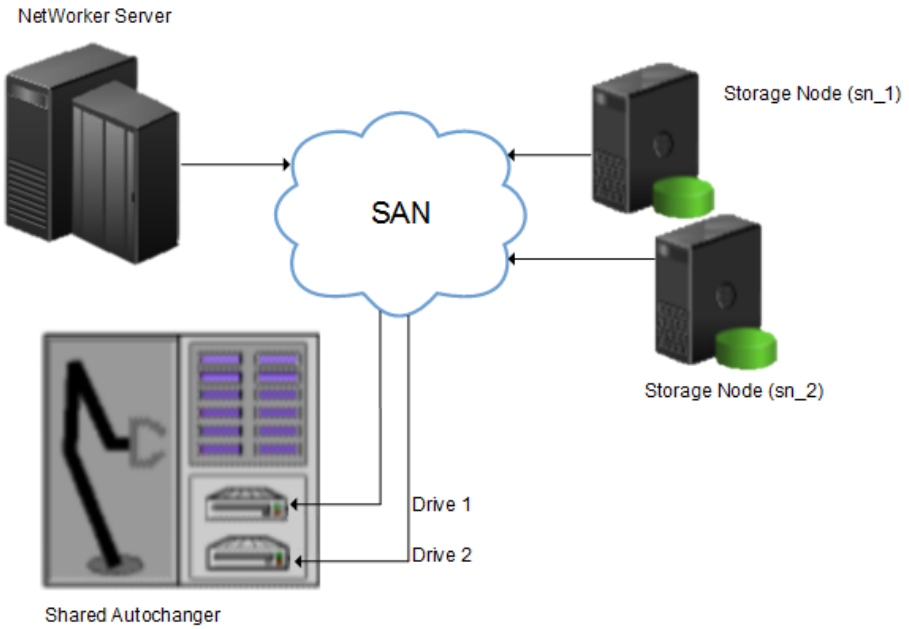
Enabling DDS on a NetWorker system provides these benefits:

- Reduces storage costs—You can share a single tape drive among several storage nodes. In fact, since NetWorker software uses the same open tape format for UNIX, Windows, NetWare and Linux, you can share the same tape between different platforms (assuming that respective save sets belong to the same pool).
- Reduces LAN traffic—You can configure clients as SAN storage nodes that can send save sets over the SAN to shared drives.
- Provides fault tolerance—Within a SAN environment, you can configure hardware to eliminate a single point of failure.
- Provides configuration over a greater distance—You can configure a system over a greater distance than with SCSI connections.

DDS configuration overview

The following figure illustrates the DDS process and potential device sharing configurations. This basic configuration consists of a server, two storage nodes, and a library with two tape drives.

Figure 5 Dynamic Drive Sharing



In this figure:

- Storage nodes sn_1 and sn_2 are attached to the library.
- Each storage node, on its own, has access to drive_1 and drive_2.
- With DDS enabled, both storage nodes have access to both drives and can recognize when a shared drive is in use.

This configuration requires two DDS licenses, one for each drive.

Note

Ensure that all applicable devices can be seen from each storage node by running the `inquire -l` command locally on each storage node.

DDS block-size compatibility between UNIX and Windows

With DDS enabled, drives can be shared between storage nodes on different platforms, such as UNIX and Microsoft Windows. For NetWorker software operations (such as backups and recoveries) to take place successfully, ensure that the block size is compatible between different platforms and/or hardware.

To ensure compatibility, make sure one of the following conditions is met:

- The various storage nodes sharing a drive support the same block sizes.
- When a tape is labeled on a drive, it is labeled with the block size defined on the storage nodes.

Block-size incompatibility between UNIX and Windows

Incompatible block-size settings between UNIX and Microsoft Windows storage nodes could result in any of these error scenarios:

- A backup taken on a UNIX node might not be recoverable on a Microsoft Windows node if the Windows node does not support large block sizes.
- A UNIX process labels and saves data to a tape and leaves the tape mounted. A Microsoft Windows process subsequently attempts to verify the label on this tape and fails because the label verification is done by reading a header from the data portion.
- A tape on a UNIX node is labeled with a large block size. The backup is started on a Microsoft Windows node and the Windows node attempts to write the backup by using the default block size. Internally, the backup on Windows is written by breaking down the big buffer of data into smaller segments of writable block sizes. Attempting to recover a specific file on Windows in this situation fails due to positioning errors on the tape. The data is still recoverable from the Windows side, since the NetWorker software will switch from using file and block positioning to reading the tape from the beginning to reach the correct position. The data might not, however, be recoverable from the UNIX side.

Unintended Access to DDS device prevention

The Reserve/Release attribute has been added to the Device resource for tape devices to support Reserve/Release, including the Persistent Reserve commands.

Reserve/Release is a mechanism that uses SCSI commands to attempt to prevent unintended access to tape drives that are connected by using a shared-access technology, such as Fibre Channel, iSCSI, or SCSI multiplexers. It is a “cooperative” and host-based mechanism, which means that all applications should respect the reservations and not purposely break them. Access is granted based on the host system that reserved the device. Other applications that run on that host cannot be prevented from accessing a reserved device.

Reserve/Release cannot prevent a malicious or badly behaved application from accessing a reserved device. It also cannot prevent all problems caused by hardware issues (such as SCSI resets or FC LIPs) from interrupting data access.

The basic sequence requires that a host reserve a tape drive (using specific SCSI commands) before attempting to access the tape drive. If this “reservation” succeeds, then the host can use the drive. If the reservation fails (usually because the device is reserved by someone else), then the host attempting the reservation should not attempt

to use the drive. When a host has finished using a reserved drive, that host must release the drive by using the appropriate SCSI commands.

The reservation is maintained by the drive itself. With older (called “Simple” in NetWorker software) Reserve/Release, the reservation is based on the SCSI ID of the system that issued the reserve command. For tape drives connected to Fibre Channel (FC) using FC-SCSI bridges, the mapping between FC host and reservation is done inside the bridge, since the initiator on the SCSI side is always the bridge itself, regardless which host actually issued the reserve command.

For Persistent Reserve, the reservation is associated with a 64-bit “key” that is registered by the host. Several keys can be registered with a given drive at any given time, but only one may hold the active reservation. NetWorker software uses the “exclusive” reservation method for Persistent Reserve. Only the host that holds the active reservation is allowed to access the drive.

The Reserve/Release attribute does not support file type or advanced file type devices.

The settings that relate to Reserve/Release and Persistent Reserve are found in a device’s Properties window, on the Advanced tab. They are visible only when diagnostic mode is turned on.

The default setting for Reserve/Release is None. Once any other Reserve/Release setting is selected, it works automatically, without further user intervention. The Reserve/Release attribute is supported only on Common Device Interface (CDI) platforms, so if the CDI attribute in a device’s Properties is set to Not Used, then Reserve/Release settings are ignored.

For newer hardware, once a Reserve/Release setting (other than None) has been selected, the appropriate Persistent Reserve commands are automatically issued before a device is opened for reading or writing, and before the device is closed. With older hardware, a SCSI-2 Reserve command is issued before opening the device, and a SCSI-2 Release command is issued after the device is closed.

Reserve/Release has these possible settings:

- None (the default)
- Simple
- Persistent Reserve
- Persistent Reserve + APTPL (Activate Persist Through Power Loss)

The Persistent Reserve Key attribute has also been added. It is used with Persistent Reservation calls.

Restrictions for use of the SCSI Reserve/Release setting

There are restrictions for using the SCSI Reserve or Release setting.

Consider the following:

- It is available on CDI platforms only. Consequently, since CDI is not supported within an NDMP environment, Reserve/Release is not supported with NDMP.
- Not all drives support persistent Reserve/Release. (All drives support at least simple reserve release. The code automatically drops back from Persistent +APTPL or Persistent to Simple on drives that do not support Persistent.)
- SCSI resets can clear Simple reservations at the device.
- Even with Reserve/Release, there is no guarantee against data loss.
- If the operating system has its own Reserve/Release feature, that feature must be disabled in order for the NetWorker Reserve/Release feature to work.

- Even if all of the enterprise's NetWorker storage nodes have this feature enabled, then it is possible that, on the storage node where a backup operation is run, data loss can be caused by the operating system's utilities or by third-party programs.

DDS on NDMP nodes in a SAN environment

You can configure shared drives between NDMP nodes in a SAN environment.

Ensure that:

- All the components of a SAN configuration are compatible when DDS is enabled with the NetWorker NDMP feature.
- The Fibre Channel switches are compatible with any NDMP hosts within a SAN.
- NDMP hosts and libraries in the SAN are compatible with each other.
- The NDMP nodes that will share the drives are homogeneous.

Note

The current NDMP implementation does not allow the sharing of drives between non-homogeneous NDMP nodes. There is, however, no inherent limitation within DDS that would prevent this.

DDS attributes in the device properties

Configure the attributes that DDS uses, in the **Properties** window for a device.

The attributes include:

- Hardware ID
- Shared Devices

Hardware ID attribute

The Hardware ID attribute tracks the drives that are shared between multiple hosts. Device instances that share the same physical drive across multiple hosts have the same hardware ID. The device autoconfiguration process automatically assigns the Hardware ID to a device, or it is added when manually configuring a device. Users cannot edit the Hardware ID.

You can view the Hardware ID in the **Properties** window for a device, on the **General** tab, in the **Device Sharing** area.

NetWorker generates the Hardware ID when a device is scanned or configured. The Hardware ID consists of the following components:

- Hardware serial number
- Device type
- Worldwide part number (WWPN)
- Worldwide name (WWN)

Shared Devices attribute

The Shared Devices attribute appears on the **Operations** tab of a device's **Properties** window when in diagnostic mode. It features values that can be used to manipulate all shared instances of a drive simultaneously. This attribute enables or disables all devices that share the same Hardware ID with a single action. The following table lists allowed values and descriptions for the attribute.

Table 5 Shared Devices attributes

Value	Description
Enable All	When selected, enables all devices with the same Hardware ID.
Disable All	When selected, disables all the devices with the same Hardware ID.
Done	This value is the default setting. After the server has enabled or disabled all devices with the same Hardware ID, the attribute value is reset to Done.

You cannot configure the Shared Devices attribute with the `jbconfig` program.

Idle Device Timeout attribute and DDS

A tape might remain mounted in a drive after a backup completes. Other requests for the drive from another device path must wait during this timeout period. Use the Idle Device Timeout attribute to adjust the timeout value.

The Idle Device Timeout attribute is not specifically a DDS attribute, but is useful in configuring shared drives. This attribute appears on the device **Properties** window on the **Advanced** tab when displayed in Diagnostic Mode. The default value is 0 (zero) minutes, which means that the device never times out and you must manually eject the tape.

If the device belongs to a library, you can also specify the Idle Device Timeout value for all devices in the library. However, the library value will take effect only on those devices whose **Idle Device Timeout** value is 0. The Idle Device Timeout value for a library is located on the **Timer** tab of the library **Properties** window.

Max active devices

In a DDS environment, use the Max active devices attribute, on the **General** tab of the Storage Node resource to define the maximum number of active devices for a storage node.

This attribute sets the maximum number of devices that NetWorker may use from the storage node in a DDS configuration. In large environments with media libraries that have a large number of devices, storage nodes might not have the ability to optimize all the drives in the library. The Max active devices attribute allows you to limit the number of devices that the storage node uses at a specified time, which allows the storage node to have access to all the devices in the library, but does not limit the storage node to the number of devices it can fully optimize.

Configuring NDMP devices

You can back up NDMP data to an NDMP or non-NDMP device in a standalone or library configuration. You can also back up NDMP data to ACSLS controlled silos.

Configuring a standalone NDMP device

Use NMC to configure a standalone NDMP tape device for Direct NDMP backups.

Procedure

1. In the **Administration** window, click **Devices**.
2. Right-click **Devices** in the navigation tree, and select **New**.
3. In the **Name** attribute, specify the NDMP device in the format:

   ***rd=NAS_hostname:NAS_device_handle* (NDMP)**

   where:

- *NAS_hostname* is the hostname of the NAS that has the NDMP device attached.
- *NAS_device_handle* is the path of the device.

Note

Configure the NDMP device as a remote device and add **(NDMP)** after the pathname. Otherwise, you receive a message similar to the following:

```
NDMP device name shall be in rd=snode:devname (NDMP) format
```

4. In the **Media Type** attribute, specify the device type.
5. Specify a valid NAS administrator account in the **Remote User** attribute.

Note

For the EMC Celerra and VNX filers, specify the trusted account that was created for backup operations on each NDMP-Host Data Mover. Some EMC Celerra versions require that you use a trusted account named *ndmp*. Configuring NDMP on EMC Celerra on the EMC Online Support web site provides detailed information.

6. Specify the password for the NAS administrator account in the **Password** attribute.
7. On the **Configuration** tab:
   a. Select the **NDMP** checkbox. You can only set this attribute when you create the device. You cannot change the NDMP attribute after you create the device. To change the device configuration, delete and re-create the device.
   b. Set the **Target Sessions** attribute to `1`. NDMP devices do not support multiplexing.
   c. The **Dedicated Storage Node** attribute must remain at the default value: **No**.
8. Under the **Advanced** tab, the **CDI** attribute must remain at the default value: **Not used**.
9. Optionally, change the block size used by the NDMP device.

   By default, NDMP devices use a block size of 60 KB. If required, select a different block size in the **Device block size** field. When you configure the NDMP client, set the *NDMP_AUTO_BLOCK_SIZE* environment variable in the **Application Information** attribute.
10. Click **OK**.

Configuring an NDMP autochanger

You can use an NDMP autochanger to manage Direct NDMP or Three-party backups with NDMP devices. To configure an NDMP autochanger, use NMC or the `jbconfig` command.

Configuring an NDMP autochanger with NMC

When you configure an NDMP autochanger in NMC, the NetWorker software first detects the NDMP devices and then configures the library.

Procedure

1. In the **NetWorker Administration** window, click **Devices**.
2. Right-click on the NetWorker Server and then select **Configure All Libraries**.
3. On the **Provide General Configuration Information** window, accept the default library type, **SCSI/NDMP**, and then click **Next**.

4. On the **Select Target Storage Nodes** window, click **Create a new Storage Node**.
5. On the **Storage Node Name** field, specify the hostname of the NAS.
6. In the **Device Scan Type** attribute, select **NDMP**.
7. In the **NDMP User Name** and **NDMP Password** fields, specify the NAS administrator account. If DinoStor TapeServer manages the autochanger, specify the DinoStor username and password.
8. Click **Start Configuration.**
9. Click **Finish**.
10. Monitor the **Log** window for the status of the device scan.

    When you specify an incorrect username and password combination:

    - The Log status window reports:

      ```
      No configured libraries detected on storage node
      storage_node_name
      ```

    - The `daemon.raw` file on the NetWorker server reports:

      ```
      NDMP Service Debug: The process id for NDMP service is
      0xb6c0b7b0
      42597:dvdetect: connect auth: connection has not been
      authorized
      42610:dvdetect: The NDMP connection is not successfully
      authorized on host 'storage_node_name'
      ```

      To resolve this issue, relaunch the **Configure All Libraries** wizard and correct the NDMP username and password combination.

Note

If the **Log** window reports that NetWorker cannot detect the serial numbers for the library, see Configuring an NDMP autochanger by using the jbconfig command on page 38 for detailed instructions.

Configuring an NDMP autochanger by using the jbconfig command

EMC recommends that you use the NMC interface to configure an NDMP autochanger. Use the `jbconfig` command when you cannot configure the autochanger by using the NMC Configure Library wizard.

The *EMC NetWorker Command Reference Guide* or the UNIX man page provides more information about the `jbconfig` command.

Procedure

1. Log in to the NetWorker server as root on UNIX, or Administrator on Windows.
2. At the command prompt, type **`jbconfig`**
3. At the **What kind of jukebox are you configuring** prompt, type **3** to configure an autodetected NDMP SCSI jukebox.
4. When prompted for an NDMP username, specify the NAS administrator account.
5. When prompted for an NDMP password, specify the NAS administrator password.
6. When prompted for the NDMP Tape Server Name, specify the NAS filer hostname.
7. At the **What name do you want to assign to this jukebox device** prompt, provide a name to identify the autochanger.

8. To enable auto-cleaning, accept the default value of **Yes**, otherwise type **No**.
9. At the **Is (any path of) any drive intended for NDMP use? (yes / no) [no]** prompt, type **Yes**.
10. At the **Is any drive going to have more than one path defined? (yes / no) [no]** prompt, type **No** if you will not configure shared devices. Type **Yes** to configure shared drives.
11. When prompted, for the first pathname for the NDMP devices in the jukebox, perform the following steps.
    a. Specify the pathname in the following format:

       NDMP_tape_server_name*:*device path

       where:

       - *NDMP_tape_server_name* is the hostname of the NDMP Server.
       - *device_path* is the first device path.

    b. At the **Is this device configured as NDMP** prompt, type **yes**.
    c. Repeat step a and step b for all NDMP devices in the autochanger.
    d. When prompted, assign a hardware ID.
    e. To use DDS:
       - Respond to the prompts as required so that the first host will have access to the shared drive.
       - When prompted to share this drive with another host, type **yes**.
       - When prompted, type the hostname and device path of the second host that will have access to the shared drive.
12. Complete the prompts for the second device.
13. In the **Enter the drive type of drive 1** prompt, specify the number that corresponds to the NDMP device type.
14. If each drive in the autochanger is the same model, then type **Yes**. Otherwise, type **No**, and then specify the appropriate device types for each additional autochanger device.
15. When prompted to configure another autochanger, type **No**.

Changing the block size of an NDMP device

By default, the block size used to write data to an NDMP backup is 60KB. With the exception of EMC Celerra, when you specify the *NDMP_AUTO_BLOCK_SIZE=Y* variable for an NDMP client, an NDMP device can use the value defined in its Device block size attribute.

Consult the applicable vendor documentation to determine the block sizes supported by the NDMP filer before setting the block size for an NDMP device.

To change the block size defined for the NDMP device, perform the following steps:

Procedure

1. From the **View** menu, select **Diagnostic Mode**.
2. In the **Devices** window, right-click the NDMP device and select **Properties**.
3. On the **Advanced** tab, select a value in the **Device block size** field.

Note

The selected block size must not exceed the block size configured on the NAS filer.

4. Click **Ok**.

Configuring NDMP-DSA devices

When you use DSA, NetWorker sends the NDMP data to a NDMP-DSA device, which includes tape, virtual tape, AFTD, and Data Domain devices. The steps to configure a NDMP-DSA device for a specified device type is the same as configuring a non-NDMP device. The *EMC NetWorker Administration Guide* provides detailed information.

Configuring the Clone Storage Node

When cloning NDMP data, specify the destination storage node, called the clone “write source” (the device that receives the clone data), in the Clone storage nodes attribute. The "Determining the storage node for writing cloned data" section in the *EMC NetWorker Administration Guide* provides details.

Pools requirements for NDMP

When you create a pool for non-NDMP devices, select only the devices that are required by the NDMP clients.

NetWorker cannot send bootstrap and index backups to an NDMP device. When you do not configure a non-NDMP devices or a non-NDMP device is not available to receive the index and bootstrap backups, the NDMP client backup appears to hang. Configure a separate pool to direct the index and bootstrap to a non-NDMP device.

Auto media verification in the Pool resourcedoes not support NDMP.

When an NDMP client backup is a member of a clone-enabled group, configure a clone pool with non-NDMP devices that are local to the NetWorker server to receive the clone bootstrap and index.

Configure NetWorker for NDMP backup and clone operations

This section explains how to configure NetWorker for NDMP backup and clone operations.

Performing schedule backup and clone operations

Data Protection Policies provide you with the ability to schedule backup and clone operations, to protect NDMP data.

You can use the NDMP protocol to protect data on NAS devices.

For a detailed overview about creating, editing, and deleting groups and policies, refer to the Data Protection Policies chapter in the *EMC NetWorker Administration Guide*. NDMP backup configuration follows the traditional backup strategy.

Overview of data protection policies

Data protection policy is a concept that provides you with the ability to design a data protection solution for the environment at the data level instead of at the host level. With

a data protection policy, each client in the environment is a backup object and not simply a host.

Data protection policies enable you to back up and manage data in a variety of environments, as well as to perform system maintenance tasks on the NetWorker server.

A data protection policy solution encompasses the configuration of the following key NetWorker resources:

Policies

Policies provide you with the ability to develop a service-catalogue approach to the configuration of a NetWorker datazone. Policies enable you to manage all data protection tasks and the data protection lifecycle from a central location.

Policies provide an organizational container for the workflows, actions, and groups that support and define the backup, management, and system maintenance actions that you want to perform.

Workflows

Workflows define the start time for a series of actions, the frequency in which the actions run, the order of actions in a sequence, and the protection group to which the workflow applies.

A workflow can be as simple as a single action that applies to a finite list of Client resources, or a complex chain of actions that apply to a dynamically changing list of resources. In a workflow, some actions can be set to occur sequentially, and others can occur concurrently.

You can create multiple workflows in a single policy. However, each workflow can belong to only one policy. When you add multiple workflows to the same policy, you can logically group data protection activities with similar service level provisions together, to provide easier configuration, access, and task execution.

Protection groups

Protection groups define a set of static or dynamic Client resources or save sets to which a workflow applies. There are also dedicated protection groups for backups in a VMware environment or for snapshot backups on a NAS device. Review the following information about protection groups:

- Create one protection group for each workflow. Each group can be assigned to only one workflow.
- You can add the same Client resources and save sets to more than one group at a time.
- You can create the group before you create the workflow, or you can create the group after you create the workflow and then assign the group to the workflow later.

Actions

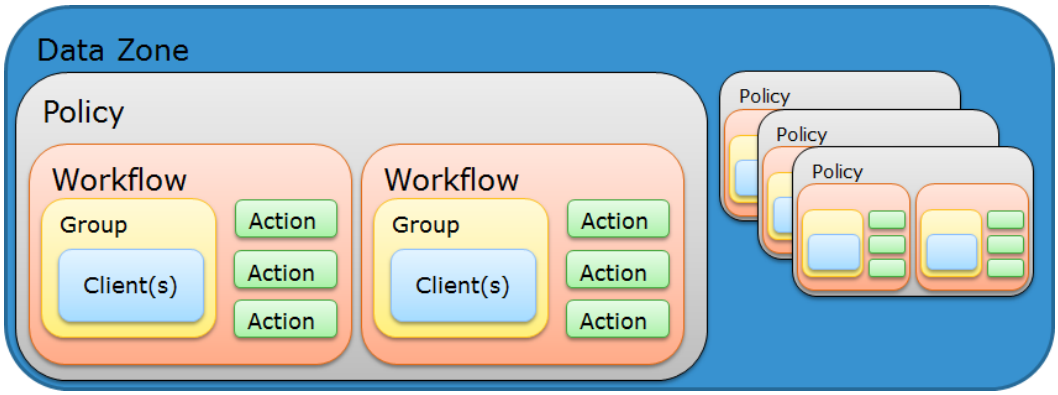
Actions are the key resources in a workflow for a data protection policy and define a specific task, for example, a backup, clone, or snapshot. NetWorker uses a work list to the define task. A work list is composed of one or several work items. Work items include client resources, virtual machines, save sets, or tags. You can chain multiple actions together to occur sequentially or concurrently in a workflow. All chained actions use the same work list.

When you configure an action, you define the days on which to perform the action, as well as other settings specific to the action. For example, you can specify a destination pool, a retention period, and a target storage node for the backup action, which can differ from the subsequent action that clones the data.

You can create multiple actions for a single workflow. However, each action applies to a single workflow and policy.

The following figure provides a high level overview of the components that make up a data protection policy in a datazone.

Figure 6 Data Protection Policy



Default data protection policies

NetWorker provides you with preconfigured data protection polices resources that you can use immediately to protect your environment, modify to suit your environment, or use an example to create new resource configurations. To use these policy resources, you must add clients to the appropriate group resource.

Each protection policy provides an example of the EMC best practices that you should follow when you design your data protection solution:

- Separate file system backups from application database backups, to provide ease of access at recovery time.
- Stagger the start times for file system backup from the application database backups, to prevent disk contention on the target hosts.

The default data protection policy resources mimic the requirements of a service provider, with different policies to that are designed to provide protection based on service level agreements.

Platinum policy

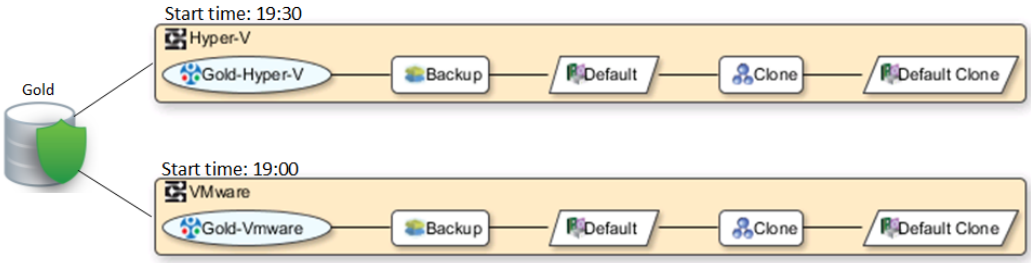
The Platinum policy provides you with an example of a data protection policy for an environment that contains EMC storage arrays or appliances and requires backup data redundancy. The policy contains one workflow with two actions, a snapshot backup action, followed by a clone action.

Figure 7 Platinum policy configuration

Gold policy

The Gold policy provides an example of a data protection policy for an environment that contains virtual machines and requires backup data redundancy. The policy contains two workflows, one to protect Hyper-V hosts and one to protect VMware hosts. Each workflow contains a backup action followed by a clone action.

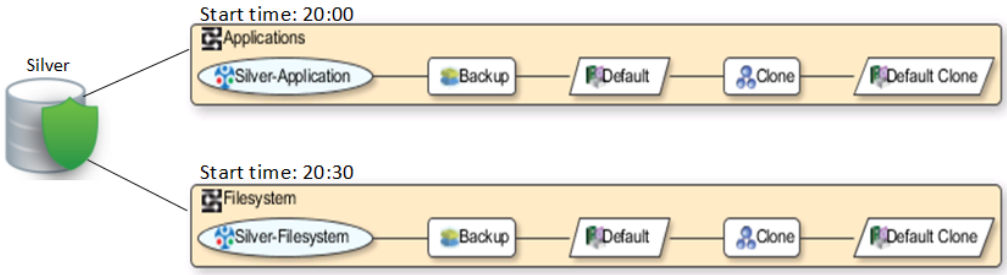
Figure 8 Gold policy configuration



Silver policy

The Silver policy provides an example of a data protection policy for an environment that contains non-virtualized machines and requires backup data redundancy. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action followed by a clone action.

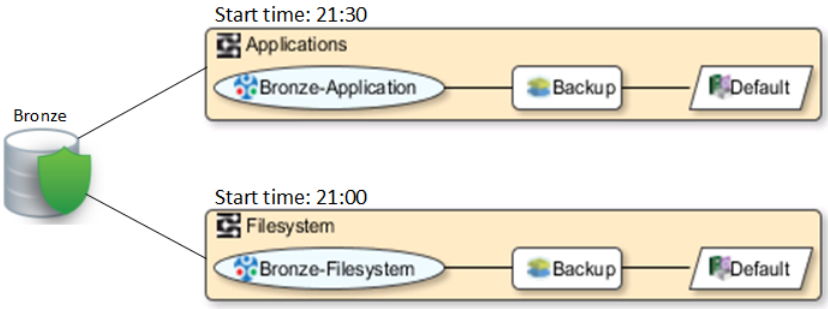
Figure 9 Silver policy configuration



Bronze policy

The Bronze policy provides an example of a data protection policy for an environment that contains non-virtualized machines. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action.

Figure 10 Bronze policy configuration



Road map for configuring a new data protection policy

Procedure

1. Create a policy.

   When you create a policy, you specify the name and notification settings for the policy.

2. Within the policy, create a workflow for each data type.

   For example, create one workflow to protect file system data and one workflow to protect application data. When you create a workflow, you specify the name of the workflow, the time to start the workflow, notification settings for the workflow, and the protection group to which the workflow applies.

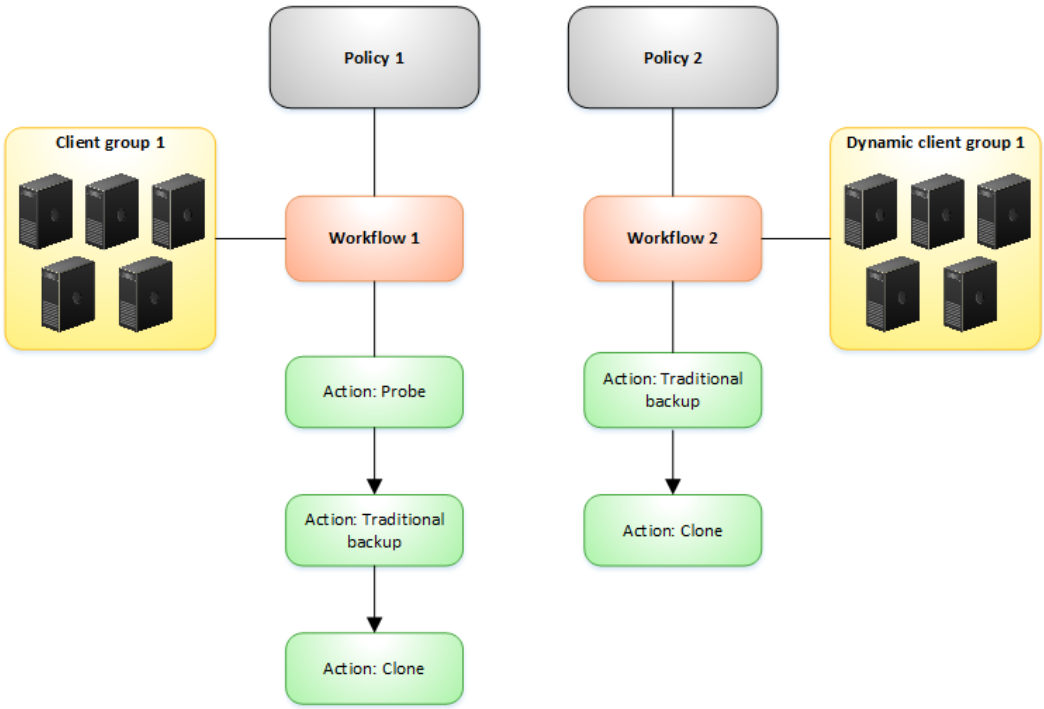
3. Create a protection group.

   The type of group that you create depends on the types of clients and data that you want to protect. The actions that appear for a group depend on the group type.

4. Create one or more actions for the workflow.
5. To define the backup data that you want to protect, configure Client resources, and then assign the client resources to a protection group.

The following figure illustrates a policy with two different workflows. Workflow 1 performs a probe and then a backup of the Client resources in Client group 1, and then clones the save sets from the backups. Workflow 2 performs a backup of the Client resources in Dynamic client group 1, and then clones the save sets from the backups.

Figure 11 Data protection policy example



Strategies for traditional backups

The primary considerations for a traditional backup strategy are the groups of Client resources, the workflows that define the series of actions that are associated with the backup, and the schedule for the backup.

Creating a policy

Procedure

1. On the **Administration** window, click **Protection**.

2. In the expanded left pane, right-click **Policies**, and then select **New**.

   The **Create Policy** dialog box appears.

3. On the **General** tab, in the **Name** field type a name for the policy.

   The maximum number of characters for the policy name is 128.

   Note

   After you create a policy, the **Name** attribute is read-only.

4. In the **Comment** box, type a description for the policy.
5. From the **Send Notifications** list, select whether to send notifications for the policy:
   - To avoid sending notifications, select **Never**.
   - To send notifications with information about each successful and failed workflow and action after all the actions in the policy complete, select **On Completion**.
   - To send a notification with information about each failed workflow and action after all the actions in the policy complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:

   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```

   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```

   - On Windows, to send a notification email, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:

     - **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
     - **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
     - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. To specify the Restricted Data Zone (RDZ) for the policy, select the **Restricted Data Zones** tab, and then select the RDZ from the list.
8. Click **OK**.

After you finish

Create the workflows and actions for the policy.

Creating a workflow in a new policy

A policy must contain one or more workflows.

Procedure

1. In the left pane of the **Protection** window, expand **Policies**, and then select the policy that you created.
2. In the right pane of the **Protection** window, select **Create a new workflow**.
3. In the **Name** field, type the name of the workflow.

   The maximum number of characters for the name of the group is 64.
4. In the **Comment** box, type a description for the workflow. The maximum number of characters for the **Comment** field is 128.
5. From the **Send Notifications** list, select how to send notifications for the workflow:
   - To use the notification configuration that is defined in the policy resource to determine when to send the notification, select **Set at policy level**.
   - To send notifications with information about each successful and failed workflow and action, after all the actions in the workflow complete, select **On Completion**.
   - To send notifications with information about each failed workflow and action, after all the actions in the workflow complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:
   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```
   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```
   - On Windows, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:

- **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
- **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
- *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. In the **Running** group box, define when and how often the workflow runs.
   a. To ensure that the actions contained in the workflow run when the policy or workflow is started, in the **Enabled** box, leave the option selected. To prevent the actions in the workflow from running when the policy or workflow that contains the action is started, clear this option.
   b. To ensure that the workflow starts at the time that is specified in the **Start time** attribute, on the days that are defined in the action resource, in the **AutoStart Enabled** box, leave the option selected. To prevent the workflow from running at the time that is specified in the **Start time** attribute, clear this option.
   c. To define the time to start the actions in the workflow, in the **Start Time** attribute, use the spin boxes.

      The default value is 9:00 P.M.
   d. To define how frequently to repeat the actions that are defined in the workflow over a 24 hour period, In the **Interval** attribute, use the spin boxes.

      The default value is 24 hours, or once a day. When you select a value that is less than 24 hours, the **Interval End** attribute appears. To define the last time to start a workflow in a defined interval period, use the spin boxes .
   e. To define the duration of time in which NetWorker can manually or automatically restart a failed or canceled workflow, in the **Restart Window** attribute, use the spin boxes.

      If the restart window has elapsed, NetWorker considers the restart as a new run of the workflow. NetWorker calculates the restart window from the start of the last incomplete workflow. The default value is 24 hours.

   For example, when you set the **Start Time** to 7:00 PM, the **Interval** to 1 hour, and the **Interval end time** to 11:00 P.M., then the workflow automatically starts every hour beginning at 7:00 P.M. and the last start time is 11:00 PM.
8. To create the workflow, click **OK**.

After you finish

Create the actions that will occur in the workflow, and then assign a group to the workflow. If a workflow does not contain a group, a policy does not perform any actions.

Protection groups for traditional backups

Create protection groups for traditional backups, which identifies the Client resources to back up.

You can create two types of protection groups for a traditional backup:

- Basic client group—Defines a static list of Client resources to back up.

- Dynamic client group—Specifies a dynamic list of Client resources to back up. A dynamic client group automatically generates a list of Client resources that use client tag which matches the client tag that is specified for the group.

Create multiple groups to perform different types of backups for different Client resources, or to perform backups on different schedules. For example:

- Create one group for backups of clients in the Accounting department, and another group for backups of clients in the Marketing department.
- Create one group for file system backups and one group for backups of Microsoft Exchange data with the NetWorker Module for Microsoft.
- Create one group for a workflow with backups actions that start at 11 p.m., and another group for a workflow with backup actions that start at 2 a.m.

Note

A Client resource can belong to more than one group.

Creating a client group

Basic client groups define a static list of Client resources for a traditional backup, check connectivity, or probe action.

Before you begin

Create the Client resources for the data to include in a protection group.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, leave the default selection of **Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.
7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group.

Creating a dynamic client group

Dynamic client groups prevent you from having to edit group settings when you add Client resources to the NetWorker datazone. You can configure a dynamic group to

include all the clients on the NetWorker server or you can configure the dynamic group to perform a query that generates a list of clients that is based on a matching tag value. A tag is a string attribute that you define in a Client resource. When an action starts in a workflow that is a member of a tagged dynamic protection group, the policy engine dynamically generates a list of Client resources that match the tag attribute value.

Use dynamic client groups to specify a dynamic list of Client resources for a traditional backup, probe, check connectivity, or server backup action.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, select **Dynamic Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.
7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group and define one or more tags.

Actions sequences in traditional backup workflows

Workflows enable you to chain together multiple actions and run them sequentially or concurrently.

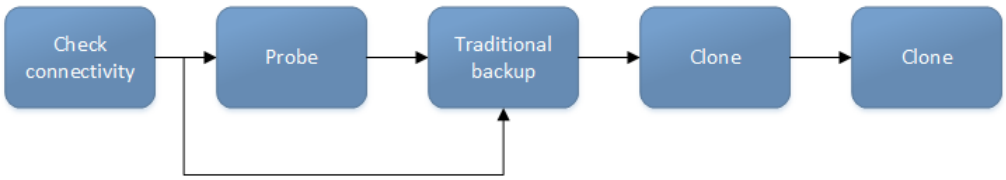
A workflow for a traditional backup can optionally include a probe or check connectivity action before the backup, and a clone action either concurrently with or after the backup.

The following sections provide details on supported actions that can follow the lead action and other actions in a workflow.

All possible workflow actions for a traditional backup

The following figure illustrates the possible workflow actions that are associated with a traditional backup.

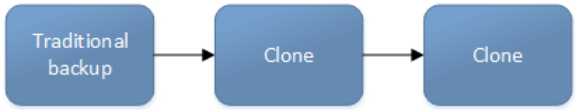
Figure 12 All possible workflow actions for a traditional backup



Workflow path from a traditional backup action

The only action that can follow a traditional backup is a clone action.

Figure 13 Workflow path from a traditional backup action



Creating a check connectivity action

A check connectivity action tests connectivity between clients and the NetWorker server, usually before another action such as a backup occurs.

Before you begin

Create the policy and workflow that contain the action. The check connectivity action should be the first action in the workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Check Connectivity**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.

8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to check connectivity with the client.

   The following table provides details on the icons.

   Table 6 Schedule icons

Icon	Label	Description
	Execute	Check connectivity on this day.
	Skip	Do not check connectivity on this day.

   To check connectivity every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Connectivity Options** page appears.
11. Select the success criteria for the action:
    - To specify that the connectivity check is successful only if successful connectivity is achieved with all clients in the assigned group, select the **Succeed only after all clients succeed** checkbox.
    - To specify that the connectivity check is successful if connectivity is achieved with one or more clients in the assigned group, clear the checkbox.
12. Click **Next**.

    The **Specify the Advanced Options** page appears.
13. (Optional) Configure advanced options and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, **Inactivity Timeout**, or the **Send Notification** options appear, the Check Connectivity action does not support these options and ignores the values.

14. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

15. From the **Failure Impact** list, specify what to do when a job fails:

- To continue the workflow when there are job failures, select **Continue**.
- To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

  Note

  The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

- To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

16. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
17. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
18. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

19. Click **Next**.

    The **Action Configuration Summary** page appears.

20. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create one of the following actions to automatically occur after the check connectivity action:

- Probe
- Traditional backup

  Note

  This option is not available for NAS snapshot backups.

- Snapshot backup

Creating a probe action

A probe action runs a user-defined script on a NetWorker client before the start of a backup. A user-defined script is any program that passes a return code. If the return code is 0 (zero), then a client backup is required. If the return code is 1, then a client backup is not required.

Before you begin

- Create the Probe resource script on the clients that use the probe. Create a client Probe resource on the NetWorker server, and then associate the client Probe resource with the Client resource on the NetWorker server.
- Create the policy and workflow that contain the action.
- (Optional) Create a check connectivity action to precede the probe action in the workflow. A check connectivity action is the only supported action that can precede a probe action in a workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Probe**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to probe the client.

   The following table provides details on the icons.

Table 7 Schedule icons

Icon	Label	Description
	Execute	Perform the probe on this day.
	Skip	Do not perform a probe on this day.

To perform a probe every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Probe Options** page appears.

11. Choose whether to start the subsequent backup action only after all probes succeed by selecting or clearing the **Start backup only after all probes succeed** checkbox.
    - To start the backup only if all the probes associated with Client resources in the assigned group succeed, select the checkbox.
    - To start the backup if any one of the probes are associated with a Client resource in the assigned group succeed, clear the checkbox.

12. Click **Next**.

    The **Specify the Advanced Options** page appears.

13. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

14. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

    Note

    The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

15. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

Note

The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

16. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

17. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

18. Leave the default selections for the Notification group box. NetWorker does not support notifications for probe actions and ignores the values that are defined in the attributes.
19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

- Select the day in the calendar, which changes the action task for the specific day.
- Use the action task list to select the task, then perform one of the following steps:
  - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
  - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
  - In the **Override** field, type an override.

    Note

    To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.

23. Review the settings that you specified for the action, and then click **Configure**.

Creating a traditional backup action

A traditional backup is a scheduled backup of the save sets defined for the Client resources in the assigned group for the workflow.

Before you begin

- Create the policy and workflow that contain the action.
- (Optional) Create actions to precede the backup action in the workflow. Supported actions that can precede a backup include:
  - Probe
  - Check connectivity

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.

2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.

3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Backup**.
6. From the secondary action list, select the backup type, for example, **Traditional**.

7. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
8. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
9. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
10. Click the icon on each day to specify the backup level to perform.

    The following table provides details about the backup level that each icon represents.

Table 8 Schedule icons

Icon	Label	Description
	Full	Perform a full backup on this day. Full backups include all files, regardless of whether the files changed.
	Incr	Perform an incremental backup on this day. Incremental backups include files that have changed since the last backup of any type (full or incremental).
	Cumulative Incr	Perform a cumulative incremental backup. Cumulative incremental backups include files that have changed since the last full backup.
	Logs Only	Perform a backup of only database transaction logs.
	Synthetic Full **Note** Not supported for NDMP.	Perform a synthetic backup on this day. A synthetic full backup includes all data that changed since the last full backup and subsequent incremental backups to create a synthetic full backup.
	Skip	Do not perform a backup on this day.

To perform the same type of backup on each day, select the backup type from the list and click **Make All**.

NetWorker does not support the use of synthetic full backup levels for NDMP data.

EMC Celerra, Isilon, VNX, and NetApp filers with NDMP version 4 or later support token-based backups (TBB) to perform NDMP full and incremental backups. NetWorker supports the same number of incremental levels that the NAS vendor supports. EMC Celerra, Isilon, and NetApp documentation provide the maximum number of incremental levels that the TBB incremental backup can support.

When you configure TBB after you update the NetWorker server from 7.6 SP1 or earlier, the first incremental backup does not occur until after one complete full backup.

Filers that do not support TBB, do not support incremental backups. If you select the level Incr, the NetWorker server performs a full backup.

Verify the NAS storage vendor supports NDMP incremental backups before you use this feature.

11. Click **Next**.

    The **Specify the Backup Options** page appears.

12. From the **Destination Storage Node** box, select the storage node with the devices on which to store the backup data.
13. From the **Destination Pool** box, select the media pool in which to store the backup data.
14. From the **Retention** boxes, specify the amount of time to retain the backup data.

    After the retention period expires, the save set is removed from the client file index and marked as recyclable in the media database during an expiration server maintenance task.

    When you define the retention policy an NDMP client, consider the amount of disk space that is required for the client file index. NDMP clients with several thousands of small files have significantly larger client file indexes on the NetWorker server than a non-NDMP client. A long retention policy for an NDMP client increases disk space requirements on the file system that contains the client file indexes.

15. From the **Client Override Behavior** box, specify how NetWorker uses certain client configuration attributes that perform the same function as attributes in the Action resource.
    - **Client Can Override**—The values in the Client resource for **Schedule**, **Pool**, **Retention policy**, and the **Storage Node** attributes will take precedence over the values that are defined in the equivalent Action resource attributes.
    - **Client Can Not Override** —The values in the Action resource for the **Schedule**, **Destination Pool**, **Destination Storage Node**, and the **Retention** attributes take precedence over the values that are defined in the equivalent Client resource attributes.
    - **Legacy Backup Rules**—This value only appears in actions that are created by the migration process. The updating process sets the **Client Override Behavior** for the migrated backup actions to **Legacy Backup Rules**.

16. Click **Next**.

    The **Specify the Advanced Options** page appears.

17. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

18. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

Note

The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

19. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

    Note

    The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

20. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

21. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

22. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
23. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
24. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

25. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.
26. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

- On Window, to send a notification email, type the following command:

  `smtpmail` **`-s`** ***`subject`*** **`-h`** ***`mailserver recipient1@mailserver recipient2@mailserver...`***

  where:

  - **`-s`** ***`subject`***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
  - **`-h`** ***`mailserver`***—Specifies the hostname of the mail server to use to relay the SMTP email message.
  - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

27. Click **Next**.

    The **Action Configuration Summary** page appears.

28. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets after the backup. A clone action is the only supported action after a backup action in a workflow.

Cloning NDMP save sets

You can clone Direct-NDMP and NDMP-DSA save sets by using the same methods used to clone non-NDMP save sets.

Before you clone NDMP save sets, review these requirements:

- To clone Direct-NDMP or Three-party backup data:
  - The source NAS must run NDMP version 3 or later.
  - The destination NAS can run any version of NDMP, but you cannot clone a volume cloned with NDMP earlier than version 3 to another volume.
  - You cannot clone NDMP save sets to a non-NDMP device.
  - You can clone NDMP tapes from one NDMP host to another NDMP host of the same type. For example, you can clone tapes from a NetApp filer with an attached library to another NetApp filer or to the same filer.
- You require two NDMP devices to clone the NDMP save sets, one device to perform the read operation and one device to perform the write operation.
- You must clone NDMP-DSA backups to non-NDMP devices. You can however, clone NDMP-DSA save from one type of tape device to another. For example you can clone save sets on a DLT device to an AIT device.
- Use the nsrclone program to clone NDMP save sets from a command prompt. The *EMC NetWorker Command Reference Guide* or the UNIX man pages provide more information on nsrclone usage.

Creating a clone action

A clone action creates a copy of one or more save sets. Cloning allows for secure offsite storage, the transfer of data from one location to another, and the verification of backups.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Clone**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to perform cloning.

   The following table provides details on the icons.

   Table 9 Schedule icons

Icon	Label	Description
	Execute	Perform cloning on this day.
	Skip	Do not perform cloning on this day.

   To perform cloning every day, select **Execute** from the list and click **Make All**.

10. Click **Next**.

    The **Specify the Clone Options** page appears.

11. In the **Data Movement** group box, define the volumes and devices to which NetWorker sends the clone data.

    a. From the **Destination Storage Node** list, select the storage node with the devices on which to store the cloned save sets.

    b. In the **Delete source save sets after clone completes**, select the option to instruct NetWorker to remove the source save set information from the client file index, and to mark the save set as recyclable in the media database during a Server expiration maintenance action. Clear this option to allow the source save sets to expire based on the defined retention time.

    c. From the **Destination Pool** list, select the target media pool for the cloned save sets.

    d. From the **Retention** list, specify the amount of time to retain the cloned save sets.

       After the retention period expires, the save sets are marked as recyclable during an expiration server maintenance task.

12. In the **Filters** group box, define the criteria that NetWorker uses to create the list of eligible save sets to clone. The eligible save sets must match the requirements that are defined in each filter. NetWorker provides the following filter options:

    a. Time filter—Use the **Time** section to define the time range in which NetWorker should inspect, when searching for eligible save sets to clone in the media database. Use the spin boxes to specify the start of the time range and the end of the time range. The **Time** filter list includes three options, which define how NetWorker determines save set eligibility, based on the time criteria:

       - **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
       - **Accept**—The clone save set list includes save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.
       - **Reject**—The clone save set list does not include save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.

    b. Save Set filter—Use the **Save Set** section to instruct NetWorker to include or exclude ProtectPoint and Snapshot save sets, when searching for eligible save sets to clone in the media database. The **Save Set** filter list includes three options, which define how NetWorker determines save set eligibility, based on the save set criteria:

       - **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
       - **Accept**—The clone save set list includes eligible ProtectPoint or Snapshot save sets, when you also enable the ProtectPoint or Snapshot checkboxes.
       - **Reject**—The clone save set list does not include eligible ProtectPoint and Snapshot save sets when you also enable the ProtectPoint and Snapshot checkboxes.

    c. Clients filter—Use the **Client** section to define a list of clients to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Client** list includes three options, which define how NetWorker determines save set eligibility, based on the client criteria:

- **Do Not Filter**—NetWorker inspects save sets that are associated with the clients in the media database, to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible save sets for the selected clients.
- **Reject**—The clone save set list does not include eligible save sets for the selected clients.

d. Levels filter—Use the **Levels** section to define a list of backup levels to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Levels** filter list includes three options, which define how NetWorker determines save set eligibility, based on the level criteria:

- **Do Not Filter**—NetWorker inspects save sets regardless of level in the media database, to create a clone save set list that meets all the filter criteria.
- **Accept**—The clone save set list includes eligible save sets with the selected backup levels.
- **Reject**—The clone save set list does not include eligible save sets with the selected backup levels.

13. Click **Next**.

    The **Specify the Advanced Options** page appears.

14. Configure advanced options, including notifications and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, or the **Inactivity Timeout** options appear, the clone action does not support these options and ignores the values.

15. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

16. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

Note

The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

- To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

17. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.
18. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

    - On Window, to send a notification email, type the following command:

      ```
      smtpmail -s subject -h mailserver recipient1@mailserver
      recipient2@mailserver...
      ```

      where:

      - **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
      - **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
      - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.
23. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets again after this clone action. Another clone action is the only supported action after a clone action in a workflow.

Visual representation of traditional backup workflows

Figure 14 Traditional backup workflow

When you create actions for a workflow, a map provides a visual representation of the actions in the second right pane of the **Protection** window of the **Administration** interface.

The oval icon at the beginning of the visual representation specifies the group to which the workflow applies, the rounded rectangle icons identify actions, and the parallelogram icons identify the destination pool for the action.

You can work directly in the visual representation of a workflow to perform the following tasks:

- Adjust the display of the visual representation by right-clicking and selecting one of the following options:
  - **Zoom In**—Use to increase the size of the visual representation.
  - **Zoom Out**—Use to decrease the size of the visual representation.
  - **Zoom Area**—Use to limit the display to a single section of the visual representation.

  - **Fit Content**—Use to fit the visual representation to the window area.
  - **Reset**—Use to reset the visual representation to the default settings.
  - **Overview**—To view a separate dialog box with a high-level view of the visual representation and a legend of the icons.
- View and edit the properties for the group, action, or destination pool by right-clicking the icon for the item and selecting **Properties**.
- Create a group, action, or destination pool by right-clicking the icon for the item and selecting **New**.

Creating and configuring the NDMP client resource

Use the NMC Client Configuration Wizard to create the NDMP client or create the client manually. EMC recommends that you use the NMC Client Configuration Wizard to create NDMP clients.

Using the Client Configuration wizard

Use the NMC Client Configuration wizard to create the NDMP client.

Procedure

1. From the **Administration** window in NMC, click **Protection**.
2. In the expanded left pane, select **Clients** , and then select **Protection** › **New Client Wizard**.
3. On the **Specify Client Information** window:
   a. In the **Client Name** field, specify the hostname of the filer.
   b. Optionally, add comments in the **Comment** field.
   c. Optionally, in the **Tag** field, specify the name of the tag for the dynamic group in which you want to add this client.
   d. Optionally, in the **Groups** area, select an existing group, in which to add the client.
   e. In the **Type** area, select **NDMP**, and then click **Next**.

   For EMC Celerra, you will typically use the CIFS server name configured on the Data Mover.
4. On the **Specify the NDMP Client Credentials** window:
   a. In the **NDMP User Name** field, specify a valid NAS administrator account.
   b. In the **NDMP Password** attribute, specify the password for the NAS administrator account, and then click **Next**.

   For an EMC Celerra and VNX filers, specify the trusted account that you created on each NDMP-Host Data Mover for backups. Some versions of EMC Celerra require you to use an account called ndmp. The Configuring NDMP on EMC Celerra document on the EMC Online Support web site provides more information.
5. In the **Specify the NDMP Client Backup Options** window:
   a. In the **NDMP backup type** attribute, select or specify the backup type:
      - `dump`—Traverses a file tree in mixed width first and depth-first order.
      - `vbb`—Used to backup the entire volume at the block level rather than at a file level. The vbb backup type reads data blocks more efficiently than traditional

file-based backups. The vbb backup type does not support DDAR, TBB, and Three party backups.

- `ts`—Enables a tape silvering backup.

b. In the **NDMP Array Name** field, specify the logical name assigned to the NDMP NAS array.

The **NDMP Array Name** field enables you to configure the same NAS device with multiple NDMP clients that have different host IDs.

Note

NDMP clients that use the same NAS device must have the same NDMP array name.

c. Review the **App Info** options and disable options, as required. EMC recommends that the default options remain enabled.

App Info Type	Description
HIST	Enables the backup of index data. If you do not select this option, you can only perform full recoveries of the backup data.
UPDATE	Enables the backup process to update the last backup dates in database on the NDMP client, after the backup completes.
DIRECT	Enables DAR or DDAR support.
Use Token-Based Backup	Enables the NDMP backup to use last backup time tokens to decide what files to backup. Not all NDMP clients support token based backup. When you select this option and the NDMP data server on the client does not support token based backups, NetWorker performs the backup by using backup levels.

d. In the **Advanced App Info** field, specify additional NAS specific environments variables, one per line. The following table provides a list of the available **Application Information** environment variables for each NAS.

Table 10 EMC Celerra and VNX Application Information variables

Variables	Definition
DIRECT= n	Optional. When you use DAR or DDAR, you must set this value to `y`.
EMC_EDIRnn=string	Optional. This string value identifies a directory to exclude from the backup. You can use asterisk (*) as a wildcard, but only when * is the last character in the string. To include multiple directories, increment the number. For example: • EMC_EDIR01=/fsX/DIRx

Table 10 EMC Celerra and VNX Application Information variables (continued)

Variables	Definition
	• EMC_EDIR02=/fsX/DIRy EMC Dart version 5.5 and later supports this variable. NetWorker ignores this variable when you perform a vbb backup.
EMC_EFILEnn=string	Optional. This string value determines which files to exclude from the backup. You can use the asterisk (*) as a wildcard, but only when * is the first or last character in the string, or both. To include multiple files, increment the number. For example: • EMC_EFILE01=*mp3 • EMC_EFILE02=temp* EMC Dart version 5.5 and later supports this variable. NetWorker ignores this variable when you perform a vbb backup.
SNAPSURE=y	Required. This value ensures that a backup is performed on a SnapSure of the production file system to avoid any inconsistent problems of file access during backup window.
USE_TBB_IF_AVAILABLE=n	Optional. The NetWorker software automatically enables TBB support for EMC Celerra filers. Specify this variable and value to disable TBB support for incremental backups and when you use the vbb backup type. When you specify this value, the backup reverts to the native level-based backup of the NAS.
ALLOW_SINGLE_FILE_BACKUP=y	Optional. Specify this variable only when you perform a single file backup.
NSR_NDMP_RECOVER_NO_DAR=y	Optional. Specify this variable to perform a non-DAR recovery when you set the *DIRECT=y* variable during the backup.
NSR_NDMP_DDAR This environment variable must be set in the operating system before invoking the either the `recover` or `winworkr` program.	Optional. Use this variable to recover the permissions of the parent directories of selected files. Specify this variable to perform a DDAR recovery when: • You set the *DIRECT=y* variable during the backup. • The DART version is 5.5 and later. **Note** Do not specify *NSR_NDMP_DDAR* when you also use *NSR_NDMP_RECOVER_DIR*.
NSR_NDMP_RECOVER_DIR=y This environment variable must be set in the operating system before invoking either the `recover` or `winworkr` program.	Optional. Specify this variable to perform a DAR recovery when: • When you set the DIRECT=y variable during the backup. • The DART version is 5.5 and later. **Note** Do not use *NSR_NDMP_RECOVER_DIR* when you also use *NSR_NDMP_DDAR*.

Table 10 EMC Celerra and VNX Application Information variables (continued)

Variables	Definition
TS=y	Optional. Enables tape silvering.

6. Click **Next**.
7. On the **Select the NetWorker Client Properties** window:
   a. In the **Priority** field, specify the order in which the NetWorker server contacts clients in a protection group for backup. The attribute can contain a value between 1 and 1,000. The lower the value, the higher the priority.
   b. In the **Parallelism** attribute:
      - For Direct-NDMP, set the **Parallelism** attribute to 1.
      - For NDMP-DSA, the parallelism value depends on the NAS capabilities and set parallelism to a value that is appropriate for the NAS. Parallelism values of 4 to 8 are common. In general, the best parallelism setting depends on filer configuration and the amount of installed RAM.
      - For an EMC Celerra using DartOS v.5 and earlier, the **Parallelism** attribute cannot exceed **4**.
      - For VNX using DartOS v.6 and later, the maximum parallelism value is 8. The optimal parallelism value depends on the following factors:
        - Amount of physical memory on the Data Mover.
        - Amount of physical memory allocated to the NDMP PAX configuration.
        - Value defined for the *concurrentDataStreams* parameter on the filer. *Configuring NDMP Backups on VNX* provides more information.
   c. In the **Remote Access** attribute:
      - Specify the root account on UNIX, or the administrator account on Windows of any computer that you use to browse entries for the NDMP computer.
      - Specify the NetWorker server administrator account on Windows, or the root account on UNIX.
        Use this format to specify each account:

        `account_name@hostname`
   d. Select the **Data Domain Interface**. This option specifies the protocol to use if you send the backup data to a Data Domain Device. Available selections are Any, Fibre Channel, or IP.
   e. To enable a block based backup for the host, select the **Block Based Backup** option . The *EMC NetWorker Administration Guide* provides more information about when to enable blocked based backups and the features that do not support block based backups. Block Based backups require the **Client Direct** option.
   f. Select the **Client Direct** option to allow the client to try to directly connect to the backup storage device, instead of connecting to a NetWorker storage node. If a direct connection is not possible, the backup operation connects to the NetWorker storage node that you configure to accept data from the client.
8. On the **Specify the File System Objects** window, select or specify the objects to backup.

- EMC Celerra, VNX, and VNXe do not support the NDMP Snapshot Management extension, and do not support browsing. Specify the savesets to backup.
  - To back up all the file systems on the client, type **ALL**.
  - When you do not use the `ALL` save set, specify the file system name, as configured on the NAS.
  - File system names in the **Save set** field are case sensitive.
  - You cannot specify a share name.
- For EMC Celerra backups, do not use the `ALL` save set. List the file systems, one per line excluding the root, or "/" file system. When you include the root file system, client index updates fail for hidden file systems (directories that start with a ".") with the error:

  ```
  Failed to store index entries.
  ```
- For EMC Celerra block-level backups, specify the entire file system mount point.

To back up large client file systems, optionally schedule each file system to back up separately. For example, create two separate clients with the same name, but with different save sets.

9. Click **Next**.
10. On the **Client Configuration Summary** window, review the attributes, and then click **Create**.
11. On the **Client Configuration Results** window, review the results, and then click **Finish** to exit the wizard.

    Troubleshooting NDMP configuration and backup failures on page 75 describes how to resolve errors that you may experience when you configure the NDMP client.

Performing post Client Configuration Wizard steps

After the Client Configuration wizard creates the NDMP client, modify the properties of the new NDMP client.

Modifying the Storage Node

On the **Globals (2 of 2)** tab, specify the appropriate storage node in the **Storage Nodes** attribute.

The attribute value depends on the type of backup:

- When you perform Direct-NDMP backups with NDMP devices, specify the hostname of the NAS that manages the tape device or autochanger.
- For three-party backups, specify the destination host first.
- For NDMP-DSA backups, specify the hostname of the storage node that manages the tape device or autochanger. If the NetWorker server is the storage node, specify *nsrserverhost*.
- For a DinoStor-managed NAS, specify the hostname of the DinoStor server first.

  NOTICE

  For NDMP-DSA backups, the NetWorker software uses the **Storage Node** attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they will override the **Storage Node** attribute value.

Adding NDMP Client Properties

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, select **Clients**.
3. Right-click a **Client** and select **New Client Properties**. The **Client Properties** screen appears.
4. Select the **Apps & Modules** tab. Select the **NDMP** attributes of the **Client**. The **NDMP** options are as follows:
   - **NDMP**—Check this box to indicate whether this client is an NDMP client.
   - **NDMP multistreams enabled**—Check this box to indicate whether the Isilon client is using the NDMP multistream feature.

     Note

     Only Isilon supports multistreaming.

     Increasing the number of streams does not always increase performance. Depending on your environment, performance might be reduced when the number of streams is increased, especially for a high density file system backup and recover.

     - To start a multistream backup from the command line interface, add option **-A multistreams=<n>** to the command `nsrndmp_save` where n=Number of streams. For example:

       ```
       nsrndmp_save -T <Backup_type> -c <Isilon_client> -A
       multistreams=<n> <Backup_Path>
       ```

     - To start a multistream backup from NMC GUI or a scheduled backup, set the **Parallelism** value in the **Globals (1 of 2)** tab.
   - **NDMP log successful file recovery**— By default, NetWorker does not print each successfully recovered file name in the log messages, because this logging impacts performance and takes up space. To enable the logging of successful recoveries for each file, select this checkbox.
   - **Disable IPv6**—Check this box to disable IPv6 on NDMP backup and recovery.
   - **NDMP array name**—This name is the logical name assigned to the array in NDMP NAS array configurations.
   - **NDMP vendor information**—This attribute contains NDMP client vendor information.
5. Click **OK**.

Configuring the NDMP client manually

EMC recommends that you create NDMP client by using the Client Configuration wizard. If you create the NDMP client manually, then the configuration details for each attribute in the Client Configuration wizard apply when you create the client manually.

Review this information before you configure an NDMP client manually.

- For an NDMP configuration that includes Storage Node resources, configure a Client resource for each storage node that you define for an NDMP backup and clone operation.

- For NDMP three-party storage nodes that use NDMP devices, repeat these steps for each NDMP storage node.
- For NDMP-DSA storage nodes, create the NetWorker Client resources in the same manner as non-NDMP clients. The *EMC NetWorker Administration Guide* provides details on how to create a non-NDMP Client resource.
- NDMP does not support the use of directives including AES encryption. The NetWorker software ignores any value that you define in the **Directives** attribute for an NDMP client.
- When you select **Checkpoint enabled** on the **General** tab, do not modify the **Checkpoint granularity** attribute. NDMP backups do not support checkpoint granularity and the NetWorker software ignores any value that you define for this attribute.

  Note

  VNX does not support checkpoint restart.

- If the NAS supports the NDMP snapshot management extension, then you can browse and mark individual file systems for backup instead of specifying the save sets in the **Save set** attribute. You cannot use the **Save set browse** icon to browse the NDMP file system until you:
  - Select the **NDMP** checkbox, on the **Apps & Modules** tab.
  - Specify the NDMP username and password in the **Remote user and password** fields on the **Apps and Modules** tab.

Note

Snapshot Management Extension is not supported by Celerra, VNX, VNXe, and NetApp C-mode. Only NetApp 7-mode supports Snapshot Management Extension.

Note

Isilon, Celerra, VNX, VNXe, and NetApp C-mode filers do not allow you to browse. Only NetApp 7-mode allows you to browse.

Performing manual NDMP backups

After you configure the NetWorker server for NDMP backup data operations, you can perform manual NDMP backups.

On Windows, you can manually back up NDMP data by using the NetWorker User program. The method to backup NDMP data is the same as a non-NDMP local backup. You cannot perform a three-party backup with the NetWorker User program.

On Windows and UNIX, you can perform a manual backup from a command prompt by using the `nsrndmp_save` command. Performing an NDMP backup from the command line provides more information.

Before performing a manual backup by using the `nsrndmp_save` command or the NetWorker User program, review these requirements:

- You can only perform manual Direct-NDMP backups from a NetWorker server.
- You can start a manual NDMP-DSA backup from a NetWorker server, storage node, or client. When you do not start the NDMP-DSA backup from the NetWorker server, the `servers` file on the NetWorker server and storage node, must contain the hostname of the host that initiates the backup.

- Before you perform a manual backup, you must configure the NDMP client on the NetWorker server. Manual backups use client configuration information for example, the variables that are defined in the **Application Information** attribute of an NDMP client.
- Direct-NDMP and three-party NDMP backups support manual DAR backups when the NDMP client contains the *DIRECT=Y* and *HIST=Y* environment variables in the **Application Information** attribute for the NDMP client.

  NOTICE

  To use DAR, the NAS filer must use NDMP version 4. The *EMC NetWorker Online Software Compatibility Guide* describes how to determine if a particular NDMP vendor supports DAR.

Performing an NDMP backup from the command line

Use the `nsrndmp_save` command to perform a manual command line NDMP backup.

The `nsrndmp_save` command does not back up the bootstrap. Without the bootstrap, you cannot perform a disaster recovery of the NetWorker server. To back up the bootstrap, run the `nsrpolicy` ***-G nsrpolicy policy_name start*** command from the NetWorker server. The `nsrpolicy` command uses the attribute values specified for the policy. For example, the pool and schedule values.

To perform an NDMP backup from the command prompt, use the following syntax:

`nsrndmp_save -T` ***backup_type*** `-s` ***NetWorker_servername*** `-c` ***clientname*** `-l` ***backup_level*** `-t` ***date_time*** `-g` ***nsrpolicy path***

- *backup_type* is a supported backup type for the NAS filer.
  The optimal backup types for the EMC Celerra NAS are `tar` or `dump`. However, you can use the `vbb` backup type to back up entire volumes at the block level.
- *backup_level* is a full for a full backup, incr for an incremental backup. Each NAS supports full backups.

  Note

  EMC Celerra, Isilon, and NetApp filers only support full and incremental level backups.

- *date_time* is the date and time of the last backup, which is enclosed in double quotes. Specify this value for incr level backups. When you do not specify the date and time, the backup is a native NDMP level-based backup.

  NOTICE

  During a NetWorker scheduled policy backup, the NetWorker software supplies the date and the time information, and incremental and level backups work as expected.

  Use one of these methods to determine the date and time of the last NDMP backup:

  - Review the `daemon.raw` file on the NetWorker server or the savegroup completion report for a line similar to the following:

    ```
    42920:nsrndmp_save: browsable savetime=1296694621
    ```

    Use the value after `savetime=` with the `-t` option.
  - Specify the date and time of the last backup reported by the `mminfo` command for the NDMP save set.

Note

You can force the NDMP backup and recovery to ignore IPv6 and instead use IPv4 in one of two ways:

1. Add the `-f` option to the `nsrndmp_save` or the `nsrndmp_recover` commands as required.
2. Select the **Disable IPv6** checkbox on the Apps & Modules tab in the **Client Properties** window.

Example of an NDMP backup

To perform an incremental backup of a NetApp client that is named mynetapp, perform the following steps:

1. Determine the time of the last full backup:

   ```
   mminfo -v -c mynetapp
   ```

client	date	time	size	ssid	fl	lvl	name
mynetapp	08/16/15	15:23:58	1853MB	3864812701	cbNs	full	/.../set1
mynetapp	08/17/15	15:39:58	815MB	3848036430	cbNs	incr	/.../set2

2. Specify the last backup time in `nsrndmp_save` command:

   ```
   nsrndmp_save -T dump -s my_nwserver -c mynetapp -l incr -t
   "02/16/11 15:23:58" -g mygroup path
   ```

For NDMP-DSA backups, the NetWorker software uses the Storage Node attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they override the **Storage Node** attribute value. The *EMC NetWorker Command Reference Guide* and the `nsrndmp_save` man page on UNIX provide more information.

Troubleshooting NDMP configuration and backup failures for Celerra, VNX, and VNXe

This section provides a list of the possible causes and the resolutions for NDMP backup failures.

Unable to connect to NDMP host *hostname*

This message appears when the NetWorker server cannot create or modify an NDMP client.

To resolve this issue ensure that the environment meets the following requirements:

- Username and password specified for the client is correct and has sufficient permissions to perform NDMP operations.
- NDMP service is running on the filer.

Cannot perform NDMP backup after the NetWorker server licenses expire

If a NetWorker sever running in evaluation mode expires before you authorize the server, NDMP devices remain disabled after the addition of the required licenses and authorization of the NetWorker server.

To re-enable NDMP devices, perform the following steps.

1. Use NMC to connect to the NetWorker server and click the **Devices** button.
2. In the **Devices** windows, right-click the NDMP device and select **Properties**.
3. Click the **Configuration** tab and set the **Target Sessions** attribute to **1**.
4. Click the **General** tab and in the **Enabled** section, select **Yes**.
5. Click **Ok**.

No PAX threads available

This error message appears in the `server_log` on the NDMP Data Server when the client parallelism value for an EMC Celerra client exceeds what the EMC Celerra can support.

To resolve this issue, adjust the client parallelism attribute to a value that the Celerra supports:

- For an EMC Celerra client that runs DartOS v5.0 or earlier, the client parallelism value cannot exceed 4.
- For an EMC Celerra client that runs DartOS v6.0, the maximum parallelism value supported is 8, or the value defined in the concurrentDataStreams variable on the EMC Celerra. By default, the concurrentDataStreams variable is 4.
- The maximum parallelism value also depends on the available physical memory and the amount of memory allocated to the PAX configuration. Configuring NDMP Backups on EMC Celerra on the EMC Online Support web site provides more information.

Failed to store index entries

This error message occurs in the `daemon.raw` file when an index backups fails due to an insufficient amount of swap space.

To resolve this issue, increase the amount of swap space available to the NetWorker server.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

IO_WritePage write failed - No space left on device (28): No space left on device

This error message appears in the `daemon.raw` file when the index backup fails. There is insufficient temporary space to store the index entries before the NetWorker software commits the information into the client file index.

To resolve this issue, specify a new the temp directory with sufficient disk space in one of the following ways:

- Define the *NSR_NDMP_TMP_DIR* environment variable in the Application Information attribute of the client.
- Define the *NSR_NDMP_TMP_DIR* as an operating system environment variable on the NetWorker server.

Memory and space requirements for NDMP FH updates on page 23 describes how to determine the amount of disk space the NetWorker software requires to temporarily store client files index entries.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Error reading the FH entries from save through stdin

This error message appears in the `daemon.raw` file of the NetWorker server when there is a communication error between the `nsrndmp_save` and `nsrndmp_2fh` processes.

Resolve any communication or connection issues, then retry the backup.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Cannot find file history info for filename...You may still be able to recover this file with a saveset recovery

This error message appears in the `daemon.raw` file of the NetWorker server when FH information is missing or corrupted for the file specified in the error message. For example, NetWorker cannot update the client file index(CFI) with FH information when a backup process interruption occurs during the failover of a clustered NetWorker environment.

You cannot perform an NMDP file-by-file recover or a save set recover when the CFI does not contain the associated FH information.

To recover this file, perform a save set recover from the command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides for further information.

NOTICE

The NetWorker server does not delete the FH files stored in the `tmp` directory when the CFI updates fail.

nsrndmp_save: data connect: failed to establish connection

This error message appears in the `daemon.raw` file of the NetWorker server for several reasons:

- Network connectivity or name resolution issues exist between the NetWorker server and the NDMP client.
- You specified an incorrect NDMP username or password specified for the NDMP client.
- The NDMP service is not started on the NAS filer.
- The NetWorker server cannot communicate with the NAS filer over port 10000.
- A free port in the NetWorker server's default port range (7937-9936) is not available during an NDMP-DSA backup.
  The *EMC NetWorker Security Configuration Guide* provides more information about NDMP port requirements and configuration.
- A misconfigured loop router. For an EMC Celerra filer, the server route command utility configures the loop router. For NetApp, the route utility configures loop back router. The value of this setup is network-specific and depends on the number of switches and hubs between the NAS filer, NetWorker server, and NetWorker storage node.

- On the host where DSA is running, if the hostname is present in the hosts file, the `nsrdsa_save` process uses this name during backup. The DSA host passes the loopback entry to the NDMP data server and the connection fails. To resolve this issue, remove the hostname from the localhost list.

Knowledge base articles on the EMC Online Support Site provides detailed troubleshooting information for this error message and other failed to establish connection failures that you might encounter during an NDMP backup.

Monitoring NetWorker server activities in the Administration window

The **Monitoring** window in the NetWorker **Administration** application enables you to monitor the activities of an individual NetWorker server.

The **Monitoring** window provides the following types of activity and status information:

- Data protection policies, workflows, and individual actions.
- Cloning, recovering, synthetic full backups, and browsing of client file indexes.
- Operations that are related to devices and jukeboxes.
- Alerts and log messages.

You can also perform some management operations from the **Monitoring** window, for example, starting, stopping, or restarting a data protection policy.

Procedure

1. From the **NMC Console** window, click **Enterprise**.
2. In the **Enterprise** view, right-click the NetWorker server and select **Launch Application**.

   The **Administration** window appears.
3. Click **Monitoring** to view the **Monitoring** window.

About the Monitoring window

On the **Administration** window taskbar, select **Monitoring** to view the details of current NetWorker server activities and status, such as:

- Policies and actions.
- Cloning, recovering, synthetic backups, checkpoint restart backups, and browsing of client file indexes.
- Alerts and log messages, and operations that are related to devices and jukeboxes.

While the **Monitoring** window is used primarily to monitor NetWorker server activities, it can also be used to perform certain operations. These operations include starting, stopping, or restarting a workflow.

The **Monitoring** window includes a docking panel that displays specific types of information. Select the types of information you want to view from the docking panel.

A portion of the **Monitoring** window, which is known as the task monitoring area, is always visible across all windows. A splitter separates the task monitoring area from the rest of the window. You can click and move the splitter to resize the task monitoring area. The arrow icon in the upper right corner of the **Monitoring** window allows you to select which tasks you want to appear in this view.

Smaller windows appear within the **Monitoring** window for each window. Each smaller window, once undocked, is a floating window and can be moved around the page to customize the view. You can select multiple types from the panel to create multiple

floating windows that can be viewed simultaneously. The following table describes the various types of information available in the docking panel, and the details each one provides.

Table 11 Monitoring window panel

Window	Information provided
Policies/Actions	The **Policies** tab provides you with status information about all configure policies and the associated workflows and actions. The **Actions** tab provides you with status information for all actions. Policies/Actions pane on page 81 provides more information.
Sessions	Allows you to customize whether to display all session types, or only certain session types. The information that is provided depends on which session type you select. For example, if you select **Save Sessions**, the window lists clients, save sets, groups, backup level, backup start time, duration of the backup, devices, rate, and size. Sessions pane on page 84 provides more information.
Alerts	Lists the priority, category, time, and message of any alerts. Alerts pane on page 85 provides more information.
Devices	Lists devices, device status, storage nodes, libraries, volumes, pools, and related messages. Devices pane on page 86 provides more information.
Operations	Lists the status of all library and silo operations, including `nsrjb` operations that are run from the command prompt. Also lists user input, libraries, origin, operation data, operation start time, duration of the operation, progress messages, and error messages. When displaying Show Details from the **Operations** window, the length of time that the window is displayed depends on the value that is typed in the **Operation Lifespan** attribute on the **Timers** tab of the **Properties** dialog box for the corresponding library. To access library properties, click **Devices** in the taskbar. By default, this pane is hidden.
Log	Lists messages that are generated by the NetWorker server, including the priority of each message, the time the message was generated, the source of the message, and the category. Log pane on page 89 provides more information.

Customizing the Monitoring window

This section describes how to customize the **Monitoring** window in the **Administration** interface.

Customizing tables

You can customize the organization and display of tabular information in the **Monitoring** window.

Sorting tables

You can change the display of tabular information that appears in the window. You can sort Table grids by column heading, and then by alphabetic or numeric order within those columns.

1. Drag-and-drop the column heading to its new position.
2. Click the column heading to sort the items into alphabetic and numeric order. An arrow appears in the column heading to indicate the sort order.

Sorting selected rows in a table

Selected rows are sorted to the top of the table. This is particularly useful when you select **Highlight All** from the Find panel to select all rows matching the Find criteria and then moving all selected rows to the top of the table to view the results.

1. From the **Edit** menu, select **Find**, or press **Ctl + F** to view the **Find** panel.
2. To select the rows, click each row or use the Find criteria.
3. Select **Sort Selected**.

Sorting multiple columns in a table

You can select the column that you want to use as the tertiary sort key, the secondary sort key, and the primary sort key.

1. Click the column that you want to use as the last sort key.
2. Click the column that you want to use as the next-to-last sort key, and so on, until you select the primary column.

Displaying columns in a table

You can select which columns to display in a table.

1. From the **View** menu, select **Choose Table Columns**.
2. Click a column name to select or clear the column and then click **OK**. You can also select the columns to display by right-clicking a table header and selecting **Add Column** from the drop-down.

Displaying panes

You can choose to show or hide panes in the **Monitoring** window.

Perform the following steps to hide or show a pane in the **Monitoring** window.

Procedure

1. From the **View** menu, select **Show**. A check mark appears beside the panes that appear in the **Monitoring** window.
2. To hide a pane, select a marked pane.

   A check mark does not appear beside the pane.
3. To show a pane, select an unmarked pane.

A check mark appears beside the pane.

Policies/Actions pane

The **Policies/Actions** pane provides you with the ability to review status information about policies and actions.

This pane has two tabs:

- Policies—Provides a navigation tree that displays all configured policies on the NetWorker server. Expand each policy to display the workflows that are associated with each policy. Expand each workflow to display each action that is contained in the workflow.
- Actions—Provides a list of all Action resources.

Policies pane

The **Monitoring** window in the **NetWorker Administration** window enables you to monitor activities for specific policies, workflows, and actions.

The **Policies/Actions** pane at the top of the **Monitoring** window lists the policies on the NetWorker server by default. Click the + (plus) sign next to a policy in the list to view the workflows in the policy, and the + (plus) sign next to a workflow to view the actions for a workflow.

The **Policies** pane provides the following information for each item (where applicable):

- Overall status

  The following table provides details on the status icons that may appear in the **Policies** pane.

  Table 12 Policy status icons

Icon	Status
	Never run
	Running
	Succeeded
	Failed
	Probing
	Interrupted
	Queued
	Cloning
	Consolidating (NetWorker server 8.2.x and lower only)

- Most recent start time.
- Duration of the most recent run.

- Next scheduled runtime.
- Name of the assigned save set.
- Device on which the save set is stored.
- Backup level.
- Data transfer rate.
- Size of the save set.
- Messages that resulted from an action.

Right-click an action in the **Policies** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

When you sort the items on the **Policies/Actions** pane by using the **Status** column, NetWorker sorts the items in alphabetical order that is based on the label of the icon.

Consider the following when a policy/action is in a probing state:

- A message is sent when the group starts and finishes the probe operation.
- The results of the probe operation (run backup/do not run backup) are also logged.
- Probes do not affect the final status of the group, and the group status does not indicate the results of the probe.
- If probing indicates that a backup should not run, then the group status reverts to its state before the group running.
- Check the results of the probe in the **Log** window to ensure that the probe indicates that the backup can be taken.

Actions pane

To view a list of all actions, click the **Actions** tab at the bottom of the **Policies** pane. The **Policies** pane becomes the **Actions** pane.

The **Actions** pane provides the following information for each action:

- Overall status

  Note

  The **Actions** pane displays the same status icons as the **Policies** pane.

- Name
- Assigned policy
- Assigned workflow
- Type
- Date and time of the most recent run
- Duration of the most recent run
- Percent complete, for actions that are in progress
- Next scheduled runtime

Right-click an action in the **Actions** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

Workflow operations

This section describes how to use the **Monitoring** window to start, stop, and restart workflows.

Starting, stopping, and restarting data protection policies

The workflows in a data protection policy can run automatically, based on a schedule. You can also manually start, stop, and restart specific workflows, in the **Monitoring** window of the **NetWorker Administration** window.

Note

You cannot stop, restart, or start individual actions.

You can restart any failed or canceled workflow. However, the restart must happen within the restart window that you specified for the workflow.

You can also start specific policies and workflows in the **Protection** window by right-clicking the policy or workflow, and selecting **Start**.

Procedure

1. Select the workflow, or action in the **Monitoring** window.
2. Right-click and select **Start**, **Stop**, or **Restart**.

   A confirmation message appears.
3. Click **Yes**.

Viewing workflow backup details

Perform the following steps to view backup details for workflows.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Policies** in the docking panel, and expand the Policy that you want to monitor.
3. Right-click the workflow, and then select **Show Details**. The **Workflow Summary** window appears.
4. In the **Workflow runs** pane of the **Workflow Summary** window, select the workflow.
5. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
6. Click **OK** to close the **Workflow Summary** window.

Viewing action backup details

Perform the following steps to view backup details for actions.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Actions** in the docking panel.

3. In the **Actions** pane, right-click the action, and then select **Show Details**. The details window for the action appears.
4. Review the information in the **Actions Messages** pane. To display detailed information from the action log file, click **Show Action Logs**, and then select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
5. In one of the Actions detail panes, for example, the **Completed successfully** pane, select the action that you want to review.
6. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
7. Click **OK** to close the **Details** window.

Sessions window

Use the **Sessions** window to view the sessions that are running on a NetWorker server. You can change the view of this window to display these sessions:

The **Sessions** pane below the **Policies**/**Actions** pane provides details on individual save, recover, clone, and synthetic full sessions by client.

Click the tabs at the bottom of the **Sessions** pane to view all sessions or to limit the list of sessions by the session type. Session types include:

- Save
- Recover
- Clone
- Browse
- Synthetic Full/Rehydrated Sessions
- All

To change the displayed session types go to **View** › **Show**, and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the **Monitoring** window, even if the session was started by running the `savegrp` command.

To stop a session, right-click the session in the pane, and select **Stop** from the drop-down.

Changing displayed session types

The column headings displayed on this window will differ depending on the type of sessions you chose to display.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Sessions** in the docking panel.
3. Go to **View** › **Show** and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

Stopping a session

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the Monitoring window, even if the session was started by running `savegrp`.

To stop a session, right-click the session in the window and select Stop from the drop-down.

The following table provides a list of actions that can be stopped from NMC.

Table 13 Sessions that can be stopped from NMC

Session type	Stop from NMC?
Save by Savegroup	Yes
Synthetic Full by Savegroup	Yes
Clone by Savegroup	Yes
Schedule Clone	Yes
Manual Save	No
Manual Clone via NMC	No
Manual Clone via CLI	No
Winworker and CLI Recovery	No
Recovery started from Recover wizard	Yes
VMware Backup Appliance Save and Recover	No

NOTICE

Stopping a session from NMC does not affect any other group operations running.

Alerts pane

The **Alerts** pane displays alerts that are generated by a particular NetWorker server or Data Domain system that has devices that are configured on the NetWorker server. The **Alerts** pane includes priority, category, time, and message information.

An icon represents the priority of the alert. The following table lists and describes each icon.

Table 14 Alerts window icons

Icon	Label	Description
	Alert	Error condition detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.
	Warning	A non-fatal error has occurred.

When items on the **Alerts** pane are sorted by the **Priority** column, they are sorted in alphabetical order based on the label of the icon.

Removing alerts

Remove individual alert messages from the **Events** tables by removing them from the **Events** table. To delete a message in the **Events** table, right-click the message, and select **Dismiss**.

Note

The alert message remains in the **Log** window in the NetWorker **Administration** program.

Devices pane

The **Devices** pane allows you to monitor the status of all devices, including NDMP devices. If the NetWorker server uses shared and logical devices, the window is adjusted dynamically to present a set of columns appropriate for the current configuration.

The **Devices** pane provides the following information:

- Status of the operation.
- Name of the device.
- Name of the storage node that contains the device.
- For tape devices, the name of the library that contains the device.
- Name of the volume in the device.
- Name of the pool that is associated with the volume.
- Last message generated for the device.
- Whether the operation requires user input.

  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape.

Entering user input on page 89 provides instructions on how to deal with a user input notification.

If the current server configuration includes a shared device, a **Shared Device Name** column appears on the **Devices** pane. The name of the shared device appears in the **Shared Device Name** column. If other devices for that configuration are not shared devices, then the **Shared Device Name** column is blank for those devices. Since only a single device per hardware ID can be active at any particular moment, the information for inactive shared devices is filtered out, so only one device per hardware ID is presented on the window at any time.

An icon represents the device status. The following table lists and describes each icon.

Table 15 Devices status icons

Icon	Label	Description
	Library device active	The library device is active.
	Library device disabled	The library device is disabled.
	Library device idle	The library device is idle.
	Stand-alone device active	The stand-alone device is active.
	Stand-alone device disabled	The stand-alone device is disabled.
	Stand-alone device idle	The stand-alone device is idle.

When you sort items in the **Devices** pane by the **Status** column, NetWorker sorts the devices in alphabetical order based on the label name of the icon.

Operations window

The **Operations** window displays information about device operations. It provides the following information:

- Status of the operation.
- Name of the library.
- Whether the operation requires user input.
  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape. Entering user input on page 89 provides instructions on how to deal with a user input notification.
- The origin, or source, of the operation.
  For example, the interface, nsrjb or the NetWorker server.
- Time the operation started.
- Type of operation.
- Duration of the operation.
- Status messages from the operation.
- Any error messages.

NOTICE

Only the last error message of the operation appears in the **Error Messages** column. Move the mouse pointer over the cell containing the last error message to display the entire list of error messages.

The operation status is represented by an icon. The following table lists and describes each of the icons.

Table 16 Operations window icons

Icon	Label	Description
	Failed	The operation failed.
	Queued	The operation is waiting in the queue to run.
	Retry	The operation failed, but may work if you try again.
	Running	The operation is running.
	Successful	The operation completed successfully.
	User Input	The operation requires user input.

When items on the **Operations** window are sorted by the Status column, they are sorted in alphabetical order based on the label of the icon.

Viewing operation details

The **Operation Details** dialog box opens, providing information about the completion of the operation. The **Completion Time** displays the time that the operation finished. The time that it took to complete the operation is the difference between the completion and start times of the operation.

To save operation details to a file, click **Save** in the **Operation Details** dialog box. When prompted, identify a name and location for the file.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation, then select **Show Details**.

Stopping an operation

Certain operations can be stopped from the **Operations** window.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation to stop, then select **Stop**.
4. Click **Yes** to confirm the stop.

Note

Operations that were started from a command line program, such as the `nsrjb` command, cannot be stopped from the **Operations** window. To stop these operations, press **`Ctrl-c`** from the window where the command was started.

Entering user input

If the system requires user input, select the labeling operation in slow/verbose mode and the Supply User Input icon appears.

Procedure

1. Right-click the operation, then select **Supply Input**.
2. Confirm whether or not to supply input.
   - If **Yes**, and input is supplied, the icon in the User Input column disappears.

     If two users attempt to respond to the same user input prompt, the input of the first user will take precedence, and the second user will receive an error message.
   - If **No**, and input is not supplied, the operation will time out and fail.

Log window

To view the most recent notification logs, click the **Log** window from the docking panel in the **Monitoring** window. The **Log** window provides the priority, time, source, category, and message for each log.

Note

If a particular log file is no longer available, check the log file on the NetWorker server. The log files are located in *`NetWorker_install_path`*`\logs` directory.

An icon represents the priority of the log entry. The following table lists and describes each icon.

Table 17 Icons in the Log pane

Icon	Label	Description
	Alert	Error condition that is detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.

Table 17 Icons in the Log pane (continued)

Icon	Label	Description
	Warning	Non-fatal error has occurred.

When you sort items on the **Log** pane by using the **Priority** column, NetWorker sorts the icons in alphabetical order based on the name of the label.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 18 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.

Table 18 Recovery toolbar options (continued)

Button	Function
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 19 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 20 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Reporting NDMP Data

The NetWorker software reports information about NDMP clients, data, and volumes in two ways.

- The NMC reporting feature—Reports NDMP data in the same manner as non-NDMP data. The *EMC NetWorker Administration Guide* provides more information.
- The `mminfo` command. Use the `mminfo` program to query the media database for NDMP volume or save set information.

Querying the NDMP volumes by backup type with the mminfo command

You can query save sets by backup format (NDMP or DSA) to display volume information.

- For example, to query NDMP volumes, type `mminfo -q ndmp`. Output similar to the following appears:

```
volume client date size level name
005D0000 sim1cifs1 6/22/2011 1036 MB full /fs1
005D0001 sim1cifs1 6/22/2011 173 MB full /fs1
005D0001 sim1cifs1 6/22/2011 862 MB full /fs1
005D0002 sim1cifs1 6/22/2011 348 MB full /fs1
```

- For example, to query NDMP -DSA volumes, type `mminfo -q dsa`. Output similar to the following appears:

```
volume client date size level name
NDMP.001 10.8.67.219 12/13/2011 644 MB full /vol/vol0
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 36 MB full /vol/vol2
```

Querying the NDMP save sets with the mminfo command

Query the media database to determine which save sets are NDMP save sets and the status of an NDMP save set in the media database. NDMP save set status information is important when performing NDMP recoveries.

- To perform a browseable NDMP recover, the ssflags (fl) field for an NDMP save set must contain a (b). The b value denotes a browsable save set.
- To perform a save set recover from the NetWorker User program, the ssflags (fl) field for an NDMP save set must contain either (r) or (b).
- An NDMP save set contains an N attribute in the ssflags (fl) field.
- An NDMP-DSA save set contains an s attribute in the ssflags (fl) field.

In the following example, the NDMP save set status is recoverable (r). To recover the data, you can only perform a save set recovery from a command line.

```
mminfo -av
```

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 1036MB 3842140553 hrN full /fs1
```

In the following example, the NDMP-DSA save set status is brows able (b). Recover the data by using the NetWorker User program, or from the command line. A browseable NDMP-DSA save set supports brows able and save set recoveries.

```
mminfo -av
```

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 36MB 4259813785 cbNs full /fs1
```

Performing NDMP recoveries

NetWorker uses the `nsrndmp_recover` program to coordinate recover operations between the NetWorker software and the NDMP client. The `nsrndmp_recover` program does not move data to the NDMP client. When the `nsrndmp_recover` program identifies an NDMP-DSA save set, `nsrndmp_recover` automatically runs the `nsrdsa_recover` program on the same host that runs the `nsrndmp_recover` command.

To recover NDMP data, you can run the `nsrndmp_recover` program from a command prompt, or use one of following programs, which automatically starts `nsrndmp_recover`:

- `recover`—The command line program on Windows and UNIX.
- `winworkr`—The NetWorker User GUI on Windows.
- The NMC Recovery wizard.

During the recovery process, the `nsrndmp_recover` program passes nlist information to the NDMP client. There are three methods to recover NDMP backups:

- Index-based file-by-file recover — The nlist includes file offset and ACL information. When you recover many files, the recover process uses a significant amount of system resources on both the NetWorker server and the NDMP client to build and process the nlist information.
- Full save set recovery—The nlist only includes the path to the recovery directory, down to and including the mount point. When you recover many files, the recover

process uses less system resources than an index-based NDMP recover to build and process the nlist information.

- NDMP directory restore — A partial save set recovery of a single file or single directory.

For example, when the NetWorker software writes NDMP data to a remote storage node, start the `recover` program on the NetWorker storage node to prevent the data from traversing the network.

Note

When you start the `recover` program on the NetWorker server, the data flows from the storage node to the NetWorker server and from the NetWorker server to the NDMP client, over the network.

NDMP recovery requirements for EMC Celerra and VNX

The following list summarizes the requirements:

`scanner`

You cannot use the `scanner` command with the `-i`, `-f` and `-r` options on an NDMP volume. You cannot use the `scanner` command on a volume that contains NDMP and non-NDMP save sets when you load the volume in an NDMP device. The *Scanner command usage* technical note provides more information about using the `scanner` command with NDMP data.

Cross platform recoveries

You can recover NDMP data to different NDMP client however, you cannot perform a cross platform recover. Recover NDMP data to an NDMP client that is the same brand, a compatible model, and the same operating system as the original NDMP client.

Devices

Recover Direct-NDMP and Three-party backups performed to an NDMP device from an NDMP device. To improve recover performance from an NDMP tape device, configure the tape device to support variable length records. Recover NDMP-DSA backups from a non-NDMP device.

Localized environments

When recovering data in a localized NDMP environment, the Index Recover status window shows the process in English and not the localized language.

NDMP-DSA

For better recovery performance, start the recover process on the NetWorker host where the backup volume resides.

Immediate recoveries

Run the `nsrndmp_recover` program on the storage node with the locally attached backup device to perform an immediate recovery of NDMP-DSA data.

EMC Celerra and VNX

During recover operation the filer skips char and block special files. The following error message appears:

```
Warning: /fs1/SPE_REL/my.char_file has an unknown file
type, skipping
```

When you recover named pipes:

- If the recover directory contains 10,000 or more named pipes, then the recover operation will fail. Ensure that the recover directory contains less than 10,000 named pipes.
- The recover process changes the file permissions. The NetWorker software recovers named pipes as normal files.

The Configuring NDMP for VNX documentation on EMC Online Support describes how to recover a tape silvering backup to a different data mover.

vbb

When you set the backup type for an EMC Celerra or VNX filer to vbb, the NetWorker software performs a block-based backup.

The NetWorker software recovers the data to a raw device. Use the Relocate data option to specify the raw device. When you use deduplication on the source or target file system, you cannot perform an index based file-by-file recover. When you perform a destructive save set recover, the recover process performs the following actions:

- Recovers the data to the original location or an alternate location.
- Overwrites existing data.
- Overlays the data at the file system level and reimposes the saved image on the file system.

Configuring NDMP backups on Celerra and Using Celerra Data Deduplication documentation on EMC Support Online provides detailed information about how to prepare the filer before you perform FDR.

DAR and DDAR

By default, the NDMP recover process reads an entire tape from start to finish. The recover process extracts the data as it encounters the data on the tape. For large backup images, recovery is slow.

The DAR/DDAR recovery process:

- Provides the ability to recover a file or directory from the exact location on a tape.
- DDAR only passes the directory path to the NAS filer. DAR passes the paths of each file individually.
- Reduces the size of the nlist information that the recover process stores in memory. During the recover process, the NAS filer (DDAR) assumes that the directory path includes all cataloged files and directories. However, DAR mentions each file that it wants recovered.
- Does not sequentially read the file or record numbers on the tape to locate the data, which reduces the amount of time that you require to recover specific files from a backup.

Note

Creating and configuring the NDMP client resource on page 67 describes how to configure the DAR and DDAR Application Information attributes for NDMP clients.

Use the `recover` command or the NetWorker User program to perform DAR and DDAR recoveries. You cannot use the `nsrndmp_recover` program to perform DAR/DDAR recoveries.

When not to use DAR or DDAR

DAR and DDAR recoveries send multiple pathnames across the network to the NDMP Data Server and, in three-party configurations, to the NetWorker server. The recover process stores the pathnames in memory on the NDMP Data Server. Recoveries of a large amount of data from a large save set can negatively affect the network and the NDMP Data Server resources.

Do not use DAR and DDAR to recover the following objects:

- Several thousands of files in a single index-based recover operation.
- A specific directory structure containing several thousand or millions of files.

To perform a non-DAR-based recovery of a save set when you set the *DIRECT=y* at the time of backup, first define the *NSR_NDMP_RECOVER_NO_DAR=y* variable in the Application Information attribute of the NDMP client.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 21 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.

Table 21 Recovery toolbar options (continued)

Button	Function
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 22 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 23 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Performing an NDMP index-based file-by-file data recovery

Perform an NDMP index based file-by-file recover in the same manner as a non-NDMP data recover. You can restore the data to the original NDMP client or perform a directed recovery to a different NDMP client.

Before you perform an index-based file-by-file recover, review the following information.

- Set the *HIST=y* in the Application Information attribute of the NDMP client at the time of the backup.
- The NDMP save set must be browsable. You cannot perform a browsable recover of a recoverable or recyclable save set. Reporting NDMP Data on page 93 describes how to determine the status of an NDMP save set.
- Do not use an index-based recovery to recover a large numbers of files or directories. For better recovery performance, use a save set recover. Performing a full or Directory Restore of NDMP data by using a save set recovery on page 104 provides more information.
- To perform an index-based file-by-file recover:
  - Use the NetWorker User program on a Windows host. Performing an NDMP index-based file-by-file recover using the NetWorker User program on page 101 provides detailed information.
  - Use the `recover` program. Performing an NDMP index-based file-by-file recover from a command prompt on page 103 provides detailed information.

Performing an NDMP index-based file-by-file recover using the NetWorker User program

On Windows, to recover data to the original NDMP client or to a different NDMP client, perform the following steps.

Procedure

1. Open the NetWorker User program and connect to the NetWorker server.

   NOTICE

   If you receive the error:

   ```
   No file indexes were found for client client_name on server
   server_name
   ```

   Try connecting to a different NetWorker server and you selected the correct NetWorker server, then ensure that you selected a browsable save set. Alternatively, perform a save set recover.

2. Select **Recover** to open the **Source Client** window.
3. Select source NDMP client and click **OK**. The local client is the default selection.
4. Select the destination client for the recovered data and click **OK**. If the destination client is not the source client, ensure the NAS filer is the same brand, a compatible model and the same operating system as the source NDMP client.
5. (Optional) Recover the data from an earlier backup time. The **Recover** window appears with the latest version of the backup files. To recover data from an earlier backup, change the date and time of backup using one of the following methods:

   a. Change the browse time for all files in the recover window:

      - From the **View** menu, select **Change Browse Time**.
      - In the **Change Browse Time** window, select a new day within the calendar. Select **Previous Month** or **Next Month** to change from the current month.
      - In the **Time** field, change the time of day by typing an hour, a minute, and the letter a for A.M. or p for P.M. Use the 12-hour format.
      - Click **OK**.

   b. View all versions of the selected file system object:

      - Highlight the file or directory for review.
      - From the **View** menu select **Versions**.
      - Once you locate the version to recover, change the browse time. To change the browse time, highlight the volume, directory, or file and click **Change Browse Time**. The **Version** window closes and the **Recover** window reflects the new browse time.

6. (Optional) Search for the files. To search for and recover the most recently backed-up version of a file or directory:

   a. From the **File** menu, select **Find**.

   b. Type the name of the file or directory. Use wildcards to expand the search; without wildcards, partial filenames do not provide any results.

7. Mark the data to recover. To select file system objects to recover:

a. In the left pane of the **Recover** window, click the appropriate directory folder.

b. Mark each directory or file to recover by selecting the checkbox next to each directory or file.

8. (Optional) Relocate the data to a different location. By default, the recover process recovers the selected files to the original location.

Note

The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

To relocate the files to a different location:

a. Select **Recover Options** from the **Options** menu.

NDMP recoveries do not support the following options:

- Rename recovered file
- Discard recovered file
- Prompt for every file conflict
  NDMP recoveries will always overwrite existing files. EMC recommends that you relocate the NDMP data to a different location, to avoid data loss.

b. In the **Relocate Recovered Data To** field, type the full path name of the target directory, click **OK**.

The target directory is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the recover process uses the original location and overwrites existing files with the same name.

9. (Optional) To view the volumes required to recover the marked file system objects, from the **View** menu, select **Required Volumes**.

10. Click **Start** to begin the recovery. If any required volume is not available to the NetWorker server, a volume status warning appears.

When this warning appears:

a. Click **No**.

b. From the **View** menu, select **Required Volumes**.

c. Ensure that the NetWorker software can mount each listed volume into an available device.

d. Attempt the recover operation again.

The NetWorker server takes a few moments to recover the files, depending on file size, network traffic, server load, and tape positioning. During this time, messages appear so that you can monitor the progress of the recovery.

When the recovery completes successfully, a message similar to the following appears:

```
Received 1 file(S) from NSR server
server Recover completion time: Tue Jan 21 08:33:04 2009
```

Performing an NDMP index-based file-by-file recover from a command prompt

This section applies to command line recoveries from a Windows and UNIX client.

To avoid using the Windows version of `recover.exe` on Windows operating systems, perform one of the following actions:

- Specify the full path to the recover program. For example: `C:\Program Files\EMC NetWorker\nsr\bin\recover.exe`.
- Ensure that the *$PATH* environment variable contains the `NetWorker_install_path\bin directory before %SystemRoot%\System32`.

To recover NDMP data from a command prompt on a UNIX or Windows NetWorker host, perform the following steps:

Procedure

1. From the command prompt, type:

   `recover -s` *NetWorker_servername* `-c` *client_name*

   where:

   - the `-s` *NetWorker_servername* option specifies a particular NetWorker server on the network to use when recovering data.

     When you do not use the `-s` option, the `recover` program tries to connect to the first computer listed in the servers file. When the servers file does not contain any servers, or lists more than one server, the **Change Server** window appears, and you can select the server.
   - the **-c***client_name* option specifies the source NDMP client.
2. When prompted, type the directory to browse, for example:

   ```
   cd /mydirectory
   ```

3. Use the `add` command to add the required files or folders to the recover list. The *EMC NetWorker Command Reference Guide* provides a complete list of options for the `recover` command.
4. When restoring NDMP data, EMC recommends that you relocate the NDMP data to a different location.

   Note

   The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

   - To relocate the data to a different directory, type:

     `relocate` ***destination_directory_name***

     The target pathname for *destination_directory_name* is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the

recover operation uses the original location and overwrites existing files with the same name.

- To recover the data to a different host, type:

  `relocate` ***`target_hostname`***`::`***`/mount_point`***

  Data ONTAP may require you to add a backslash (\) after the mount point. For example, *target_hostname::\mount_point*.

5. After you add all of the required files, type:

   `recover`

Performing a full or Directory Restore of NDMP data by using a save set recovery

You perform an NDMP save set recover in the same manner as a non-NDMP save set recovery. You can recover data to the original NDMP client or perform a directed recovery of the data to a different NDMP client of the same platform.

Before you perform a full save set recover, review the following information.

- Use a full save set recovery to recover all files and folders in an NDMP data save set, or to recover an entire directory within an NDMP save set. You cannot use the NetWorker User program to perform an NDMP Directory Restore.
- To use the NetWorker User program on Windows, a client file index entry for the save set must exist. When the index entry for the save set does not exist, the recover fails with an `index not found` error. When the client file index entries do not exist for the save set, use the `nsrndmp_recover` program with the '-v off' option.
- You cannot perform a save set recover from the NetWorker User program when the save set status is eligible for recycling (E). The recover process requires a recoverable (r) or brows able (b) save set status. The *EMC NetWorker Administration Guide* provides information on how to change the status of a save set. A save set recover reads the entire tape, from beginning to end, to find and recover the requested files. The recovery process completes when the recover operations reads all required tapes in their entirety.
- As each file recovers, the file name appears on the target share but the file size is 0 KB. The actual file size update occurs after the recovery completes.

Performing an NDMP save set recover by using the NetWorker User in Windows

NOTICE

When the recover operations fails with the error:

```
Failed to propagate handle <number> to child process: Access is
denied
```

The save set is not in the client file index of the NDMP client. Perform a save set recover from a command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides more information.

Procedure

1. Start the NetWorker User program.
2. On the **Change Server** window, select the NetWorker server and click **Ok**.
3. Select **Options** › **Recover Save Sets**.

4. On the **Source Client** window, select the appropriate NDMP client, and then click **Ok**.
5. On the **Save Sets** window, select the name of the save set.
6. Select the version of the save set, if there are multiple versions. You can also select the cloned version of a save set, if applicable.
7. To recover specific files and directories instead of the entire save set:
   a. Click **Files**.
   b. Specify the files and directories, one per line.
   c. Click **OK**.

   NOTICE

   Do not use this method to mark tens of thousands of files. Instead, perform an NDMP Directory Restore. Marking many files and directories generates a large nlist and requires intensive resources on both the NetWorker server and the NAS filer.

8. Click **Recover Options**.

   An NDMP data recovery does not support the following options:

   - Rename recovered file
   - Discard recovered file
   - Prompt for every file conflict

   NOTICE

   EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries *always* overwrite existing files.

9. To recover the data to a pathname that is different from the original backup location, in the **Relocate Recovered Data To** field, type the full pathname of the destination directory, then click **Ok**.

   For NDMP data recoveries, the target pathname is a literal string and *must* exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

10. To recover the data to a different NDMP client, specify the name of the client to receive the NDMP data in the **Destination Client** field.
11. To view the volumes required to perform the recover, select **View › Required Volumes**
12. Click **OK** to begin the recovery. The recovery status appears in the **Recover Status** window.

Performing an NDMP save set recovery from the command prompt

To perform a save set recovery to the original NDMP client or to a different NDMP client, use the `nsrndmp_recover` command.

For example:

```
nsrndmp_recover -s NetWorker_server -c source_ndmp_client -S ssid/
cloneid -v off -m target_ndmp_client::/target_path /source_path
```

where:

- *source_ndmp_client* is the hostname of the source NDMP client.

- *target_ndmp_client* is the hostname of the destination NDMP client.
- */source_path* is the original location of the data.
- */target_path* is the location to recover the data.

  NOTICE

  EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries always overwrite existing files. The `/target_path` is a literal string and must exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

- **-v off** allows you to restore data when client file index of the NDMP client does not contain information about the NDMP save set.
  In the following examples, the NetWorker server is mars and the backup client is venus.
  - To recover a mount point `/mnt` from a backup of NDMP host venus to a directory `/newmnt` on NDMP host jupiter, type:

    ```
    nsrndmp_recover -s mars -c venus -S 123456789 -v off -m
    jupiter::/newmnt
    ```

  - To recover a mount point `/mnt` from a backup of NDMP host venus to NDMP host pluto, type:

    ```
    nsrndmp_recover -s mars -c venus -R pluto -S 123456789 -v off -
    m /mnt
    ```

    Data ONTAP may require that you to add a slash (/) after the mount point. For example, *target_hostname*::/*mount_point*/.

Performing destructive save set recoveries for vbb backups

Use the `nsrndmp_recover` command with the `-r` *raw_device* and `-m` *mount_point* options to perform a destructive save set recovery.

NOTICE

Do not perform a NDMP Directory Restore from a vbb backup of a Celerra deduplicated file system.

For example:

On a Windows system to perform a destructive save set recovery to the `/data` drive:

```
nsrndmp_recover -s mars -c venus -m /data -r raw_device_name -S
2674606849
```

On a UNIX system, the following command performs a destructive save set recovery to the `/dev/c1t1d0s0 device`, mounted at the `/` file system:

```
nsrndmp_recover -s mars -c venus -r /dev/c1t1d0s0 -S 2674606849 -m /
```

The *EMC NetWorker Command Reference Guide* or the UNIX man page provides more information about the `nsrndmp_recover` command.

If you do not specify the `-r` option when you use the `-m`, the recover operation:

- Is nondestructive.

- Operates at the file or directory level, rather than the file system level.

This nondestructive restore overwrites existing files on the destination that have the same names as those in the recovery list. Other data remains untouched on the file system.

Use this nondestructive method to:

- Perform a directory level recovery on a high density file system.
- Recover many files in one directory.

Troubleshooting NDMP recover

This section provides a list of the possible causes and the possible resolutions for NDMP recovery issues.

RESTORE: could not create path *pathname*

This error message appears when restoring NetApp data. This error, when encountered, appears in the `daemon.raw` file of the NetWorker server and the recovery output.

To resolve this issue:

- Ensure that you specify a source and a target path during the recover that exists on the target filer.
- If you set the *UTF8=Y* application information variable during an NDMP client backup and the backup contains path names with non-ASCII characters, then perform a save set recover. Index-based recoveries will fail with this error message.

These files were not restored (Restore failed with error, or file/directory specified but not found in backup)

This error message appears in the `daemon.raw` file of the NetWorker server and the in the recovery output.

To resolve this issue:

- Ensure that the file or directory specified during the recover, exists in the save set.
- Ensure that the pathname specified to relocate the data exists on the destination filer. For NDMP data recoveries, the target pathname is a literal string and must exactly match the path as seen by the native OS on the NAS filer.

CHAPTER 3

Isilon

This section includes the following topics:

- Configuring devices for NDMP operations 110
- Configure NetWorker for NDMP backup and clone operations 121
- Monitoring NetWorker server activities in the Administration window 159
- Reporting NDMP Data 176
- Performing NDMP recoveries 177

Configuring devices for NDMP operations

Review this section for information about how to configure the NetWorker environment for NDMP data operations.

The *EMC NetWorker Hardware Compatibility Guide* on the EMC Online Support web site provides a list of NDMP devices that the NetWorker software supports.

NDMP device limitations

Review these limitations before you configure NDMP devices.

- The timeout of the NetWorker server resource attribute, `nsrmmd`, does not apply to NDMP devices, but it does apply to storage nodes devices.
- You cannot use the `jbexercise` utility with an NDMP autochanger.
- You cannot configure NDMP devices on a dedicated storage node.
- You must use a non-rewind device handle for the NDMP media device handle.
- You cannot configure Advanced file type devices and file type devices as an NDMP device.
- You cannot configure an NDMP Autochanger when the NDMP protocol is before version 3. You must determine the NDMP device handles, then use the `jbconfig` command to configure the autochanger.

Determining NDMP device path names

To configure an NDMP standalone device or NDMP jukebox, you must first determine the path names of the media devices. If the NAS filer does not support the NDMP_CONFIG interface or uses NDMP version 3, you must also determine the library device handle.

To determine the NDMP device path names and the library handle, use the `inquire` command or vendor-specific commands.

Determining the NDMP device path names by using inquire

Use the `inquire` command to determine the path names and library handle.

Procedure

1. From a command prompt on the NetWorker server, type:

   ```
   inquire -N NAS_hostname -T
   ```

2. When prompted, specify the NAS username and password.

   NOTICE

   Use the `inquire` command with caution. When you run `inquire`, the command sends the `SCSI inquiry` command to all devices detected on the SCSI bus. If you use the `inquire` command during normal operations, then unforeseen errors can occur, resulting in possible data loss.

Determining the NDMP device path names for Isilon

Before you configure an NDMP autochanger you must determined the device path names of NDMP devices and the robotic arm. The following table provides vendor-specific information that you can use to determine the device path names.

For an NDMP local backup, configure Backup Accelerator:

Procedure

- Use the `isi fc` list command to ensure that the state of each fibre channel ports is enabled.
- Use the `isi tape rescan --reconcile` command to scan for tape devices.

  `--reconcile` deletes the device entries for devices that a Backup Accelerator node no longer manages.
- Use the `isi tape ls -v` to display a list of current devices.

Dynamic drive sharing

Dynamic Drive Sharing (DDS) is a feature that provides NetWorker software with the ability to recognize shared physical tape drives. DDS enables NetWorker software to perform the following operations:

- Skip the shared tape drives that are in use.
- Route the backups or recoveries to other available shared tape drives.

Introduction to DDS

DDS controls application requests for tape media and allows the NetWorker server and all storage nodes to access and share all attached devices.

A system administrator can configure DDS by setting a sharing policy for devices that are accessible from multiple storage nodes.

There are two terms that are central to the use of DDS are drive and device. Within the context of DDS, these terms are defined as follows:

- Drive—The physical backup object, such as a tape drive, disk, or file.
- Device—The access path to the physical drive.

Note

NetWorker only supports DDS in a storage area network (SAN) Fibre Channel environment and not in a direct-connect SCSI environment.

Benefits of DDS

Enabling DDS on a NetWorker system provides these benefits:

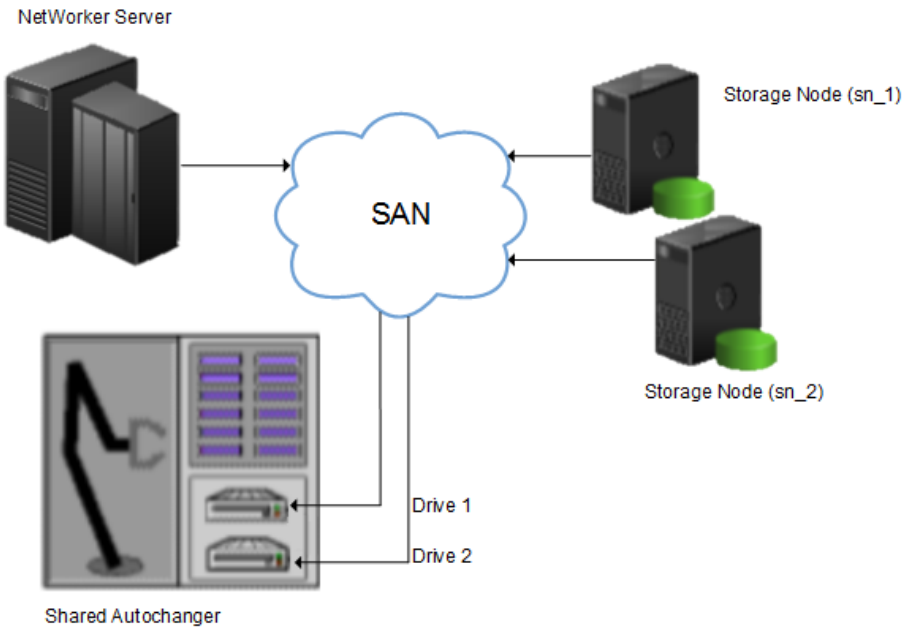
- Reduces storage costs—You can share a single tape drive among several storage nodes. In fact, since NetWorker software uses the same open tape format for UNIX, Windows, NetWare and Linux, you can share the same tape between different platforms (assuming that respective save sets belong to the same pool).
- Reduces LAN traffic—You can configure clients as SAN storage nodes that can send save sets over the SAN to shared drives.
- Provides fault tolerance—Within a SAN environment, you can configure hardware to eliminate a single point of failure.

- Provides configuration over a greater distance—You can configure a system over a greater distance than with SCSI connections.

DDS configuration overview

The following figure illustrates the DDS process and potential device sharing configurations. This basic configuration consists of a server, two storage nodes, and a library with two tape drives.

Figure 15 Dynamic Drive Sharing



In this figure:

- Storage nodes sn_1 and sn_2 are attached to the library.
- Each storage node, on its own, has access to drive_1 and drive_2.
- With DDS enabled, both storage nodes have access to both drives and can recognize when a shared drive is in use.

This configuration requires two DDS licenses, one for each drive.

Note

Ensure that all applicable devices can be seen from each storage node by running the `inquire -l` command locally on each storage node.

DDS block-size compatibility between UNIX and Windows

With DDS enabled, drives can be shared between storage nodes on different platforms, such as UNIX and Microsoft Windows. For NetWorker software operations (such as backups and recoveries) to take place successfully, ensure that the block size is compatible between different platforms and/or hardware.

To ensure compatibility, make sure one of the following conditions is met:

- The various storage nodes sharing a drive support the same block sizes.
- When a tape is labeled on a drive, it is labeled with the block size defined on the storage nodes.

Block-size incompatibility between UNIX and Windows

Incompatible block-size settings between UNIX and Microsoft Windows storage nodes could result in any of these error scenarios:

- A backup taken on a UNIX node might not be recoverable on a Microsoft Windows node if the Windows node does not support large block sizes.
- A UNIX process labels and saves data to a tape and leaves the tape mounted. A Microsoft Windows process subsequently attempts to verify the label on this tape and fails because the label verification is done by reading a header from the data portion.
- A tape on a UNIX node is labeled with a large block size. The backup is started on a Microsoft Windows node and the Windows node attempts to write the backup by using the default block size. Internally, the backup on Windows is written by breaking down the big buffer of data into smaller segments of writable block sizes. Attempting to recover a specific file on Windows in this situation fails due to positioning errors on the tape. The data is still recoverable from the Windows side, since the NetWorker software will switch from using file and block positioning to reading the tape from the beginning to reach the correct position. The data might not, however, be recoverable from the UNIX side.

Unintended Access to DDS device prevention

The Reserve/Release attribute has been added to the Device resource for tape devices to support Reserve/Release, including the Persistent Reserve commands.

Reserve/Release is a mechanism that uses SCSI commands to attempt to prevent unintended access to tape drives that are connected by using a shared-access technology, such as Fibre Channel, iSCSI, or SCSI multiplexers. It is a “cooperative” and host-based mechanism, which means that all applications should respect the reservations and not purposely break them. Access is granted based on the host system that reserved the device. Other applications that run on that host cannot be prevented from accessing a reserved device.

Reserve/Release cannot prevent a malicious or badly behaved application from accessing a reserved device. It also cannot prevent all problems caused by hardware issues (such as SCSI resets or FC LIPs) from interrupting data access.

The basic sequence requires that a host reserve a tape drive (using specific SCSI commands) before attempting to access the tape drive. If this “reservation” succeeds, then the host can use the drive. If the reservation fails (usually because the device is reserved by someone else), then the host attempting the reservation should not attempt to use the drive. When a host has finished using a reserved drive, that host must release the drive by using the appropriate SCSI commands.

The reservation is maintained by the drive itself. With older (called “Simple” in NetWorker software) Reserve/Release, the reservation is based on the SCSI ID of the system that issued the reserve command. For tape drives connected to Fibre Channel (FC) using FC-SCSI bridges, the mapping between FC host and reservation is done inside the bridge, since the initiator on the SCSI side is always the bridge itself, regardless which host actually issued the reserve command.

For Persistent Reserve, the reservation is associated with a 64-bit “key” that is registered by the host. Several keys can be registered with a given drive at any given time, but only one may hold the active reservation. NetWorker software uses the “exclusive” reservation method for Persistent Reserve. Only the host that holds the active reservation is allowed to access the drive.

The Reserve/Release attribute does not support file type or advanced file type devices.

The settings that relate to Reserve/Release and Persistent Reserve are found in a device's Properties window, on the Advanced tab. They are visible only when diagnostic mode is turned on.

The default setting for Reserve/Release is None. Once any other Reserve/Release setting is selected, it works automatically, without further user intervention. The Reserve/Release attribute is supported only on Common Device Interface (CDI) platforms, so if the CDI attribute in a device's Properties is set to Not Used, then Reserve/Release settings are ignored.

For newer hardware, once a Reserve/Release setting (other than None) has been selected, the appropriate Persistent Reserve commands are automatically issued before a device is opened for reading or writing, and before the device is closed. With older hardware, a SCSI-2 Reserve command is issued before opening the device, and a SCSI-2 Release command is issued after the device is closed.

Reserve/Release has these possible settings:

- None (the default)
- Simple
- Persistent Reserve
- Persistent Reserve + APTPL (Activate Persist Through Power Loss)

The Persistent Reserve Key attribute has also been added. It is used with Persistent Reservation calls.

Restrictions for use of the SCSI Reserve/Release setting

There are restrictions for using the SCSI Reserve or Release setting.

Consider the following:

- It is available on CDI platforms only. Consequently, since CDI is not supported within an NDMP environment, Reserve/Release is not supported with NDMP.
- Not all drives support persistent Reserve/Release. (All drives support at least simple reserve release. The code automatically drops back from Persistent +APTPL or Persistent to Simple on drives that do not support Persistent.)
- SCSI resets can clear Simple reservations at the device.
- Even with Reserve/Release, there is no guarantee against data loss.
- If the operating system has its own Reserve/Release feature, that feature must be disabled in order for the NetWorker Reserve/Release feature to work.
- Even if all of the enterprise's NetWorker storage nodes have this feature enabled, then it is possible that, on the storage node where a backup operation is run, data loss can be caused by the operating system's utilities or by third-party programs.

DDS on NDMP nodes in a SAN environment

You can configure shared drives between NDMP nodes in a SAN environment.

Ensure that:

- All the components of a SAN configuration are compatible when DDS is enabled with the NetWorker NDMP feature.
- The Fibre Channel switches are compatible with any NDMP hosts within a SAN.
- NDMP hosts and libraries in the SAN are compatible with each other.
- The NDMP nodes that will share the drives are homogeneous.

Note

The current NDMP implementation does not allow the sharing of drives between non-homogeneous NDMP nodes. There is, however, no inherent limitation within DDS that would prevent this.

DDS attributes in the device properties

Configure the attributes that DDS uses, in the **Properties** window for a device.

The attributes include:

- Hardware ID
- Shared Devices

Hardware ID attribute

The Hardware ID attribute tracks the drives that are shared between multiple hosts. Device instances that share the same physical drive across multiple hosts have the same hardware ID. The device autoconfiguration process automatically assigns the Hardware ID to a device, or it is added when manually configuring a device. Users cannot edit the Hardware ID.

You can view the Hardware ID in the **Properties** window for a device, on the **General** tab, in the **Device Sharing** area.

NetWorker generates the Hardware ID when a device is scanned or configured. The Hardware ID consists of the following components:

- Hardware serial number
- Device type
- Worldwide part number (WWPN)
- Worldwide name (WWN)

Shared Devices attribute

The Shared Devices attribute appears on the **Operations** tab of a device's **Properties** window when in diagnostic mode. It features values that can be used to manipulate all shared instances of a drive simultaneously. This attribute enables or disables all devices that share the same Hardware ID with a single action. The following table lists allowed values and descriptions for the attribute.

Table 24 Shared Devices attributes

Value	Description
Enable All	When selected, enables all devices with the same Hardware ID.
Disable All	When selected, disables all the devices with the same Hardware ID.
Done	This value is the default setting. After the server has enabled or disabled all devices with the same Hardware ID, the attribute value is reset to Done.

You cannot configure the Shared Devices attribute with the `jbconfig` program.

Idle Device Timeout attribute and DDS

A tape might remain mounted in a drive after a backup completes. Other requests for the drive from another device path must wait during this timeout period. Use the Idle Device Timeout attribute to adjust the timeout value.

The Idle Device Timeout attribute is not specifically a DDS attribute, but is useful in configuring shared drives. This attribute appears on the device **Properties** window on the **Advanced** tab when displayed in Diagnostic Mode. The default value is 0 (zero) minutes, which means that the device never times out and you must manually eject the tape.

If the device belongs to a library, you can also specify the Idle Device Timeout value for all devices in the library. However, the library value will take effect only on those devices whose **Idle Device Timeout** value is 0. The Idle Device Timeout value for a library is located on the **Timer** tab of the library **Properties** window.

Max active devices

In a DDS environment, use the Max active devices attribute, on the **General** tab of the Storage Node resource to define the maximum number of active devices for a storage node.

This attribute sets the maximum number of devices that NetWorker may use from the storage node in a DDS configuration. In large environments with media libraries that have a large number of devices, storage nodes might not have the ability to optimize all the drives in the library. The Max active devices attribute allows you to limit the number of devices that the storage node uses at a specified time, which allows the storage node to have access to all the devices in the library, but does not limit the storage node to the number of devices it can fully optimize.

Configuring NDMP on Isilon filer

Before you perform a NDMP backup for an Isilon client, you must configure OneFS NDMP.

Note

The *Isilon OneFS Administration Guide* provides updates and details about Isilon commands. You can also perform this configuration through the Isilon OneFS Storage Administration user interface.

Procedure

1. Use `ssh` to connect to a node in the cluster.
2. Use the `isi` command to create the NDMP username and password:

   ```
   isi ndmp user create username password
   ```

3. Use the `isi` command to enable NDMP:

   ```
   isi services ndmpd enable
   ```

4. Use the `isi` command to enable NDMP settings:

   ```
   isi ndmp settings set --name dma --value emc
   ```

Configuring NDMP devices

You can back up NDMP data to an NDMP or non-NDMP device in a standalone or library configuration. You can also back up NDMP data to ACSLS controlled silos.

Configuration for an Isilon attached tape library

For Isilon attached with a tape library, tape drivers are only attached to the backup Accelerator node. The tape drivers are not accessible from other data nodes. To enable backups to the tape drivers, you must configure a NAS client with the Accelerator node on the NetWorker server. Meaning you must configure Device and storage pool with the Accelerator client.

Configuring a standalone NDMP device

Use NMC to configure a standalone NDMP tape device for Direct NDMP backups.

Procedure

1. In the **Administration** window, click **Devices**.
2. Right-click **Devices** in the navigation tree, and select **New**.
3. In the **Name** attribute, specify the NDMP device in the format:

   `rd=`*`NAS_hostname`*`:`*`NAS_device_handle`*` (NDMP)`
   where:

   - *NAS_hostname* is the hostname of the NAS that has the NDMP device attached.
   - *NAS_device_handle* is the path of the device.

   Note

   Configure the NDMP device as a remote device and add **`(NDMP)`** after the pathname. Otherwise, you receive a message similar to the following:

   `NDMP device name shall be in rd=`*`snode`*`:`*`devname (NDMP)`*` format`

4. In the **Media Type** attribute, specify the device type.
5. Specify a valid NAS administrator account in the **Remote User** attribute.
6. Specify the password for the NAS administrator account in the **Password** attribute.
7. On the **Configuration** tab:
   a. Select the **NDMP** checkbox. You can only set this attribute when you create the device. You cannot change the NDMP attribute after you create the device. To change the device configuration, delete and re-create the device.
   b. Set the **Target Sessions** attribute to `1`. NDMP devices do not support multiplexing.
   c. The **Dedicated Storage Node** attribute must remain at the default value: **`No`**.
8. Under the **Advanced** tab, the **CDI** attribute must remain at the default value: **`Not used`**.
9. Optionally, change the block size used by the NDMP device.

   By default, NDMP devices use a block size of 60 KB. If required, select a different block size in the **Device block size** field. When you configure the NDMP client, set the *NDMP_AUTO_BLOCK_SIZE* environment variable in the **Application Information** attribute.
10. Click **OK**.

Configuring an NDMP autochanger

You can use an NDMP autochanger to manage Direct NDMP or Three-party backups with NDMP devices. To configure an NDMP autochanger, use NMC or the `jbconfig` command.

Configuring an NDMP autochanger with NMC

When you configure an NDMP autochanger in NMC, the NetWorker software first detects the NDMP devices and then configures the library.

Procedure

1. In the **NetWorker Administration** window, click **Devices**.
2. Right-click on the NetWorker Server and then select **Configure All Libraries**.
3. On the **Provide General Configuration Information** window, accept the default library type, **SCSI/NDMP**, and then click **Next**.
4. On the **Select Target Storage Nodes** window, click **Create a new Storage Node**.
5. On the **Storage Node Name** field, specify the hostname of the NAS.
6. In the **Device Scan Type** attribute, select **NDMP**.
7. In the **NDMP User Name** and **NDMP Password** fields, specify the NAS administrator account. If DinoStor TapeServer manages the autochanger, specify the DinoStor username and password.
8. Click **Start Configuration.**
9. Click **Finish**.
10. Monitor the **Log** window for the status of the device scan.

    When you specify an incorrect username and password combination:

    - The Log status window reports:

      ```
      No configured libraries detected on storage node
      storage_node_name
      ```

    - The `daemon.raw` file on the NetWorker server reports:

      ```
      NDMP Service Debug: The process id for NDMP service is
      0xb6c0b7b0
      42597:dvdetect: connect auth: connection has not been
      authorized
      42610:dvdetect: The NDMP connection is not successfully
      authorized on host 'storage_node_name'
      ```

      To resolve this issue, relaunch the **Configure All Libraries** wizard and correct the NDMP username and password combination.

Note

If the **Log** window reports that NetWorker cannot detect the serial numbers for the library, see Configuring an NDMP autochanger by using the jbconfig command on page 38 for detailed instructions.

Configuring an NDMP autochanger by using the jbconfig command

EMC recommends that you use the NMC interface to configure an NDMP autochanger. Use the `jbconfig` command when you cannot configure the autochanger by using the NMC Configure Library wizard.

The *EMC NetWorker Command Reference Guide* or the UNIX man page provides more information about the `jbconfig` command.

Procedure

1. Log in to the NetWorker server as root on UNIX, or Administrator on Windows.
2. At the command prompt, type **`jbconfig`**
3. At the **What kind of jukebox are you configuring** prompt, type **`3`** to configure an autodetected NDMP SCSI jukebox.
4. When prompted for an NDMP username, specify the NAS administrator account.
5. When prompted for an NDMP password, specify the NAS administrator password.
6. When prompted for the NDMP Tape Server Name, specify the NAS filer hostname.
7. At the **What name do you want to assign to this jukebox device** prompt, provide a name to identify the autochanger.
8. To enable auto-cleaning, accept the default value of **Yes**, otherwise type **`No`**.
9. At the **Is (any path of) any drive intended for NDMP use? (yes / no) [no]** prompt, type **`Yes`**.
10. At the **Is any drive going to have more than one path defined? (yes / no) [no]** prompt, type **`No`** if you will not configure shared devices. Type **`Yes`** to configure shared drives.
11. When prompted, for the first pathname for the NDMP devices in the jukebox, perform the following steps.
    a. Specify the pathname in the following format:

       `NDMP_tape_server_name``:`***`device path`***

       where:

       - *NDMP_tape_server_name* is the hostname of the NDMP Server.
       - *device_path* is the first device path.

    b. At the **Is this device configured as NDMP** prompt, type **`yes`**.
    c. Repeat step a and step b for all NDMP devices in the autochanger.
    d. When prompted, assign a hardware ID.
    e. To use DDS:
       - Respond to the prompts as required so that the first host will have access to the shared drive.
       - When prompted to share this drive with another host, type **`yes`**.
       - When prompted, type the hostname and device path of the second host that will have access to the shared drive.
12. Complete the prompts for the second device.
13. In the **Enter the drive type of drive 1** prompt, specify the number that corresponds to the NDMP device type.

14. If each drive in the autochanger is the same model, then type **Yes**. Otherwise, type **No**, and then specify the appropriate device types for each additional autochanger device.
15. When prompted to configure another autochanger, type **No**.

Changing the block size of an NDMP device

By default, the block size used to write data to an NDMP backup is 60KB. With the exception of EMC Celerra, when you specify the *NDMP_AUTO_BLOCK_SIZE=Y* variable for an NDMP client, an NDMP device can use the value defined in its Device block size attribute.

Consult the applicable vendor documentation to determine the block sizes supported by the NDMP filer before setting the block size for an NDMP device.

To change the block size defined for the NDMP device, perform the following steps:

Procedure

1. From the **View** menu, select **Diagnostic Mode**.
2. In the **Devices** window, right-click the NDMP device and select **Properties**.
3. On the **Advanced** tab, select a value in the **Device block size** field.

   Note

   The selected block size must not exceed the block size configured on the NAS filer.

4. Click **Ok**.

Message displayed when CDI enabled on NDMP or file type device

If you enable the CDI feature for an NDMP tape device or file type device (FTD), a message similar to the following appears:

```
nsrd: media notice: The CDI attribute for device "/dev/rmt/
3cbn" has been changed to "Not used".
```

To avoid this message, do not enable the CDI attribute for these device types.

Configuring NDMP-DSA devices

When you use DSA, NetWorker sends the NDMP data to a NDMP-DSA device, which includes tape, virtual tape, AFTD, and Data Domain devices. The steps to configure a NDMP-DSA device for a specified device type is the same as configuring a non-NDMP device. The *EMC NetWorker Administration Guide* provides detailed information.

Configuring the Clone Storage Node

When cloning NDMP data, specify the destination storage node, called the clone “write source” (the device that receives the clone data), in the Clone storage nodes attribute. The "Determining the storage node for writing cloned data" section in the *EMC NetWorker Administration Guide* provides details.

Pools requirements for NDMP

When you create a pool for non-NDMP devices, select only the devices that are required by the NDMP clients.

NetWorker cannot send bootstrap and index backups to an NDMP device. When you do not configure a non-NDMP devices or a non-NDMP device is not available to receive the

index and bootstrap backups, the NDMP client backup appears to hang. Configure a separate pool to direct the index and bootstrap to a non-NDMP device.

Auto media verification in the Pool resourcedoes not support NDMP.

When an NDMP client backup is a member of a clone-enabled group, configure a clone pool with non-NDMP devices that are local to the NetWorker server to receive the clone bootstrap and index.

Configure NetWorker for NDMP backup and clone operations

This section explains how to configure NetWorker for NDMP backup and clone operations.

Performing schedule backup and clone operations

Data Protection Policies provide you with the ability to schedule backup and clone operations, to protect NDMP data.

You can use the NDMP protocol to protect data on NAS devices.

For a detailed overview about creating, editing, and deleting groups and policies, refer to the Data Protection Policies chapter in the *EMC NetWorker Administration Guide*. NDMP backup configuration follows the traditional backup strategy.

Overview of data protection policies

Data protection policy is a concept that provides you with the ability to design a data protection solution for the environment at the data level instead of at the host level. With a data protection policy, each client in the environment is a backup object and not simply a host.

Data protection policies enable you to back up and manage data in a variety of environments, as well as to perform system maintenance tasks on the NetWorker server.

A data protection policy solution encompasses the configuration of the following key NetWorker resources:

Policies
Policies provide you with the ability to develop a service-catalogue approach to the configuration of a NetWorker datazone. Policies enable you to manage all data protection tasks and the data protection lifecycle from a central location.

Policies provide an organizational container for the workflows, actions, and groups that support and define the backup, management, and system maintenance actions that you want to perform.

Workflows
Workflows define the start time for a series of actions, the frequency in which the actions run, the order of actions in a sequence, and the protection group to which the workflow applies.

A workflow can be as simple as a single action that applies to a finite list of Client resources, or a complex chain of actions that apply to a dynamically changing list of resources. In a workflow, some actions can be set to occur sequentially, and others can occur concurrently.

You can create multiple workflows in a single policy. However, each workflow can belong to only one policy. When you add multiple workflows to the same policy, you can logically group data protection activities with similar service level provisions together, to provide easier configuration, access, and task execution.

Protection groups

Protection groups define a set of static or dynamic Client resources or save sets to which a workflow applies. There are also dedicated protection groups for backups in a VMware environment or for snapshot backups on a NAS device. Review the following information about protection groups:

- Create one protection group for each workflow. Each group can be assigned to only one workflow.
- You can add the same Client resources and save sets to more than one group at a time.
- You can create the group before you create the workflow, or you can create the group after you create the workflow and then assign the group to the workflow later.

Actions

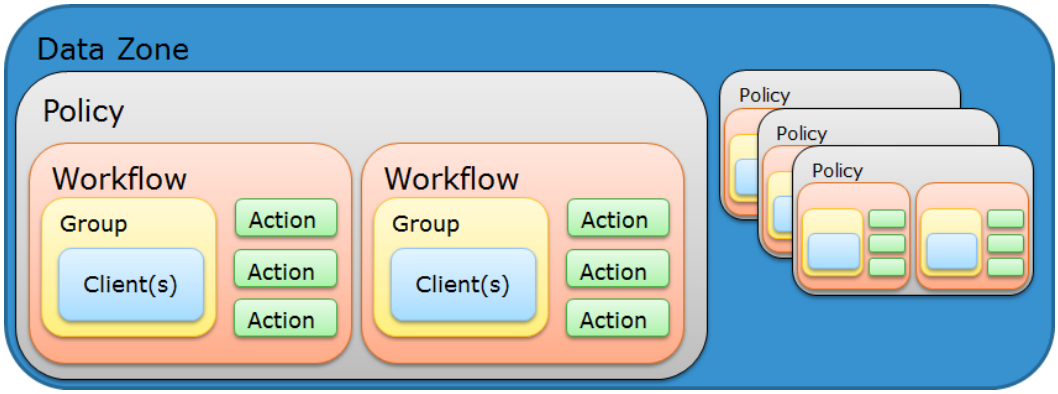
Actions are the key resources in a workflow for a data protection policy and define a specific task, for example, a backup, clone, or snapshot. NetWorker uses a work list to the define task. A work list is composed of one or several work items. Work items include client resources, virtual machines, save sets, or tags. You can chain multiple actions together to occur sequentially or concurrently in a workflow. All chained actions use the same work list.

When you configure an action, you define the days on which to perform the action, as well as other settings specific to the action. For example, you can specify a destination pool, a retention period, and a target storage node for the backup action, which can differ from the subsequent action that clones the data.

You can create multiple actions for a single workflow. However, each action applies to a single workflow and policy.

The following figure provides a high level overview of the components that make up a data protection policy in a datazone.

Figure 16 Data Protection Policy



Default data protection policies

NetWorker provides you with preconfigured data protection polices resources that you can use immediately to protect your environment, modify to suit your environment, or use an example to create new resource configurations. To use these policy resources, you must add clients to the appropriate group resource.

Each protection policy provides an example of the EMC best practices that you should follow when you design your data protection solution:

- Separate file system backups from application database backups, to provide ease of access at recovery time.

- Stagger the start times for file system backup from the application database backups, to prevent disk contention on the target hosts.

The default data protection policy resources mimic the requirements of a service provider, with different policies to that are designed to provide protection based on service level agreements.

Platinum policy

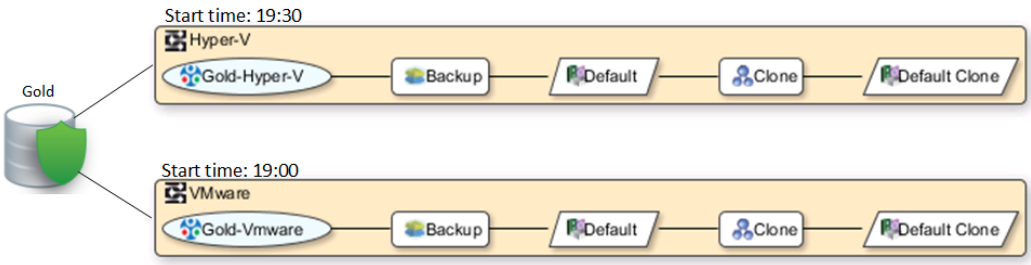
The Platinum policy provides you with an example of a data protection policy for an environment that contains EMC storage arrays or appliances and requires backup data redundancy. The policy contains one workflow with two actions, a snapshot backup action, followed by a clone action.

Figure 17 Platinum policy configuration

Gold policy

The Gold policy provides an example of a data protection policy for an environment that contains virtual machines and requires backup data redundancy. The policy contains two workflows, one to protect Hyper-V hosts and one to protect VMware hosts. Each workflow contains a backup action followed by a clone action.

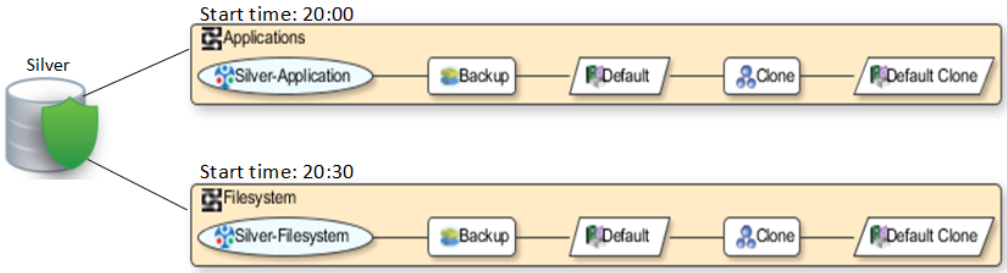
Figure 18 Gold policy configuration



Silver policy

The Silver policy provides an example of a data protection policy for an environment that contains non-virtualized machines and requires backup data redundancy. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action followed by a clone action.

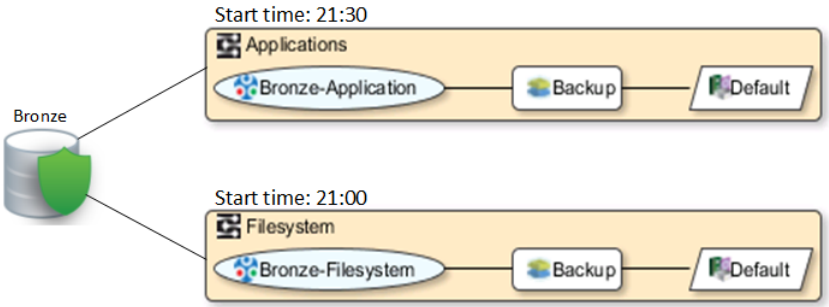
Figure 19 Silver policy configuration



Bronze policy

The Bronze policy provides an example of a data protection policy for an environment that contains non-virtualized machines. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action.

Figure 20 Bronze policy configuration



Road map for configuring a new data protection policy

Procedure

1. Create a policy.

   When you create a policy, you specify the name and notification settings for the policy.

2. Within the policy, create a workflow for each data type.

   For example, create one workflow to protect file system data and one workflow to protect application data. When you create a workflow, you specify the name of the workflow, the time to start the workflow, notification settings for the workflow, and the protection group to which the workflow applies.

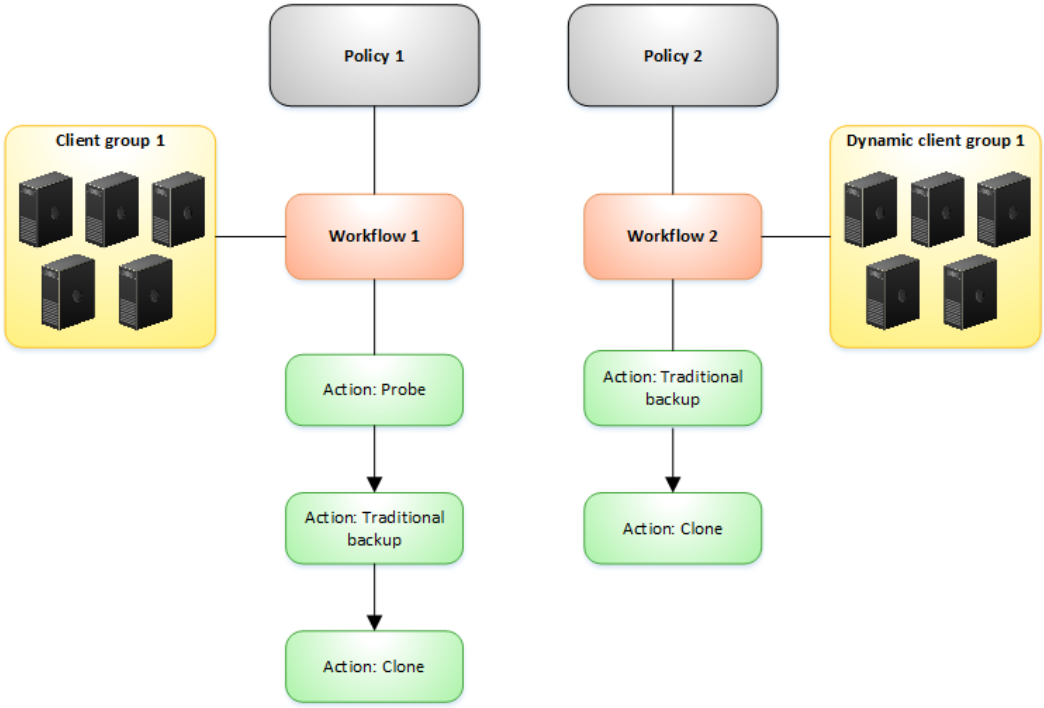
3. Create a protection group.

   The type of group that you create depends on the types of clients and data that you want to protect. The actions that appear for a group depend on the group type.

4. Create one or more actions for the workflow.
5. To define the backup data that you want to protect, configure Client resources, and then assign the client resources to a protection group.

The following figure illustrates a policy with two different workflows. Workflow 1 performs a probe and then a backup of the Client resources in Client group 1, and then clones the save sets from the backups. Workflow 2 performs a backup of the Client resources in Dynamic client group 1, and then clones the save sets from the backups.

Figure 21 Data protection policy example



Strategies for traditional backups

The primary considerations for a traditional backup strategy are the groups of Client resources, the workflows that define the series of actions that are associated with the backup, and the schedule for the backup.

Creating a policy

Procedure

1. On the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Policies**, and then select **New**.

   The **Create Policy** dialog box appears.
3. On the **General** tab, in the **Name** field type a name for the policy.

   The maximum number of characters for the policy name is 128.

   Note

   After you create a policy, the **Name** attribute is read-only.
4. In the **Comment** box, type a description for the policy.
5. From the **Send Notifications** list, select whether to send notifications for the policy:
   - To avoid sending notifications, select **Never**.

- To send notifications with information about each successful and failed workflow and action after all the actions in the policy complete, select **On Completion**.
- To send a notification with information about each failed workflow and action after all the actions in the policy complete, select **On Failure**.

6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:

   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```

   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```

   - On Windows, to send a notification email, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:

     - ***-s subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
     - ***-h mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
     - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. To specify the Restricted Data Zone (RDZ) for the policy, select the **Restricted Data Zones** tab, and then select the RDZ from the list.
8. Click **OK**.

After you finish

Create the workflows and actions for the policy.

Creating a workflow in a new policy

A policy must contain one or more workflows.

Procedure

1. In the left pane of the **Protection** window, expand **Policies**, and then select the policy that you created.

2. In the right pane of the **Protection** window, select **Create a new workflow**.
3. In the **Name** field, type the name of the workflow.

   The maximum number of characters for the name of the group is 64.
4. In the **Comment** box, type a description for the workflow. The maximum number of characters for the **Comment** field is 128.
5. From the **Send Notifications** list, select how to send notifications for the workflow:
   - To use the notification configuration that is defined in the policy resource to determine when to send the notification, select **Set at policy level**.
   - To send notifications with information about each successful and failed workflow and action, after all the actions in the workflow complete, select **On Completion**.
   - To send notifications with information about each failed workflow and action, after all the actions in the workflow complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:
   - To log notifications to a file named `policy_notifications.log`, type the following command:

     `nsrlog` **`-f policy_notifications.log`**
   - On Linux, to send a notification email, type the following command:

     `mail` **`-s`** ***`subject recipient`***
   - On Windows, type the following command:

     `smtpmail` **`-s`** ***`subject`*** **`-h`** ***`mailserver recipient1@mailserver recipient2@mailserver...`***

     where:
     - **`-s`** ***`subject`***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
     - **`-h`** ***`mailserver`***—Specifies the hostname of the mail server to use to relay the SMTP email message.
     - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.
7. In the **Running** group box, define when and how often the workflow runs.
   a. To ensure that the actions contained in the workflow run when the policy or workflow is started, in the **Enabled** box, leave the option selected. To prevent the

actions in the workflow from running when the policy or workflow that contains the action is started, clear this option.

b. To ensure that the workflow starts at the time that is specified in the **Start time** attribute, on the days that are defined in the action resource, in the **AutoStart Enabled** box, leave the option selected. To prevent the workflow from running at the time that is specified in the **Start time** attribute, clear this option.

c. To define the time to start the actions in the workflow, in the **Start Time** attribute, use the spin boxes.

   The default value is 9:00 P.M.

d. To define how frequently to repeat the actions that are defined in the workflow over a 24 hour period, In the **Interval** attribute, use the spin boxes.

   The default value is 24 hours, or once a day. When you select a value that is less than 24 hours, the **Interval End** attribute appears. To define the last time to start a workflow in a defined interval period, use the spin boxes .

e. To define the duration of time in which NetWorker can manually or automatically restart a failed or canceled workflow, in the **Restart Window** attribute, use the spin boxes.

   If the restart window has elapsed, NetWorker considers the restart as a new run of the workflow. NetWorker calculates the restart window from the start of the last incomplete workflow. The default value is 24 hours.

For example, when you set the **Start Time** to 7:00 PM, the **Interval** to 1 hour, and the **Interval end time** to 11:00 P.M., then the workflow automatically starts every hour beginning at 7:00 P.M. and the last start time is 11:00 PM.

8. To create the workflow, click **OK**.

After you finish

Create the actions that will occur in the workflow, and then assign a group to the workflow. If a workflow does not contain a group, a policy does not perform any actions.

Protection groups for traditional backups

Create protection groups for traditional backups, which identifies the Client resources to back up.

You can create two types of protection groups for a traditional backup:

- Basic client group—Defines a static list of Client resources to back up.
- Dynamic client group—Specifies a dynamic list of Client resources to back up. A dynamic client group automatically generates a list of Client resources that use client tag which matches the client tag that is specified for the group.

Create multiple groups to perform different types of backups for different Client resources, or to perform backups on different schedules. For example:

- Create one group for backups of clients in the Accounting department, and another group for backups of clients in the Marketing department.
- Create one group for file system backups and one group for backups of Microsoft Exchange data with the NetWorker Module for Microsoft.
- Create one group for a workflow with backups actions that start at 11 p.m., and another group for a workflow with backup actions that start at 2 a.m.

Note

A Client resource can belong to more than one group.

Creating a client group

Basic client groups define a static list of Client resources for a traditional backup, check connectivity, or probe action.

Before you begin

Create the Client resources for the data to include in a protection group.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, leave the default selection of **Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.
7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group.

Creating a dynamic client group

Dynamic client groups prevent you from having to edit group settings when you add Client resources to the NetWorker datazone. You can configure a dynamic group to include all the clients on the NetWorker server or you can configure the dynamic group to perform a query that generates a list of clients that is based on a matching tag value. A tag is a string attribute that you define in a Client resource. When an action starts in a workflow that is a member of a tagged dynamic protection group, the policy engine dynamically generates a list of Client resources that match the tag attribute value.

Use dynamic client groups to specify a dynamic list of Client resources for a traditional backup, probe, check connectivity, or server backup action.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.

3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.

4. From the **Group Type** list, select **Dynamic Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.

7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group and define one or more tags.

Actions sequences in traditional backup workflows

Workflows enable you to chain together multiple actions and run them sequentially or concurrently.

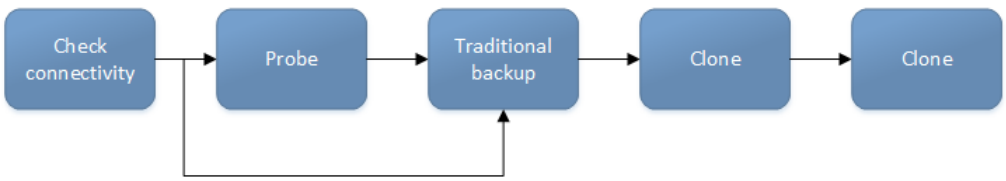
A workflow for a traditional backup can optionally include a probe or check connectivity action before the backup, and a clone action either concurrently with or after the backup.

The following sections provide details on supported actions that can follow the lead action and other actions in a workflow.

All possible workflow actions for a traditional backup

The following figure illustrates the possible workflow actions that are associated with a traditional backup.

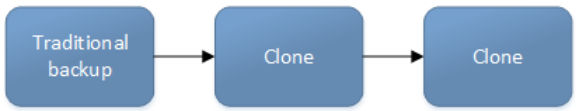
Figure 22 All possible workflow actions for a traditional backup



Workflow path from a traditional backup action

The only action that can follow a traditional backup is a clone action.

Figure 23 Workflow path from a traditional backup action



Creating a check connectivity action

A check connectivity action tests connectivity between clients and the NetWorker server, usually before another action such as a backup occurs.

Before you begin

Create the policy and workflow that contain the action. The check connectivity action should be the first action in the workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Check Connectivity**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to check connectivity with the client.

   The following table provides details on the icons.

Table 25 Schedule icons

Icon	Label	Description
	Execute	Check connectivity on this day.

Table 25 Schedule icons (continued)

Icon	Label	Description
	Skip	Do not check connectivity on this day.

To check connectivity every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Connectivity Options** page appears.

11. Select the success criteria for the action:

    - To specify that the connectivity check is successful only if successful connectivity is achieved with all clients in the assigned group, select the **Succeed only after all clients succeed** checkbox.
    - To specify that the connectivity check is successful if connectivity is achieved with one or more clients in the assigned group, clear the checkbox.

12. Click **Next**.

    The **Specify the Advanced Options** page appears.

13. Optionally, configure advanced options and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, **Inactivity Timeout**, or the **Send Notification** options appear, the Check Connectivity action does not support these options and ignores the values.

14. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

    For Isilon clients that use checkpoint restart, set the value of the Client retries attribute under the Advanced tab to a number greater than 0.

15. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

Note

The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

- To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

16. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
17. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
18. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

19. Click **Next**.

    The **Action Configuration Summary** page appears.
20. Review the settings that you specified for the action, and then click **Configure**.

After you finish

Optionally, create one of the following actions to automatically occur after the check connectivity action:

- Probe
- Traditional backup

  Note

  This option is not available for NAS snapshot backups.

- Snapshot backup

Creating a probe action

A probe action runs a user-defined script on a NetWorker client before the start of a backup. A user-defined script is any program that passes a return code. If the return code

is 0 (zero), then a client backup is required. If the return code is 1, then a client backup is not required.

Before you begin

- Create the Probe resource script on the clients that use the probe. Create a client Probe resource on the NetWorker server, and then associate the client Probe resource with the Client resource on the NetWorker server.
- Create the policy and workflow that contain the action.
- (Optional) Create a check connectivity action to precede the probe action in the workflow. A check connectivity action is the only supported action that can precede a probe action in a workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Probe**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to probe the client.

   The following table provides details on the icons.

Table 26 Schedule icons

Icon	Label	Description
	Execute	Perform the probe on this day.
	Skip	Do not perform a probe on this day.

To perform a probe every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Probe Options** page appears.

11. Choose whether to start the subsequent backup action only after all probes succeed by selecting or clearing the **Start backup only after all probes succeed** checkbox.

    - To start the backup only if all the probes associated with Client resources in the assigned group succeed, select the checkbox.
    - To start the backup if any one of the probes are associated with a Client resource in the assigned group succeed, clear the checkbox.

12. Click **Next**.

    The **Specify the Advanced Options** page appears.

13. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

14. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

    Note

    The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

15. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

Note

The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

16. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

17. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

18. Leave the default selections for the Notification group box. NetWorker does not support notifications for probe actions and ignores the values that are defined in the attributes.
19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

- Select the day in the calendar, which changes the action task for the specific day.
- Use the action task list to select the task, then perform one of the following steps:
  - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
  - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
  - In the **Override** field, type an override.

    Note

    To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.

23. Review the settings that you specified for the action, and then click **Configure**.

Creating a traditional backup action

A traditional backup is a scheduled backup of the save sets defined for the Client resources in the assigned group for the workflow.

Before you begin

- Create the policy and workflow that contain the action.
- (Optional) Create actions to precede the backup action in the workflow. Supported actions that can precede a backup include:
  - Probe
  - Check connectivity

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.

2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.

3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Backup**.
6. From the secondary action list, select the backup type, for example, **Traditional**.

7. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
8. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
9. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
10. Click the icon on each day to specify the backup level to perform.

    The following table provides details about the backup level that each icon represents.

Table 27 Schedule icons

Icon	Label	Description
	Full	Perform a full backup on this day. Full backups include all files, regardless of whether the files changed.
	Incr	Perform an incremental backup on this day. Incremental backups include files that have changed since the last backup of any type (full or incremental).
	Cumulative Incr	Perform a cumulative incremental backup. Cumulative incremental backups include files that have changed since the last full backup.
	Logs Only	Perform a backup of only database transaction logs.
	Synthetic Full **Note** Not supported for NDMP.	Perform a synthetic backup on this day. A synthetic full backup includes all data that changed since the last full backup and subsequent incremental backups to create a synthetic full backup.
	Skip	Do not perform a backup on this day.

To perform the same type of backup on each day, select the backup type from the list and click **Make All**.

NetWorker does not support the use of synthetic full backup levels for NDMP data.

EMC Celerra, Isilon, VNX, and NetApp filers with NDMP version 4 or later support token-based backups (TBB) to perform NDMP full and incremental backups. NetWorker supports the same number of incremental levels that the NAS vendor supports. EMC Celerra, Isilon, and NetApp documentation provide the maximum number of incremental levels that the TBB incremental backup can support.

When you configure TBB after you update the NetWorker server from 7.6 SP1 or earlier, the first incremental backup does not occur until after one complete full backup.

Filers that do not support TBB, do not support incremental backups. If you select the level Incr, the NetWorker server performs a full backup.

Verify the NAS storage vendor supports NDMP incremental backups before you use this feature.

11. Click **Next**.

    The **Specify the Backup Options** page appears.

12. From the **Destination Storage Node** box, select the storage node with the devices on which to store the backup data.
13. From the **Destination Pool** box, select the media pool in which to store the backup data.
14. From the **Retention** boxes, specify the amount of time to retain the backup data.

    After the retention period expires, the save set is removed from the client file index and marked as recyclable in the media database during an expiration server maintenance task.

    When you define the retention policy an NDMP client, consider the amount of disk space that is required for the client file index. NDMP clients with several thousands of small files have significantly larger client file indexes on the NetWorker server than a non-NDMP client. A long retention policy for an NDMP client increases disk space requirements on the file system that contains the client file indexes.

15. From the **Client Override Behavior** box, specify how NetWorker uses certain client configuration attributes that perform the same function as attributes in the Action resource.
    - **Client Can Override**—The values in the Client resource for **Schedule**, **Pool**, **Retention policy**, and the **Storage Node** attributes will take precedence over the values that are defined in the equivalent Action resource attributes.
    - **Client Can Not Override** —The values in the Action resource for the **Schedule**, **Destination Pool**, **Destination Storage Node**, and the **Retention** attributes take precedence over the values that are defined in the equivalent Client resource attributes.
    - **Legacy Backup Rules**—This value only appears in actions that are created by the migration process. The updating process sets the **Client Override Behavior** for the migrated backup actions to **Legacy Backup Rules**.

16. Click **Next**.

    The **Specify the Advanced Options** page appears.

17. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

18. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

Note

The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

19. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

    Note

    The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

20. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

21. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

22. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
23. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
24. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

25. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.
26. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

- On Window, to send a notification email, type the following command:

  `smtpmail -s subject -h mailserver recipient1@mailserver recipient2@mailserver...`

  where:

  - **-s *subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
  - **-h *mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
  - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

27. Click **Next**.

    The **Action Configuration Summary** page appears.

28. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets after the backup. A clone action is the only supported action after a backup action in a workflow.

Cloning NDMP save sets

You can clone Direct-NDMP and NDMP-DSA save sets by using the same methods used to clone non-NDMP save sets.

Before you clone NDMP save sets, review these requirements:

- To clone Direct-NDMP or Three-party backup data:
  - The source NAS must run NDMP version 3 or later.
  - The destination NAS can run any version of NDMP, but you cannot clone a volume cloned with NDMP earlier than version 3 to another volume.
  - You cannot clone NDMP save sets to a non-NDMP device.
  - You can clone NDMP tapes from one NDMP host to another NDMP host of the same type. For example, you can clone tapes from a NetApp filer with an attached library to another NetApp filer or to the same filer.
- You require two NDMP devices to clone the NDMP save sets, one device to perform the read operation and one device to perform the write operation.
- You must clone NDMP-DSA backups to non-NDMP devices. You can however, clone NDMP-DSA save from one type of tape device to another. For example you can clone save sets on a DLT device to an AIT device.
- Use the nsrclone program to clone NDMP save sets from a command prompt. The *EMC NetWorker Command Reference Guide* or the UNIX man pages provide more information on nsrclone usage.

Creating a clone action

A clone action creates a copy of one or more save sets. Cloning allows for secure offsite storage, the transfer of data from one location to another, and the verification of backups.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Clone**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to perform cloning.

   The following table provides details on the icons.

   Table 28 Schedule icons

Icon	Label	Description
	Execute	Perform cloning on this day.
	Skip	Do not perform cloning on this day.

   To perform cloning every day, select **Execute** from the list and click **Make All**.

10. Click **Next**.

    The **Specify the Clone Options** page appears.

11. In the **Data Movement** group box, define the volumes and devices to which NetWorker sends the clone data.

    a. From the **Destination Storage Node** list, select the storage node with the devices on which to store the cloned save sets.

    b. In the **Delete source save sets after clone completes**, select the option to instruct NetWorker to remove the source save set information from the client file index, and to mark the save set as recyclable in the media database during a Server expiration maintenance action. Clear this option to allow the source save sets to expire based on the defined retention time.

    c. From the **Destination Pool** list, select the target media pool for the cloned save sets.

    d. From the **Retention** list, specify the amount of time to retain the cloned save sets.

       After the retention period expires, the save sets are marked as recyclable during an expiration server maintenance task.

12. In the **Filters** group box, define the criteria that NetWorker uses to create the list of eligible save sets to clone. The eligible save sets must match the requirements that are defined in each filter. NetWorker provides the following filter options:

    a. Time filter—Use the **Time** section to define the time range in which NetWorker should inspect, when searching for eligible save sets to clone in the media database. Use the spin boxes to specify the start of the time range and the end of the time range. The **Time** filter list includes three options, which define how NetWorker determines save set eligibility, based on the time criteria:

       - **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
       - **Accept**—The clone save set list includes save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.
       - **Reject**—The clone save set list does not include save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.

    b. Save Set filter—Use the **Save Set** section to instruct NetWorker to include or exclude ProtectPoint and Snapshot save sets, when searching for eligible save sets to clone in the media database. The **Save Set** filter list includes three options, which define how NetWorker determines save set eligibility, based on the save set criteria:

       - **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
       - **Accept**—The clone save set list includes eligible ProtectPoint or Snapshot save sets, when you also enable the ProtectPoint or Snapshot checkboxes.
       - **Reject**—The clone save set list does not include eligible ProtectPoint and Snapshot save sets when you also enable the ProtectPoint and Snapshot checkboxes.

    c. Clients filter—Use the **Client** section to define a list of clients to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Client** list includes three options, which define how NetWorker determines save set eligibility, based on the client criteria:

- **Do Not Filter**—NetWorker inspects save sets that are associated with the clients in the media database, to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible save sets for the selected clients.
- **Reject**—The clone save set list does not include eligible save sets for the selected clients.

d. Levels filter—Use the **Levels** section to define a list of backup levels to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Levels** filter list includes three options, which define how NetWorker determines save set eligibility, based on the level criteria:

- **Do Not Filter**—NetWorker inspects save sets regardless of level in the media database, to create a clone save set list that meets all the filter criteria.
- **Accept**—The clone save set list includes eligible save sets with the selected backup levels.
- **Reject**—The clone save set list does not include eligible save sets with the selected backup levels.

13. Click **Next**.

    The **Specify the Advanced Options** page appears.

14. Configure advanced options, including notifications and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, or the **Inactivity Timeout** options appear, the clone action does not support these options and ignores the values.

15. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

16. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

Note

The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

- To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

17. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.
18. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

    - On Window, to send a notification email, type the following command:

      ```
      smtpmail -s subject -h mailserver recipient1@mailserver
      recipient2@mailserver...
      ```

      where:

      - **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
      - **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
      - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.
23. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets again after this clone action. Another clone action is the only supported action after a clone action in a workflow.

Visual representation of traditional backup workflows

Figure 24 Traditional backup workflow

When you create actions for a workflow, a map provides a visual representation of the actions in the second right pane of the **Protection** window of the **Administration** interface.

The oval icon at the beginning of the visual representation specifies the group to which the workflow applies, the rounded rectangle icons identify actions, and the parallelogram icons identify the destination pool for the action.

You can work directly in the visual representation of a workflow to perform the following tasks:

- Adjust the display of the visual representation by right-clicking and selecting one of the following options:
  - **Zoom In**—Use to increase the size of the visual representation.
  - **Zoom Out**—Use to decrease the size of the visual representation.
  - **Zoom Area**—Use to limit the display to a single section of the visual representation.

- **Fit Content**—Use to fit the visual representation to the window area.
- **Reset**—Use to reset the visual representation to the default settings.
- **Overview**—To view a separate dialog box with a high-level view of the visual representation and a legend of the icons.

- View and edit the properties for the group, action, or destination pool by right-clicking the icon for the item and selecting **Properties**.
- Create a group, action, or destination pool by right-clicking the icon for the item and selecting **New**.

Creating and configuring the NDMP client resource

Use the NMC Client Configuration Wizard to create the NDMP client or create the client manually. EMC recommends that you use the NMC Client Configuration Wizard to create NDMP clients.

Using the Client Configuration wizard

Use the NMC Client Configuration wizard to create the NDMP client.

Procedure

1. From the **Administration** window in NMC, click **Protection**.
2. In the expanded left pane, select **Clients** , and then select **Protection** › **New Client Wizard**.
3. On the **Specify Client Information** window:
   a. In the **Client Name** field, specify the hostname of the filer.
   b. Optionally, add comments in the **Comment** field.
   c. Optionally, in the **Tag** field, specify the name of the tag for the dynamic group in which you want to add this client.
   d. Optionally, in the **Groups** area, select an existing group, in which to add the client.
   e. In the **Type** area, select **NDMP**, and then click **Next**.

   Use a hostname that is associated with a non-aggregated (non-teamed) network connection to one of the Isilon cluster nodes that has a fixed IP address. Do not use the SmartConnect hostname.
4. On the **Specify the NDMP Client Credentials** window:
   a. In the **NDMP User Name** field, specify a valid NAS administrator account.
   b. In the **NDMP Password** attribute, specify the password for the NAS administrator account, and then click **Next**.

   The *OnFS Users Guide* on EMC Online Support web site describes how to create NDMP administrators.
5. In the **Specify the NDMP Client Backup Options** window:
   a. In the **NDMP backup type** attribute, select or specify the backup type:
      - `tar`—Use this backup type for Checkpoint Restart.

      Note

      Isilon supports only `tar` backups.

b. In the **NDMP Array Name** field, specify the logical name assigned to the NDMP NAS array.

The **NDMP Array Name** field enables you to configure the same NAS device with multiple NDMP clients that have different host IDs.

Note

NDMP clients that use the same NAS device must have the same NDMP array name.

c. Review the **App Info** options and disable options, as required. EMC recommends that the default options remain enabled.

App Info Type	Description
HIST	Enables the backup of index data. If you do not select this option, you can only perform full recoveries of the backup data.
UPDATE	Enables the backup process to update the last backup dates in database on the NDMP client, after the backup completes.
DIRECT	Enables DAR or DDAR support.
Use Token-Based Backup	Enables the NDMP backup to use last backup time tokens to decide what files to backup. Not all NDMP clients support token based backup. When you select this option and the NDMP data server on the client does not support token based backups, NetWorker performs the backup by using backup levels.

d. In the **Advanced App Info** field, specify additional NAS specific environments variables, one per line. The following table provides a list of the available **Application Information** environment variables for each NAS.

NOTICE

Environment variables are case-sensitive. Use an equal (=) sign to separate the environment variable name from its value.

Table 29 Isilon Application Information variables

Variables	Definition
DIRECT=y	Required.
HIST=F/D	Set this variable to *F* for Checkpoint Restart backups, to ensure the use of path based file history. Set this variable to *D* to enable concurrent streaming.
*FILES=***pattern**	Optional. Use this variable to back up only files that match the defined pattern. You can use wildcards in the pattern definition.

Table 29 Isilon Application Information variables (continued)

Variables	Definition
PER_DIRECTORY_MATCHING=y	Optional. Use this variable along with the *FILES*=**pattern** variable. Matches the pattern defined by FILES across directories.
USE_TBB_IF_AVAILABLE=n	Optional. The NetWorker software automatically enables TBB for Isilon filers. Specify this variable to disable TBB support for incremental backups. When you specify this value, the backup reverts to the native level-based backup of the NAS.
NSR_NDMP_RECOVER_NO_DAR=y	Optional. Define this variable to perform an non-DAR recovery when you set the DIRECT=y variable during the backup.
NDMP_AUTO_BLOCK_SIZE=Y	Optional. Specify this variable to override the default block size of 60 KB when writing NDMP backups to an NDMP device. Uses the block size value defined in the Device block size attribute when you labeled the NDMP volume. Configuring NDMP devices on page 36 provides more information.
BACKUP_MODE=SNAPSHOT *BACKUP_OPTIONS=7*	Optional. Specify these variables to enable NetWorker to perform a Fast Incremental when the level defined for a backup is incremental.

6. Click **Next**.
7. On the **Select the NetWorker Client Properties** window:
   a. In the **Priority** field, specify the order in which the NetWorker server contacts clients in a protection group for backup. The attribute can contain a value between 1 and 1,000. The lower the value, the higher the priority.
   b. In the **Parallelism** attribute:
      - For Direct-NDMP, set the **Parallelism** attribute to 1.
      - For NDMP-DSA, the parallelism value depends on the NAS capabilities and set parallelism to a value that is appropriate for the NAS. Parallelism values of 4 to 8 are common. In general, the best parallelism setting depends on filer configuration and the amount of installed RAM.
   c. In the **Remote Access** attribute:
      - Specify the root account on UNIX, or the administrator account on Windows of any computer that you use to browse entries for the NDMP computer.
      - Specify the NetWorker server administrator account on Windows, or the root account on UNIX.
        Use this format to specify each account:

        account_name@hostname

d. Select the **Data Domain Interface**. This option specifies the protocol to use if you send the backup data to a Data Domain Device. Available selections are Any, Fibre Channel, or IP.

e. To enable a block based backup for the host, select the **Block Based Backup** option . The *EMC NetWorker Administration Guide* provides more information about when to enable blocked based backups and the features that do not support block based backups. Block Based backups require the **Client Direct** option.

f. Select the **Client Direct** option to allow the client to try to directly connect to the backup storage device, instead of connecting to a NetWorker storage node. If a direct connection is not possible, the backup operation connects to the NetWorker storage node that you configure to accept data from the client.

8. On the **Specify the File System Objects** window, select or specify objects to backup.
   - When the NAS supports NDMP snapshot management extension, you can browse and mark individual file systems to back up. When the client supports browsing, by default, NetWorker selects all objects.
   - When the client does not support browsing, specify the save sets to back up.
     - To back up all the file systems on the client, type **`ALL`**.
     - NAS versions earlier than 3 do not support the `ALL` save set. List the file systems one per line.
     - When you do not use the `ALL` save set, specify the file system name, as configured on the NAS.
     - File system names in the **Save set** field are case sensitive.
     - You cannot specify a share name.

   To back up large client file systems, optionally schedule each file system to back up separately. For example, create two separate clients with the same name, but with different save sets.

9. Click **Next**.
10. On the **Client Configuration Summary** window, review the attributes, and then click **Create**.
11. On the **Client Configuration Results** window, review the results, and then click **Finish** to exit the wizard.

    Troubleshooting NDMP configuration and backup failures on page 75 describes how to resolve errors that you may experience when you configure the NDMP client.

Performing post Client Configuration Wizard steps

After the Client Configuration wizard creates the NDMP client, modify the properties of the new NDMP client.

Modifying the Storage Node

On the **Globals (2 of 2)** tab, specify the appropriate storage node in the **Storage Nodes** attribute.

The attribute value depends on the type of backup:

- When you perform Direct-NDMP backups with NDMP devices, specify the hostname of the NAS that manages the tape device or autochanger.
- For three-party backups, specify the destination host first.

- For NDMP-DSA backups, specify the hostname of the storage node that manages the tape device or autochanger. If the NetWorker server is the storage node, specify *nsrserverhost*.
- For a DinoStor-managed NAS, specify the hostname of the DinoStor server first.

  NOTICE

  For NDMP-DSA backups, the NetWorker software uses the **Storage Node** attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they will override the **Storage Node** attribute value.

Enabling Checkpoint Restart

To allow a failed backup for a client to restart from a known good point, you must enable Checkpoint Restart for the NetWorker client resource and configure the number of automatic retries for the backup action in the data protection policy.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, select **Clients**.
3. Right-click the client resource and select **Properties**.

   The **Client Properties** dialog box appears.
4. On the **General** tab, select the **Checkpoint enabled** checkbox.

   Note

   When you enable **Diagnostic Mode** the **Checkpoint granularity** attribute appears. This attribute does not apply to NDMP.

5. Define the interval at which checkpoints are written during the backup:
   a. Select the **Apps & Modules** tab on the **Client Properties** dialog box.
   b. In the **Application information** attribute, specify the `CHECKPOINT_INTERVAL_IN_BYTES` variable.

      For example, to write a checkpoint after every 1,000,000 bytes, type:

      ***CHECKPOINT_INTERVAL_IN_BYTES*=1000000**

      To define the value by using a different multiplier, specify the multiplier with the numeric value. Supported multipliers include `KB`, `MB`, `GB`, `TB`, `kb`, `mb`, `gb`, and `tb`. For example, to write a checkpoint after every 1 GB, type:

      ***CHECKPOINT_INTERVAL_IN_BYTES*=1GB**

      Note

      The checkpoint interval value is automatically rounded up to a multiple of the tape block size.

6. Click **OK** on the **Client Properties** dialog box.

Adding NDMP Client Properties

Procedure

1. In the **Administration** window, click **Protection**.

2. In the expanded left pane, select **Clients**.
3. Right-click a **Client** and select **New Client Properties**. The **Client Properties** screen appears.
4. Select the **Apps & Modules** tab. Select the **NDMP** attributes of the **Client**. The **NDMP** options are as follows:
   - **NDMP**—Check this box to indicate whether this client is an NDMP client.
   - **NDMP multistreams enabled**—Check this box to indicate whether the Isilon client is using the NDMP multistream feature.

     Note

     Only Isilon supports multistreaming.

     Increasing the number of streams does not always increase performance. Depending on your environment, performance might be reduced when the number of streams is increased, especially for a high density file system backup and recover.

     - To start a multistream backup from the command line interface, add option **-A multistreams=<n>** to the command `nsrndmp_save` where n=Number of streams. For example:

       ```
       nsrndmp_save -T <Backup_type> -c <Isilon_client> -A
       multistreams=<n> <Backup_Path>
       ```

     - To start a multistream backup from NMC GUI or a scheduled backup, set the **Parallelism** value in the **Globals (1 of 2)** tab.
   - **NDMP log successful file recovery**— By default, NetWorker does not print each successfully recovered file name in the log messages, because this logging impacts performance and takes up space. To enable the logging of successful recoveries for each file, select this checkbox.
   - **Disable IPv6**—Check this box to disable IPv6 on NDMP backup and recovery.
   - **NDMP array name**—This name is the logical name assigned to the array in NDMP NAS array configurations.
   - **NDMP vendor information**—This attribute contains NDMP client vendor information.
5. Click **OK**.

Configuring the NDMP client manually

EMC recommends that you create NDMP client by using the Client Configuration wizard. If you create the NDMP client manually, then the configuration details for each attribute in the Client Configuration wizard apply when you create the client manually.

Review this information before you configure an NDMP client manually.

- For an NDMP configuration that includes Storage Node resources, configure a Client resource for each storage node that you define for an NDMP backup and clone operation.
- For NDMP three-party storage nodes that use NDMP devices, repeat these steps for each NDMP storage node.
- For NDMP-DSA storage nodes, create the NetWorker Client resources in the same manner as non-NDMP clients. The *EMC NetWorker Administration Guide* provides details on how to create a non-NDMP Client resource.

- NDMP does not support the use of directives including AES encryption. The NetWorker software ignores any value that you define in the **Directives** attribute for an NDMP client.
- When you select **Checkpoint enabled** on the **General** tab, do not modify the **Checkpoint granularity** attribute. NDMP backups do not support checkpoint granularity and the NetWorker software ignores any value that you define for this attribute.

  Note

  VNX does not support checkpoint restart.

- If the NAS supports the NDMP snapshot management extension, then you can browse and mark individual file systems for backup instead of specifying the save sets in the **Save set** attribute. You cannot use the **Save set browse** icon to browse the NDMP file system until you:
  - Select the **NDMP** checkbox, on the **Apps & Modules** tab.
  - Specify the NDMP username and password in the **Remote user and password** fields on the **Apps and Modules** tab.

Note

Snapshot Management Extension is not supported by Celerra, VNX, VNXe, and NetApp C-mode. Only NetApp 7-mode supports Snapshot Management Extension.

Note

Isilon, Celerra, VNX, VNXe, and NetApp C-mode filers do not allow you to browse. Only NetApp 7-mode allows you to browse.

Performing manual NDMP backups

After you configure the NetWorker server for NDMP backup data operations, you can perform manual NDMP backups.

On Windows, you can manually back up NDMP data by using the NetWorker User program. The method to backup NDMP data is the same as a non-NDMP local backup. You cannot perform a three-party backup with the NetWorker User program.

On Windows and UNIX, you can perform a manual backup from a command prompt by using the `nsrndmp_save` command. Performing an NDMP backup from the command line provides more information.

Before performing a manual backup by using the `nsrndmp_save` command or the NetWorker User program, review these requirements:

- You can only perform manual Direct-NDMP backups from a NetWorker server.
- You can start a manual NDMP-DSA backup from a NetWorker server, storage node, or client. When you do not start the NDMP-DSA backup from the NetWorker server, the `servers` file on the NetWorker server and storage node, must contain the hostname of the host that initiates the backup.
- Before you perform a manual backup, you must configure the NDMP client on the NetWorker server. Manual backups use client configuration information for example, the variables that are defined in the **Application Information** attribute of an NDMP client.

- Direct-NDMP and three-party NDMP backups support manual DAR backups when the NDMP client contains the *DIRECT=Y* and *HIST=Y* environment variables in the **Application Information** attribute for the NDMP client.

  NOTICE

  To use DAR, the NAS filer must use NDMP version 4. The *EMC NetWorker Online Software Compatibility Guide* describes how to determine if a particular NDMP vendor supports DAR.

Performing an NDMP backup from the command line

Use the `nsrndmp_save` command to perform a manual command line NDMP backup.

The `nsrndmp_save` command does not back up the bootstrap. Without the bootstrap, you cannot perform a disaster recovery of the NetWorker server. To back up the bootstrap, run the `nsrpolicy` ***-G nsrpolicy policy_name start*** command from the NetWorker server. The `nsrpolicy` command uses the attribute values specified for the policy. For example, the pool and schedule values.

To perform an NDMP backup from the command prompt, use the following syntax:

`nsrndmp_save -T` ***backup_type*** `-s` ***NetWorker_servername*** `-c` ***clientname*** `-l` ***backup_level*** `-t` ***date_time*** `-g` ***nsrpolicy path***

where:

- *backup_type* is a supported backup type for the NAS filer:
  Isilon accepts `tar` and `dump` backup types. However, if you select `dump` as the backup type, Isilon stores the backup data only in `tar` format.
- *backup_level* is a full for a full backup, incr for an incremental backup. Each NAS supports full backups.

  Note

  EMC Celerra, Isilon, and NetApp filers only support full and incremental level backups.

- *date_time* is the date and time of the last backup, which is enclosed in double quotes. Specify this value for incr level backups. When you do not specify the date and time, the backup is a native NDMP level-based backup.

  NOTICE

  During a NetWorker scheduled policy backup, the NetWorker software supplies the date and the time information, and incremental and level backups work as expected.

  Use one of these methods to determine the date and time of the last NDMP backup:

  - Review the `daemon.raw` file on the NetWorker server or the savegroup completion report for a line similar to the following:

    ```
    42920:nsrndmp_save: browsable savetime=1296694621
    ```

    Use the value after `savetime=` with the `-t` option.
  - Specify the date and time of the last backup reported by the `mminfo` command for the NDMP save set.

Note

You can force the NDMP backup and recovery to ignore IPv6 and instead use IPv4 in one of two ways:

1. Add the `-f` option to the `nsrndmp_save` or the `nsrndmp_recover` commands as required.
2. Select the **Disable IPv6** checkbox on the Apps & Modules tab in the **Client Properties** window.

Example of an NDMP backup

To perform an incremental backup of a NetApp client that is named mynetapp, perform the following steps:

1. Determine the time of the last full backup:

```
mminfo -v -c mynetapp
```

client	date	time	size	ssid	fl	lvl	name
mynetapp	08/16/15	15:23:58	1853MB	3864812701	cbNs	full	/.../set1
mynetapp	08/17/15	15:39:58	815MB	3848036430	cbNs	incr	/.../set2

2. Specify the last backup time in `nsrndmp_save` command:

```
nsrndmp_save -T dump -s my_nwserver -c mynetapp -l incr -t
"02/16/11 15:23:58" -g mygroup path
```

For NDMP-DSA backups, the NetWorker software uses the Storage Node attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they override the **Storage Node** attribute value. The *EMC NetWorker Command Reference Guide* and the `nsrndmp_save` man page on UNIX provide more information.

Troubleshooting NDMP configuration and backup failures for Isilon

This section provides a list of the possible causes and the resolutions for NDMP backup failures.

Unable to connect to NDMP host *hostname*

This message appears when the NetWorker server cannot create or modify an NDMP client.

To resolve this issue ensure that the environment meets the following requirements:

- Username and password specified for the client is correct and has sufficient permissions to perform NDMP operations.
- NDMP service is running on the filer.

Cannot perform NDMP backup after the NetWorker server licenses expire

If a NetWorker sever running in evaluation mode expires before you authorize the server, NDMP devices remain disabled after the addition of the required licenses and authorization of the NetWorker server.

To re-enable NDMP devices, perform the following steps.

1. Use NMC to connect to the NetWorker server and click the **Devices** button.
2. In the **Devices** windows, right-click the NDMP device and select **Properties**.
3. Click the **Configuration** tab and set the **Target Sessions** attribute to **1**.
4. Click the **General** tab and in the **Enabled** section, select **Yes**.
5. Click **Ok**.

Failed to store index entries

This error message occurs in the `daemon.raw` file when an index backups fails due to an insufficient amount of swap space.

To resolve this issue, increase the amount of swap space available to the NetWorker server.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

IO_WritePage write failed - No space left on device (28): No space left on device

This error message appears in the `daemon.raw` file when the index backup fails. There is insufficient temporary space to store the index entries before the NetWorker software commits the information into the client file index.

To resolve this issue, specify a new the temp directory with sufficient disk space in one of the following ways:

- Define the *NSR_NDMP_TMP_DIR* environment variable in the Application Information attribute of the client.
- Define the *NSR_NDMP_TMP_DIR* as an operating system environment variable on the NetWorker server.

Memory and space requirements for NDMP FH updates on page 23 describes how to determine the amount of disk space the NetWorker software requires to temporarily store client files index entries.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Error reading the FH entries from save through stdin

This error message appears in the `daemon.raw` file of the NetWorker server when there is a communication error between the `nsrndmp_save` and `nsrndmp_2fh` processes.

Resolve any communication or connection issues, then retry the backup.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Cannot find file history info for filename...You may still be able to recover this file with a saveset recovery

This error message appears in the `daemon.raw` file of the NetWorker server when FH information is missing or corrupted for the file specified in the error message. For

example, NetWorker cannot update the client file index(CFI) with FH information when a backup process interruption occurs during the failover of a clustered NetWorker environment.

You cannot perform an NMDP file-by-file recover or a save set recover when the CFI does not contain the associated FH information.

To recover this file, perform a save set recover from the command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides for further information.

NOTICE

The NetWorker server does not delete the FH files stored in the `tmp` directory when the CFI updates fail.

nsrndmp_save: data connect: failed to establish connection

This error message appears in the `daemon.raw` file of the NetWorker server for several reasons:

- Network connectivity or name resolution issues exist between the NetWorker server and the NDMP client.
- You specified an incorrect NDMP username or password specified for the NDMP client.
- The NDMP service is not started on the NAS filer.
- The NetWorker server cannot communicate with the NAS filer over port 10000.
- A free port in the NetWorker server's default port range (7937-9936) is not available during an NDMP-DSA backup.
  The *EMC NetWorker Security Configuration Guide* provides more information about NDMP port requirements and configuration.
- A misconfigured loop router. For an EMC Celerra filer, the server route command utility configures the loop router. For NetApp, the route utility configures loop back router. The value of this setup is network-specific and depends on the number of switches and hubs between the NAS filer, NetWorker server, and NetWorker storage node.
- On the host where DSA is running, if the hostname is present in the hosts file, the `nsrdsa_save` process uses this name during backup. The DSA host passes the loopback entry to the NDMP data server and the connection fails. To resolve this issue, remove the hostname from the localhost list.

Knowledge base articles on the EMC Online Support Site provides detailed troubleshooting information for this error message and other failed to establish connection failures that you might encounter during an NDMP backup.

nsrndmp_save: get extension list: communication failure

This message appears during a NDMP local backup when NetWorker cannot determine the filer name.

To resolve this issue, perform the following steps.

1. From a command prompt on the NetWorker server, type:

   nsrndmpsup -c NDMP_hostname -o output_filename

   For example:

   nsrndmpsup -c myfiler.mnd.com -o nsrndmpsup.txt

2. Edit the output file that the `nsrndmpsup` command generates and search for the string **Vendor Name**. Make note of the reported Vendor Name.
   For example:

   ```
   Vendor Name = BlueArc Corp
   ```

3. Change to the `/nsr/debug` directory on UNIX or the `NetWorker_installation_dir\nsr\debug` directory on Windows.
4. Create new empty file and name it with the following format:

   ndmpgetextlist_disable_*VENDOR_NAME*

   where you replace *VENDOR_NAME* with the vendor name of the filer reported in the nsrndmpsup output file.

   For example, to create this file for a BlueArc filer on UNIX, type:

   ```
   touch "ndmpgetextlist_disable_BlucArc Corp"
   ```

Monitoring NetWorker server activities in the Administration window

The **Monitoring** window in the NetWorker **Administration** application enables you to monitor the activities of an individual NetWorker server.

The **Monitoring** window provides the following types of activity and status information:

- Data protection policies, workflows, and individual actions.
- Cloning, recovering, synthetic full backups, and browsing of client file indexes.
- Operations that are related to devices and jukeboxes.
- Alerts and log messages.

You can also perform some management operations from the **Monitoring** window, for example, starting, stopping, or restarting a data protection policy.

Procedure

1. From the **NMC Console** window, click **Enterprise**.
2. In the **Enterprise** view, right-click the NetWorker server and select **Launch Application**.

   The **Administration** window appears.
3. Click **Monitoring** to view the **Monitoring** window.

About the Monitoring window

On the **Administration** window taskbar, select **Monitoring** to view the details of current NetWorker server activities and status, such as:

- Policies and actions.
- Cloning, recovering, synthetic backups, checkpoint restart backups, and browsing of client file indexes.
- Alerts and log messages, and operations that are related to devices and jukeboxes.

While the **Monitoring** window is used primarily to monitor NetWorker server activities, it can also be used to perform certain operations. These operations include starting, stopping, or restarting a workflow.

The **Monitoring** window includes a docking panel that displays specific types of information. Select the types of information you want to view from the docking panel.

A portion of the **Monitoring** window, which is known as the task monitoring area, is always visible across all windows. A splitter separates the task monitoring area from the rest of the window. You can click and move the splitter to resize the task monitoring area. The arrow icon in the upper right corner of the **Monitoring** window allows you to select which tasks you want to appear in this view.

Smaller windows appear within the **Monitoring** window for each window. Each smaller window, once undocked, is a floating window and can be moved around the page to customize the view. You can select multiple types from the panel to create multiple floating windows that can be viewed simultaneously. The following table describes the various types of information available in the docking panel, and the details each one provides.

Table 30 Monitoring window panel

Window	Information provided
Policies/Actions	The **Policies** tab provides you with status information about all configure policies and the associated workflows and actions. The **Actions** tab provides you with status information for all actions. Policies/Actions pane on page 81 provides more information.
Sessions	Allows you to customize whether to display all session types, or only certain session types. The information that is provided depends on which session type you select. For example, if you select **Save Sessions**, the window lists clients, save sets, groups, backup level, backup start time, duration of the backup, devices, rate, and size. Sessions pane on page 84 provides more information.
Alerts	Lists the priority, category, time, and message of any alerts. Alerts pane on page 85 provides more information.
Devices	Lists devices, device status, storage nodes, libraries, volumes, pools, and related messages. Devices pane on page 86 provides more information.
Operations	Lists the status of all library and silo operations, including `nsrjb` operations that are run from the command prompt. Also lists user input, libraries, origin, operation data, operation start time, duration of the operation, progress messages, and error messages. When displaying Show Details from the **Operations** window, the length of time that the window is displayed depends on the value that is typed in the **Operation Lifespan** attribute on the **Timers** tab of the **Properties** dialog box for the corresponding library. To access library properties, click **Devices** in the taskbar. By default, this pane is hidden.
Log	Lists messages that are generated by the NetWorker server, including the priority of each message, the time the message was generated, the source of the message, and the category. Log pane on page 89 provides more information.

Customizing the Monitoring window

This section describes how to customize the **Monitoring** window in the **Administration** interface.

Customizing tables

You can customize the organization and display of tabular information in the **Monitoring** window.

Sorting tables

You can change the display of tabular information that appears in the window. You can sort Table grids by column heading, and then by alphabetic or numeric order within those columns.

1. Drag-and-drop the column heading to its new position.
2. Click the column heading to sort the items into alphabetic and numeric order. An arrow appears in the column heading to indicate the sort order.

Sorting selected rows in a table

Selected rows are sorted to the top of the table. This is particularly useful when you select **Highlight All** from the Find panel to select all rows matching the Find criteria and then moving all selected rows to the top of the table to view the results.

1. From the **Edit** menu, select **Find**, or press **Ctl + F** to view the **Find** panel.
2. To select the rows, click each row or use the Find criteria.
3. Select **Sort Selected**.

Sorting multiple columns in a table

You can select the column that you want to use as the tertiary sort key, the secondary sort key, and the primary sort key.

1. Click the column that you want to use as the last sort key.
2. Click the column that you want to use as the next-to-last sort key, and so on, until you select the primary column.

Displaying columns in a table

You can select which columns to display in a table.

1. From the **View** menu, select **Choose Table Columns**.
2. Click a column name to select or clear the column and then click **OK**. You can also select the columns to display by right-clicking a table header and selecting **Add Column** from the drop-down.

Displaying panes

You can choose to show or hide panes in the **Monitoring** window.

Perform the following steps to hide or show a pane in the **Monitoring** window.

Procedure

1. From the **View** menu, select **Show**. A check mark appears beside the panes that appear in the **Monitoring** window.
2. To hide a pane, select a marked pane.

   A check mark does not appear beside the pane.
3. To show a pane, select an unmarked pane.

A check mark appears beside the pane.

Policies/Actions pane

The **Policies/Actions** pane provides you with the ability to review status information about policies and actions.

This pane has two tabs:

- Policies—Provides a navigation tree that displays all configured policies on the NetWorker server. Expand each policy to display the workflows that are associated with each policy. Expand each workflow to display each action that is contained in the workflow.
- Actions—Provides a list of all Action resources.

Policies pane

The **Monitoring** window in the **NetWorker Administration** window enables you to monitor activities for specific policies, workflows, and actions.

The **Policies/Actions** pane at the top of the **Monitoring** window lists the policies on the NetWorker server by default. Click the + (plus) sign next to a policy in the list to view the workflows in the policy, and the + (plus) sign next to a workflow to view the actions for a workflow.

The **Policies** pane provides the following information for each item (where applicable):

- Overall status

  The following table provides details on the status icons that may appear in the **Policies** pane.

  Table 31 Policy status icons

Icon	Status
	Never run
	Running
	Succeeded
	Failed
	Probing
	Interrupted
	Queued
	Cloning
	Consolidating (NetWorker server 8.2.x and lower only)

- Most recent start time.
- Duration of the most recent run.

- Next scheduled runtime.
- Name of the assigned save set.
- Device on which the save set is stored.
- Backup level.
- Data transfer rate.
- Size of the save set.
- Messages that resulted from an action.

Right-click an action in the **Policies** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

When you sort the items on the **Policies/Actions** pane by using the **Status** column, NetWorker sorts the items in alphabetical order that is based on the label of the icon.

Consider the following when a policy/action is in a probing state:

- A message is sent when the group starts and finishes the probe operation.
- The results of the probe operation (run backup/do not run backup) are also logged.
- Probes do not affect the final status of the group, and the group status does not indicate the results of the probe.
- If probing indicates that a backup should not run, then the group status reverts to its state before the group running.
- Check the results of the probe in the **Log** window to ensure that the probe indicates that the backup can be taken.

Actions pane

To view a list of all actions, click the **Actions** tab at the bottom of the **Policies** pane. The **Policies** pane becomes the **Actions** pane.

The **Actions** pane provides the following information for each action:

- Overall status

  Note

  The **Actions** pane displays the same status icons as the **Policies** pane.

- Name
- Assigned policy
- Assigned workflow
- Type
- Date and time of the most recent run
- Duration of the most recent run
- Percent complete, for actions that are in progress
- Next scheduled runtime

Right-click an action in the **Actions** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

Workflow operations

This section describes how to use the **Monitoring** window to start, stop, and restart workflows.

Starting, stopping, and restarting data protection policies

The workflows in a data protection policy can run automatically, based on a schedule. You can also manually start, stop, and restart specific workflows, in the **Monitoring** window of the **NetWorker Administration** window.

Note

You cannot stop, restart, or start individual actions.

You can restart any failed or canceled workflow. However, the restart must happen within the restart window that you specified for the workflow.

You can also start specific policies and workflows in the **Protection** window by right-clicking the policy or workflow, and selecting **Start**.

Procedure

1. Select the workflow, or action in the **Monitoring** window.
2. Right-click and select **Start**, **Stop**, or **Restart**.

   A confirmation message appears.
3. Click **Yes**.

Viewing workflow backup details

Perform the following steps to view backup details for workflows.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Policies** in the docking panel, and expand the Policy that you want to monitor.
3. Right-click the workflow, and then select **Show Details**. The **Workflow Summary** window appears.
4. In the **Workflow runs** pane of the **Workflow Summary** window, select the workflow.
5. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
6. Click **OK** to close the **Workflow Summary** window.

Viewing action backup details

Perform the following steps to view backup details for actions.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Actions** in the docking panel.

3. In the **Actions** pane, right-click the action, and then select **Show Details**. The details window for the action appears.
4. Review the information in the **Actions Messages** pane. To display detailed information from the action log file, click **Show Action Logs**, and then select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
5. In one of the Actions detail panes, for example, the **Completed successfully** pane, select the action that you want to review.
6. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
7. Click **OK** to close the **Details** window.

Sessions window

Use the **Sessions** window to view the sessions that are running on a NetWorker server. You can change the view of this window to display these sessions:

The **Sessions** pane below the **Policies/Actions** pane provides details on individual save, recover, clone, and synthetic full sessions by client.

Click the tabs at the bottom of the **Sessions** pane to view all sessions or to limit the list of sessions by the session type. Session types include:

- Save
- Recover
- Clone
- Browse
- Synthetic Full/Rehydrated Sessions
- All

To change the displayed session types go to **View** › **Show**, and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the **Monitoring** window, even if the session was started by running the `savegrp` command.

To stop a session, right-click the session in the pane, and select **Stop** from the drop-down.

Changing displayed session types

The column headings displayed on this window will differ depending on the type of sessions you chose to display.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Sessions** in the docking panel.
3. Go to **View** › **Show** and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

Stopping a session

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the Monitoring window, even if the session was started by running `savegrp`.

To stop a session, right-click the session in the window and select Stop from the drop-down.

The following table provides a list of actions that can be stopped from NMC.

Table 32 Sessions that can be stopped from NMC

Session type	Stop from NMC?
Save by Savegroup	Yes
Synthetic Full by Savegroup	Yes
Clone by Savegroup	Yes
Schedule Clone	Yes
Manual Save	No
Manual Clone via NMC	No
Manual Clone via CLI	No
Winworker and CLI Recovery	No
Recovery started from Recover wizard	Yes
VMware Backup Appliance Save and Recover	No

NOTICE

Stopping a session from NMC does not affect any other group operations running.

Alerts pane

The **Alerts** pane displays alerts that are generated by a particular NetWorker server or Data Domain system that has devices that are configured on the NetWorker server. The **Alerts** pane includes priority, category, time, and message information.

An icon represents the priority of the alert. The following table lists and describes each icon.

Table 33 Alerts window icons

Icon	Label	Description
	Alert	Error condition detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.
	Warning	A non-fatal error has occurred.

When items on the **Alerts** pane are sorted by the **Priority** column, they are sorted in alphabetical order based on the label of the icon.

Removing alerts

Remove individual alert messages from the **Events** tables by removing them from the **Events** table. To delete a message in the **Events** table, right-click the message, and select **Dismiss**.

Note

The alert message remains in the **Log** window in the NetWorker **Administration** program.

Devices pane

The **Devices** pane allows you to monitor the status of all devices, including NDMP devices. If the NetWorker server uses shared and logical devices, the window is adjusted dynamically to present a set of columns appropriate for the current configuration.

The **Devices** pane provides the following information:

- Status of the operation.
- Name of the device.
- Name of the storage node that contains the device.
- For tape devices, the name of the library that contains the device.
- Name of the volume in the device.
- Name of the pool that is associated with the volume.
- Last message generated for the device.
- Whether the operation requires user input.

  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape.

Entering user input on page 89 provides instructions on how to deal with a user input notification.

If the current server configuration includes a shared device, a **Shared Device Name** column appears on the **Devices** pane. The name of the shared device appears in the **Shared Device Name** column. If other devices for that configuration are not shared devices, then the **Shared Device Name** column is blank for those devices. Since only a single device per hardware ID can be active at any particular moment, the information for inactive shared devices is filtered out, so only one device per hardware ID is presented on the window at any time.

An icon represents the device status. The following table lists and describes each icon.

Table 34 Devices status icons

Icon	Label	Description
	Library device active	The library device is active.
	Library device disabled	The library device is disabled.
	Library device idle	The library device is idle.
	Stand-alone device active	The stand-alone device is active.
	Stand-alone device disabled	The stand-alone device is disabled.
	Stand-alone device idle	The stand-alone device is idle.

When you sort items in the **Devices** pane by the **Status** column, NetWorker sorts the devices in alphabetical order based on the label name of the icon.

Operations window

The **Operations** window displays information about device operations. It provides the following information:

- Status of the operation.
- Name of the library.
- Whether the operation requires user input.
  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape. Entering user input on page 89 provides instructions on how to deal with a user input notification.
- The origin, or source, of the operation.
  For example, the interface, nsrjb or the NetWorker server.
- Time the operation started.
- Type of operation.
- Duration of the operation.
- Status messages from the operation.
- Any error messages.

NOTICE

Only the last error message of the operation appears in the **Error Messages** column. Move the mouse pointer over the cell containing the last error message to display the entire list of error messages.

The operation status is represented by an icon. The following table lists and describes each of the icons.

Table 35 Operations window icons

Icon	Label	Description
	Failed	The operation failed.
	Queued	The operation is waiting in the queue to run.
	Retry	The operation failed, but may work if you try again.
	Running	The operation is running.
	Successful	The operation completed successfully.
	User Input	The operation requires user input.

When items on the **Operations** window are sorted by the Status column, they are sorted in alphabetical order based on the label of the icon.

Viewing operation details

The **Operation Details** dialog box opens, providing information about the completion of the operation. The **Completion Time** displays the time that the operation finished. The time that it took to complete the operation is the difference between the completion and start times of the operation.

To save operation details to a file, click **Save** in the **Operation Details** dialog box. When prompted, identify a name and location for the file.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation, then select **Show Details**.

Stopping an operation

Certain operations can be stopped from the **Operations** window.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation to stop, then select **Stop**.
4. Click **Yes** to confirm the stop.

Note

Operations that were started from a command line program, such as the `nsrjb` command, cannot be stopped from the **Operations** window. To stop these operations, press **`Ctrl-c`** from the window where the command was started.

Entering user input

If the system requires user input, select the labeling operation in slow/verbose mode and the Supply User Input icon appears.

Procedure

1. Right-click the operation, then select **Supply Input**.
2. Confirm whether or not to supply input.
   - If **Yes**, and input is supplied, the icon in the User Input column disappears.

     If two users attempt to respond to the same user input prompt, the input of the first user will take precedence, and the second user will receive an error message.
   - If **No**, and input is not supplied, the operation will time out and fail.

Log window

To view the most recent notification logs, click the **Log** window from the docking panel in the **Monitoring** window. The **Log** window provides the priority, time, source, category, and message for each log.

Note

If a particular log file is no longer available, check the log file on the NetWorker server. The log files are located in *`NetWorker_install_path`*`\logs` directory.

An icon represents the priority of the log entry. The following table lists and describes each icon.

Table 36 Icons in the Log pane

Icon	Label	Description
	Alert	Error condition that is detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.

Table 36 Icons in the Log pane (continued)

Icon	Label	Description
	Warning	Non-fatal error has occurred.

When you sort items on the **Log** pane by using the **Priority** column, NetWorker sorts the icons in alphabetical order based on the name of the label.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 37 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.

Table 37 Recovery toolbar options (continued)

Button	Function
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 38 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 39 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Monitoring checkpoint-enabled backups

You can view detailed information about a checkpoint-enabled backup.

Procedure

1. From the **Administration** window, select **Monitoring** › **Groups**.
2. Right-click the group to which the checkpoint enabled client belongs, then select **Show Details**.
3. View the detailed information related to the group backups:
   - If the partial save set is in the work list for the group, the save set appears in the **Waiting to Run** section.
   - If the partial save set is running, the save set appears in the **Currently Running** section.
   - If the entire partial save sets sequence of the savegroup is complete, the save set appears in the **Completed Successfully** section.
   - If the entire partial save sets sequence of the savegroup is not complete, the save set appears in the **Failed** section.

     NOTICE

     If any messages are generated, the Show Messages button is enabled. Click Show Messages to view the messages.
4. Click **OK** to close the **Group Details** window.

Query the media database for partial save sets

The savegrp completion report does not provide detailed information about partial save sets that might be necessary to perform a recovery.

Querying partial save sets from the Console

You can view information about the partial save sets by using the NetWorker Console.

NOTICE

If no partial save sets are found that match the query, ensure that the backup of the partial save sets was started within the Save Time period. To change the values for the Save Time attribute, open the Save Set Query tab and select a date and time from the Save Time calendar.

Procedure

1. In the **Administration** window, click **Media**. Media-related topics appear in the navigation tree.
2. Select **Save Sets**. The following tabs appear in the **Save Sets** window:
   - Query Save Set
   - Save Set List
3. Select the **Query Save Set** tab, to query:
   - All partial save sets, select **Checkpoint Enabled**.
   - All partial save sets with the same Checkpoint ID, in the **Checkpoint ID** field, type the **Checkpoint ID** of the partial save set on which you want to perform the query.
4. Select the **Save Set List** tab to view the result of the save set query:
   - The **Checkpoint ID** column displays the partial save set **Checkpoint ID** and its Sequence ID. The **Checkpoint ID** is listed first followed by the **Sequence ID**, which is encased within brackets.
   - Sort the **Checkpoint ID** column to view the complete sequence of partial save sets.
   - The **Status** column displays the status of the partial save sets:
     - A Checkpoint browsable status indicates that the save sets can be browsed for recover.
     - A Checkpoint aborted status indicates that the backup of the partial save set was stopped or aborted. A save set recover is used to recover the partial save set.
       Consider the following:
     - When a checkpoint-enabled backup completes successfully, the status of the last partial save set is Checkpoint browsable.
     - When a checkpoint-enabled backup completes successfully, on the first backup attempt, the save set status is Checkpoint browsable. Only one Sequence id is associated with the Checkpoint ID. The Sequence id is 1. If the Sequence id is 2, the first partial save set in the checkpoint-enabled backup is missing.

Querying partial save sets by using the `mminfo` command

By default, the `mminfo` command output only displays the browsable save sets. The first and intermediate partial save sets are not displayed. Only complete checkpoint-enabled save sets or final partial save sets are displayed.

Use the `mminfo` command with specific queries to display more information about checkpoint-enabled save sets.

The following table lists the new media attributes support the Checkpoint Restart feature.

Table 40 New Checkpoint Restart media attributes

Media attribute	Description
checkpoint_id	Displays the checkpoint restart id of the partial save set in the chkpt_id column.
checkpoint_seq	Displays the partial save set sequence id in the chkpt_seq column.
checkpoint-restart	This flag attribute is used to only display checkpoint restart enabled save sets.

Also, several media sumflags are used with the Checkpoint Restart feature:

- k—Indicates this is a checkpoint enabled save set.
- a—The first and all intermediate partial save sets of a checkpoint sequence will have aborted status.
- b—The last partial or complete save set of a checkpoint sequence will be marked browsable.

Displaying checkpoint enabled save sets

Display all checkpoint enabled save sets by using the following `mminfo` command:

```
# mminfo -q 'checkpoint-restart' -r 'client,nsavetime,ssid(11),
sumflags(3),name,checkpoint_id,checkpoint_seq'
```

client	save time	ssid	ssflags	filename	chkpt_id	chkpt_seq
plapew	1251910303	4204700319	cak	/space	1251910303	1
plapew	1251910327	4187923127	cbk	/space	1251910303	2
plapew	1251910710	4087260214	cak	/space	1251910710	1
plapew	1251910725	4070483013	cbk	/space	1251910710	2

Displaying all partial save sets for the checkpoint id

Display all partial savesets for the checkpoint id by using the following `mminfo` command:

```
mminfo -q "checkpoint_id=1251910303"
```

volume	client	date	size	level	name
plapew.001	plapew	08/02/15	17 MB	full	/space
plapew.001	plapew	08/02/15	799 MB	full	/space

Reporting NDMP Data

The NetWorker software reports information about NDMP clients, data, and volumes in two ways.

- The NMC reporting feature—Reports NDMP data in the same manner as non-NDMP data. The *EMC NetWorker Administration Guide* provides more information.

- The `mminfo` command. Use the `mminfo` program to query the media database for NDMP volume or save set information.

Querying the NDMP volumes by backup type with the mminfo command

You can query save sets by backup format (NDMP or DSA) to display volume information.

- For example, to query NDMP volumes, type `mminfo -q ndmp`. Output similar to the following appears:

```
volume client date size level name
005D0000 sim1cifs1 6/22/2011 1036 MB full /fs1
005D0001 sim1cifs1 6/22/2011 173 MB full /fs1
005D0001 sim1cifs1 6/22/2011 862 MB full /fs1
005D0002 sim1cifs1 6/22/2011 348 MB full /fs1
```

- For example, to query NDMP -DSA volumes, type `mminfo -q dsa`. Output similar to the following appears:

```
volume client date size level name
NDMP.001 10.8.67.219 12/13/2011 644 MB full /vol/vol0
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 36 MB full /vol/vol2
```

Querying the NDMP save sets with the mminfo command

Query the media database to determine which save sets are NDMP save sets and the status of an NDMP save set in the media database. NDMP save set status information is important when performing NDMP recoveries.

- To perform a browseable NDMP recover, the ssflags (fl) field for an NDMP save set must contain a (b). The b value denotes a browsable save set.
- To perform a save set recover from the NetWorker User program, the ssflags (fl) field for an NDMP save set must contain either (r) or (b).
- An NDMP save set contains an N attribute in the ssflags (fl) field.
- An NDMP-DSA save set contains an s attribute in the ssflags (fl) field.

In the following example, the NDMP save set status is recoverable (r). To recover the data, you can only perform a save set recovery from a command line.

`mminfo -av`

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 1036MB 3842140553 hrN full /fs1
```

In the following example, the NDMP-DSA save set status is brows able (b). Recover the data by using the NetWorker User program, or from the command line. A browseable NDMP-DSA save set supports brows able and save set recoveries.

`mminfo -av`

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 36MB 4259813785 cbNs full /fs1
```

Performing NDMP recoveries

NetWorker uses the `nsrndmp_recover` program to coordinate recover operations between the NetWorker software and the NDMP client. The `nsrndmp_recover` program

does not move data to the NDMP client. When the `nsrndmp_recover` program identifies an NDMP-DSA save set, `nsrndmp_recover` automatically runs the `nsrdsa_recover` program on the same host that runs the `nsrndmp_recover` command.

To recover NDMP data, you can run the `nsrndmp_recover` program from a command prompt, or use one of following programs, which automatically starts `nsrndmp_recover`:

- `recover`—The command line program on Windows and UNIX.
- `winworkr`—The NetWorker User GUI on Windows.
- The NMC Recovery wizard.

During the recovery process, the `nsrndmp_recover` program passes nlist information to the NDMP client. There are three methods to recover NDMP backups:

- Index-based file-by-file recover — The nlist includes file offset and ACL information. When you recover many files, the recover process uses a significant amount of system resources on both the NetWorker server and the NDMP client to build and process the nlist information.
- Full save set recovery—The nlist only includes the path to the recovery directory, down to and including the mount point. When you recover many files, the recover process uses less system resources than an index-based NDMP recover to build and process the nlist information.
- NDMP directory restore — A partial save set recovery of a single file or single directory.

For example, when the NetWorker software writes NDMP data to a remote storage node, start the `recover` program on the NetWorker storage node to prevent the data from traversing the network.

Note

When you start the `recover` program on the NetWorker server, the data flows from the storage node to the NetWorker server and from the NetWorker server to the NDMP client, over the network.

NDMP recovery requirements for Isilon

The following list summarizes the requirements:

`scanner`

You cannot use the `scanner` command with the `-i`, `-f` and `-r` options on an NDMP volume. You cannot use the `scanner` command on a volume that contains NDMP and non-NDMP save sets when you load the volume in an NDMP device. The *Scanner command usage* technical note provides more information about using the `scanner` command with NDMP data.

Cross platform recoveries

You can recover NDMP data to different NDMP client however, you cannot perform a cross platform recover. Recover NDMP data to an NDMP client that is the same brand, a compatible model, and the same operating system as the original NDMP client.

Devices

Recover Direct-NDMP and Three-party backups performed to an NDMP device from an NDMP device. To improve recover performance from an NDMP tape device,

configure the tape device to support variable length records. Recover NDMP-DSA backups from a non-NDMP device.

Localized environments

When recovering data in a localized NDMP environment, the Index Recover status window shows the process in English and not the localized language.

NDMP-DSA

For better recovery performance, start the recover process on the NetWorker host where the backup volume resides.

Immediate recoveries

Run the `nsrndmp_recover` program on the storage node with the locally attached backup device to perform an immediate recovery of NDMP-DSA data.

DAR and DDAR

By default, the NDMP recover process reads an entire tape from start to finish. The recover process extracts the data as it encounters the data on the tape. For large backup images, recovery is slow.

The DAR/DDAR recovery process:

- Provides the ability to recover a file or directory from the exact location on a tape.
- DDAR only passes the directory path to the NAS filer. DAR passes the paths of each file individually.
- Reduces the size of the nlist information that the recover process stores in memory. During the recover process, the NAS filer (DDAR) assumes that the directory path includes all cataloged files and directories. However, DAR mentions each file that it wants recovered.
- Does not sequentially read the file or record numbers on the tape to locate the data, which reduces the amount of time that you require to recover specific files from a backup.

Note

Creating and configuring the NDMP client resource on page 67 describes how to configure the DAR and DDAR Application Information attributes for NDMP clients.

Use the `recover` command or the NetWorker User program to perform DAR and DDAR recoveries. You cannot use the `nsrndmp_recover` program to perform DAR/DDAR recoveries.

When not to use DAR or DDAR

DAR and DDAR recoveries send multiple pathnames across the network to the NDMP Data Server and, in three-party configurations, to the NetWorker server. The recover process stores the pathnames in memory on the NDMP Data Server. Recoveries of a large amount of data from a large save set can negatively affect the network and the NDMP Data Server resources.

Do not use DAR and DDAR to recover the following objects:

- Several thousands of files in a single index-based recover operation.
- A specific directory structure containing several thousand or millions of files.

To perform a non-DAR-based recovery of a save set when you set the *DIRECT=y* at the time of backup, first define the *NSR_NDMP_RECOVER_NO_DAR=y* variable in the Application Information attribute of the NDMP client.

Recovering data from partial save sets

If there is a complete sequence of partial save sets that span the original save set, then you can browse to and recover individual files and directories. If the sequence of partial save sets is incomplete and does not make up the original save set, then you must perform a save set recovery to recover the data from the partial save set.

To recover data from partial save sets that span the original save sets, perform a query for all partial save sets, and then use either the NetWorker User program on Windows or the `recover` program on UNIX to restore the data.

The steps to recover data from a single partial save set are the same as save set recovery from a complete save set. The partial save set contains only files that were successfully backed up. You cannot browse partial save sets.

When you perform a save set recovery of a partial NDMP save set, the recovery process recovers all partial save sets in the checkpoint sequence. You cannot recover data in a partial save set separately from other partial save sets in the checkpoint sequence.

Use the `nsrinfo` command to display the contents of a partial save set.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 41 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.

Table 41 Recovery toolbar options (continued)

Button	Function
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.

- Start Time
- End Time
- Start date

Table 42 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 43 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Performing an NDMP index-based file-by-file data recovery

Perform an NDMP index based file-by-file recover in the same manner as a non-NDMP data recover. You can restore the data to the original NDMP client or perform a directed recovery to a different NDMP client.

Before you perform an index-based file-by-file recover, review the following information.

- Set the *HIST=y* in the Application Information attribute of the NDMP client at the time of the backup.
- The NDMP save set must be browsable. You cannot perform a browsable recover of a recoverable or recyclable save set. Reporting NDMP Data on page 93 describes how to determine the status of an NDMP save set.
- Do not use an index-based recovery to recover a large numbers of files or directories. For better recovery performance, use a save set recover. Performing a full or Directory Restore of NDMP data by using a save set recovery on page 104 provides more information.
- To perform an index-based file-by-file recover:
  - Use the NetWorker User program on a Windows host. Performing an NDMP index-based file-by-file recover using the NetWorker User program on page 101 provides detailed information.
  - Use the `recover` program. Performing an NDMP index-based file-by-file recover from a command prompt on page 103 provides detailed information.

Performing an NDMP index-based file-by-file recover using the NetWorker User program

On Windows, to recover data to the original NDMP client or to a different NDMP client, perform the following steps.

Procedure

1. Open the NetWorker User program and connect to the NetWorker server.

   NOTICE

   If you receive the error:

   ```
   No file indexes were found for client client_name on server
   server_name
   ```

   Try connecting to a different NetWorker server and you selected the correct NetWorker server, then ensure that you selected a browsable save set. Alternatively, perform a save set recover.

2. Select **Recover** to open the **Source Client** window.
3. Select source NDMP client and click **OK**. The local client is the default selection.
4. Select the destination client for the recovered data and click **OK**. If the destination client is not the source client, ensure the NAS filer is the same brand, a compatible model and the same operating system as the source NDMP client.
5. (Optional) Recover the data from an earlier backup time. The **Recover** window appears with the latest version of the backup files. To recover data from an earlier backup, change the date and time of backup using one of the following methods:

   a. Change the browse time for all files in the recover window:

      - From the **View** menu, select **Change Browse Time**.
      - In the **Change Browse Time** window, select a new day within the calendar. Select **Previous Month** or **Next Month** to change from the current month.
      - In the **Time** field, change the time of day by typing an hour, a minute, and the letter a for A.M. or p for P.M. Use the 12-hour format.
      - Click **OK**.

   b. View all versions of the selected file system object:

      - Highlight the file or directory for review.
      - From the **View** menu select **Versions**.
      - Once you locate the version to recover, change the browse time. To change the browse time, highlight the volume, directory, or file and click **Change Browse Time**. The **Version** window closes and the **Recover** window reflects the new browse time.

6. (Optional) Search for the files. To search for and recover the most recently backed-up version of a file or directory:

   a. From the **File** menu, select **Find**.

   b. Type the name of the file or directory. Use wildcards to expand the search; without wildcards, partial filenames do not provide any results.

7. Mark the data to recover. To select file system objects to recover:

a. In the left pane of the **Recover** window, click the appropriate directory folder.

b. Mark each directory or file to recover by selecting the checkbox next to each directory or file.

8. (Optional) Relocate the data to a different location. By default, the recover process recovers the selected files to the original location.

Note

The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

To relocate the files to a different location:

a. Select **Recover Options** from the **Options** menu.

NDMP recoveries do not support the following options:

- Rename recovered file
- Discard recovered file
- Prompt for every file conflict
  NDMP recoveries will always overwrite existing files. EMC recommends that you relocate the NDMP data to a different location, to avoid data loss.

b. In the **Relocate Recovered Data To** field, type the full path name of the target directory, click **OK**.

The target directory is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the recover process uses the original location and overwrites existing files with the same name.

9. (Optional) To view the volumes required to recover the marked file system objects, from the **View** menu, select **Required Volumes**.

10. Click **Start** to begin the recovery. If any required volume is not available to the NetWorker server, a volume status warning appears.

When this warning appears:

a. Click **No**.

b. From the **View** menu, select **Required Volumes**.

c. Ensure that the NetWorker software can mount each listed volume into an available device.

d. Attempt the recover operation again.

The NetWorker server takes a few moments to recover the files, depending on file size, network traffic, server load, and tape positioning. During this time, messages appear so that you can monitor the progress of the recovery.

When the recovery completes successfully, a message similar to the following appears:

```
Received 1 file(S) from NSR server
server Recover completion time: Tue Jan 21 08:33:04 2009
```

Performing an NDMP index-based file-by-file recover from a command prompt

This section applies to command line recoveries from a Windows and UNIX client.

To avoid using the Windows version of `recover.exe` on Windows operating systems, perform one of the following actions:

- Specify the full path to the recover program. For example: `C:\Program Files\EMC NetWorker\nsr\bin\recover.exe`.
- Ensure that the *$PATH* environment variable contains the `NetWorker_install_path\bin directory before %SystemRoot%\System32`.

To recover NDMP data from a command prompt on a UNIX or Windows NetWorker host, perform the following steps:

Procedure

1. From the command prompt, type:

   `recover -s` *NetWorker_servername* `-c` *client_name*

   where:

   - the `-s` *NetWorker_servername* option specifies a particular NetWorker server on the network to use when recovering data.

     When you do not use the `-s` option, the `recover` program tries to connect to the first computer listed in the servers file. When the servers file does not contain any servers, or lists more than one server, the **Change Server** window appears, and you can select the server.
   - the **-c***client_name* option specifies the source NDMP client.
2. When prompted, type the directory to browse, for example:

   ```
   cd /mydirectory
   ```

3. Use the `add` command to add the required files or folders to the recover list. The *EMC NetWorker Command Reference Guide* provides a complete list of options for the `recover` command.
4. When restoring NDMP data, EMC recommends that you relocate the NDMP data to a different location.

   Note

   The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

   - To relocate the data to a different directory, type:

     `relocate` ***destination_directory_name***

     The target pathname for *destination_directory_name* is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the

recover operation uses the original location and overwrites existing files with the same name.

- To recover the data to a different host, type:

  `relocate` ***`target_hostname`***`::`***`/mount_point`***

  Data ONTAP may require you to add a backslash (\) after the mount point. For example, *target_hostname::\mount_point*.

5. After you add all of the required files, type:

   `recover`

Performing a full or Directory Restore of NDMP data by using a save set recovery

You perform an NDMP save set recover in the same manner as a non-NDMP save set recovery. You can recover data to the original NDMP client or perform a directed recovery of the data to a different NDMP client of the same platform.

Before you perform a full save set recover, review the following information.

- Use a full save set recovery to recover all files and folders in an NDMP data save set, or to recover an entire directory within an NDMP save set. You cannot use the NetWorker User program to perform an NDMP Directory Restore.
- To use the NetWorker User program on Windows, a client file index entry for the save set must exist. When the index entry for the save set does not exist, the recover fails with an `index not found` error. When the client file index entries do not exist for the save set, use the `nsrndmp_recover` program with the '-v off' option.
- You cannot perform a save set recover from the NetWorker User program when the save set status is eligible for recycling (E). The recover process requires a recoverable (r) or brows able (b) save set status. The *EMC NetWorker Administration Guide* provides information on how to change the status of a save set. A save set recover reads the entire tape, from beginning to end, to find and recover the requested files. The recovery process completes when the recover operations reads all required tapes in their entirety.
- As each file recovers, the file name appears on the target share but the file size is 0 KB. The actual file size update occurs after the recovery completes.

Performing an NDMP save set recover by using the NetWorker User in Windows

NOTICE

When the recover operations fails with the error:

```
Failed to propagate handle <number> to child process: Access is
denied
```

The save set is not in the client file index of the NDMP client. Perform a save set recover from a command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides more information.

Procedure

1. Start the NetWorker User program.
2. On the **Change Server** window, select the NetWorker server and click **Ok**.
3. Select **Options** › **Recover Save Sets**.

4. On the **Source Client** window, select the appropriate NDMP client, and then click **Ok**.
5. On the **Save Sets** window, select the name of the save set.
6. Select the version of the save set, if there are multiple versions. You can also select the cloned version of a save set, if applicable.
7. To recover specific files and directories instead of the entire save set:
   a. Click **Files**.
   b. Specify the files and directories, one per line.
   c. Click **OK**.

   NOTICE

   Do not use this method to mark tens of thousands of files. Instead, perform an NDMP Directory Restore. Marking many files and directories generates a large nlist and requires intensive resources on both the NetWorker server and the NAS filer.

8. Click **Recover Options**.

   An NDMP data recovery does not support the following options:

   - Rename recovered file
   - Discard recovered file
   - Prompt for every file conflict

   NOTICE

   EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries *always* overwrite existing files.

9. To recover the data to a pathname that is different from the original backup location, in the **Relocate Recovered Data To** field, type the full pathname of the destination directory, then click **Ok**.

   For NDMP data recoveries, the target pathname is a literal string and *must* exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

10. To recover the data to a different NDMP client, specify the name of the client to receive the NDMP data in the **Destination Client** field.
11. To view the volumes required to perform the recover, select **View › Required Volumes**
12. Click **OK** to begin the recovery. The recovery status appears in the **Recover Status** window.

Performing an NDMP save set recovery from the command prompt

To perform a save set recovery to the original NDMP client or to a different NDMP client, use the `nsrndmp_recover` command.

For example:

```
nsrndmp_recover -s NetWorker_server -c source_ndmp_client -S ssid/
cloneid -v off -m target_ndmp_client::/target_path /source_path
```

where:

- *source_ndmp_client* is the hostname of the source NDMP client.

- *target_ndmp_client* is the hostname of the destination NDMP client.
- */source_path* is the original location of the data.
- */target_path* is the location to recover the data.

  NOTICE

  EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries always overwrite existing files. The `/target_path` is a literal string and must exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

- **-v off** allows you to restore data when client file index of the NDMP client does not contain information about the NDMP save set.
  In the following examples, the NetWorker server is mars and the backup client is venus.
  - To recover a mount point `/mnt` from a backup of NDMP host venus to a directory `/newmnt` on NDMP host jupiter, type:

    ```
    nsrndmp_recover –s mars -c venus -S 123456789 -v off –m
    jupiter::/newmnt
    ```

  - To recover a mount point `/mnt` from a backup of NDMP host venus to NDMP host pluto, type:

    ```
    nsrndmp_recover –s mars -c venus -R pluto -S 123456789 -v off -
    m /mnt
    ```

    Data ONTAP may require that you to add a slash (/) after the mount point. For example, *target_hostname*:/*mount_point*/.

Troubleshooting NDMP recover

This section provides a list of the possible causes and the possible resolutions for NDMP recovery issues.

RESTORE: could not create path *pathname*

This error message appears when restoring NetApp data. This error, when encountered, appears in the `daemon.raw` file of the NetWorker server and the recovery output.

To resolve this issue:

- Ensure that you specify a source and a target path during the recover that exists on the target filer.
- If you set the *UTF8=Y* application information variable during an NDMP client backup and the backup contains path names with non-ASCII characters, then perform a save set recover. Index-based recoveries will fail with this error message.

These files were not restored (Restore failed with error, or file/directory specified but not found in backup)

This error message appears in the `daemon.raw` file of the NetWorker server and the in the recovery output.

To resolve this issue:

- Ensure that the file or directory specified during the recover, exists in the save set.

- Ensure that the pathname specified to relocate the data exists on the destination filer. For NDMP data recoveries, the target pathname is a literal string and must exactly match the path as seen by the native OS on the NAS filer.

CHAPTER 4

NetApp

This section includes the following topics:

- Configuring devices for NDMP operations 192
- Configure NetWorker for NDMP backup and clone operations 204
- Monitoring NetWorker server activities in the Administration window 243
- Reporting NDMP Data 260
- Performing NDMP recoveries 261

Configuring devices for NDMP operations

Review this section for information about how to configure the NetWorker environment for NDMP data operations.

The *EMC NetWorker Hardware Compatibility Guide* on the EMC Online Support web site provides a list of NDMP devices that the NetWorker software supports.

NDMP device limitations

Review these limitations before you configure NDMP devices.

- The timeout of the NetWorker server resource attribute, `nsrmmd`, does not apply to NDMP devices, but it does apply to storage nodes devices.
- You cannot use the `jbexercise` utility with an NDMP autochanger.
- You cannot configure NDMP devices on a dedicated storage node.
- You must use a non-rewind device handle for the NDMP media device handle.
- You cannot configure Advanced file type devices and file type devices as an NDMP device.
- You cannot configure an NDMP Autochanger when the NDMP protocol is before version 3. You must determine the NDMP device handles, then use the `jbconfig` command to configure the autochanger.

Determining NDMP device path names

To configure an NDMP standalone device or NDMP jukebox, you must first determine the path names of the media devices. If the NAS filer does not support the NDMP_CONFIG interface or uses NDMP version 3, you must also determine the library device handle.

To determine the NDMP device path names and the library handle, use the `inquire` command or vendor-specific commands.

Determining the NDMP device path names by using inquire

Use the `inquire` command to determine the path names and library handle.

Procedure

1. From a command prompt on the NetWorker server, type:

   ```
   inquire -N NAS_hostname -T
   ```

2. When prompted, specify the NAS username and password.

   NOTICE

   Use the `inquire` command with caution. When you run `inquire`, the command sends the `SCSI inquiry` command to all devices detected on the SCSI bus. If you use the `inquire` command during normal operations, then unforeseen errors can occur, resulting in possible data loss.

Determining the NDMP device path name for NetApp

Before you configure an NDMP autochanger you must determine the device path names of NDMP devices and the robotic arm.

Procedure

- Log in to the appliance as root or as a Windows Administrator and type:

  sysconfig -t

  The host responds with a list of media device names, for example:

  ```
  Tape drive (DS_300B:3.126L10) Hewlett-Packard LTO-4 nrst0l -
  no rewind device, format is: LTO-2(ro)/3 2/400GB nrst0m - no
  rewind device, format is: LTO-2(ro)/3 4/800GB cmp nrst0h -
  no rewind device, format is: LTO-4 800GB nrst0a - no rewind
  device, format is: LTO-4 1600GB cmp
  ```

  where:

  - `(DS_300B:3.126L10)` indicates the switch (DS_3--6), the port number (3) and the LUN number(10). This information must match the output in the sysconfig -v command.
  - `nrst01` is the media device name.

    When the filer uses NDMP v2, or does not support the NDMP_CONFIG interface, to determine the autochanger handle, type:

    sysconfig -m

    The host responds with the devices on the host, for example:

    ```
    Medium changer (DS_300B:3.126L9) ADIC Scalar i2000 mc5 -
    medium changer device
    ```

    where mc5 is the autochanger handle.

Dynamic drive sharing

Dynamic Drive Sharing (DDS) is a feature that provides NetWorker software with the ability to recognize shared physical tape drives. DDS enables NetWorker software to perform the following operations:

- Skip the shared tape drives that are in use.
- Route the backups or recoveries to other available shared tape drives.

Introduction to DDS

DDS controls application requests for tape media and allows the NetWorker server and all storage nodes to access and share all attached devices.

A system administrator can configure DDS by setting a sharing policy for devices that are accessible from multiple storage nodes.

There are two terms that are central to the use of DDS are drive and device. Within the context of DDS, these terms are defined as follows:

- Drive—The physical backup object, such as a tape drive, disk, or file.
- Device—The access path to the physical drive.

Note

NetWorker only supports DDS in a storage area network (SAN) Fibre Channel environment and not in a direct-connect SCSI environment.

Benefits of DDS

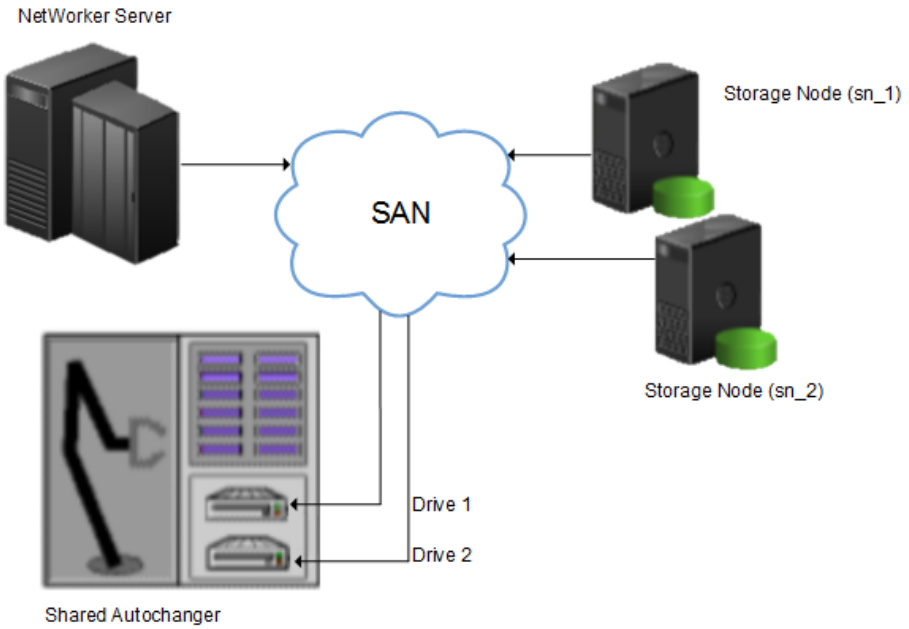
Enabling DDS on a NetWorker system provides these benefits:

- Reduces storage costs—You can share a single tape drive among several storage nodes. In fact, since NetWorker software uses the same open tape format for UNIX, Windows, NetWare and Linux, you can share the same tape between different platforms (assuming that respective save sets belong to the same pool).
- Reduces LAN traffic—You can configure clients as SAN storage nodes that can send save sets over the SAN to shared drives.
- Provides fault tolerance—Within a SAN environment, you can configure hardware to eliminate a single point of failure.
- Provides configuration over a greater distance—You can configure a system over a greater distance than with SCSI connections.

DDS configuration overview

The following figure illustrates the DDS process and potential device sharing configurations. This basic configuration consists of a server, two storage nodes, and a library with two tape drives.

Figure 25 Dynamic Drive Sharing



In this figure:

- Storage nodes sn_1 and sn_2 are attached to the library.
- Each storage node, on its own, has access to drive_1 and drive_2.
- With DDS enabled, both storage nodes have access to both drives and can recognize when a shared drive is in use.

This configuration requires two DDS licenses, one for each drive.

Note

Ensure that all applicable devices can be seen from each storage node by running the `inquire -l` command locally on each storage node.

DDS block-size compatibility between UNIX and Windows

With DDS enabled, drives can be shared between storage nodes on different platforms, such as UNIX and Microsoft Windows. For NetWorker software operations (such as backups and recoveries) to take place successfully, ensure that the block size is compatible between different platforms and/or hardware.

To ensure compatibility, make sure one of the following conditions is met:

- The various storage nodes sharing a drive support the same block sizes.
- When a tape is labeled on a drive, it is labeled with the block size defined on the storage nodes.

Block-size incompatibility between UNIX and Windows

Incompatible block-size settings between UNIX and Microsoft Windows storage nodes could result in any of these error scenarios:

- A backup taken on a UNIX node might not be recoverable on a Microsoft Windows node if the Windows node does not support large block sizes.
- A UNIX process labels and saves data to a tape and leaves the tape mounted. A Microsoft Windows process subsequently attempts to verify the label on this tape and fails because the label verification is done by reading a header from the data portion.
- A tape on a UNIX node is labeled with a large block size. The backup is started on a Microsoft Windows node and the Windows node attempts to write the backup by using the default block size. Internally, the backup on Windows is written by breaking down the big buffer of data into smaller segments of writable block sizes. Attempting to recover a specific file on Windows in this situation fails due to positioning errors on the tape. The data is still recoverable from the Windows side, since the NetWorker software will switch from using file and block positioning to reading the tape from the beginning to reach the correct position. The data might not, however, be recoverable from the UNIX side.

Unintended Access to DDS device prevention

The Reserve/Release attribute has been added to the Device resource for tape devices to support Reserve/Release, including the Persistent Reserve commands.

Reserve/Release is a mechanism that uses SCSI commands to attempt to prevent unintended access to tape drives that are connected by using a shared-access technology, such as Fibre Channel, iSCSI, or SCSI multiplexers. It is a “cooperative” and host-based mechanism, which means that all applications should respect the reservations and not purposely break them. Access is granted based on the host system that reserved the device. Other applications that run on that host cannot be prevented from accessing a reserved device.

Reserve/Release cannot prevent a malicious or badly behaved application from accessing a reserved device. It also cannot prevent all problems caused by hardware issues (such as SCSI resets or FC LIPs) from interrupting data access.

The basic sequence requires that a host reserve a tape drive (using specific SCSI commands) before attempting to access the tape drive. If this “reservation” succeeds, then the host can use the drive. If the reservation fails (usually because the device is reserved by someone else), then the host attempting the reservation should not attempt

to use the drive. When a host has finished using a reserved drive, that host must release the drive by using the appropriate SCSI commands.

The reservation is maintained by the drive itself. With older (called “Simple” in NetWorker software) Reserve/Release, the reservation is based on the SCSI ID of the system that issued the reserve command. For tape drives connected to Fibre Channel (FC) using FC-SCSI bridges, the mapping between FC host and reservation is done inside the bridge, since the initiator on the SCSI side is always the bridge itself, regardless which host actually issued the reserve command.

For Persistent Reserve, the reservation is associated with a 64-bit “key” that is registered by the host. Several keys can be registered with a given drive at any given time, but only one may hold the active reservation. NetWorker software uses the “exclusive” reservation method for Persistent Reserve. Only the host that holds the active reservation is allowed to access the drive.

The Reserve/Release attribute does not support file type or advanced file type devices.

The settings that relate to Reserve/Release and Persistent Reserve are found in a device’s Properties window, on the Advanced tab. They are visible only when diagnostic mode is turned on.

The default setting for Reserve/Release is None. Once any other Reserve/Release setting is selected, it works automatically, without further user intervention. The Reserve/Release attribute is supported only on Common Device Interface (CDI) platforms, so if the CDI attribute in a device’s Properties is set to Not Used, then Reserve/Release settings are ignored.

For newer hardware, once a Reserve/Release setting (other than None) has been selected, the appropriate Persistent Reserve commands are automatically issued before a device is opened for reading or writing, and before the device is closed. With older hardware, a SCSI-2 Reserve command is issued before opening the device, and a SCSI-2 Release command is issued after the device is closed.

Reserve/Release has these possible settings:

- None (the default)
- Simple
- Persistent Reserve
- Persistent Reserve + APTPL (Activate Persist Through Power Loss)

The Persistent Reserve Key attribute has also been added. It is used with Persistent Reservation calls.

Restrictions for use of the SCSI Reserve/Release setting

There are restrictions for using the SCSI Reserve or Release setting.

Consider the following:

- It is available on CDI platforms only. Consequently, since CDI is not supported within an NDMP environment, Reserve/Release is not supported with NDMP.
- Not all drives support persistent Reserve/Release. (All drives support at least simple reserve release. The code automatically drops back from Persistent +APTPL or Persistent to Simple on drives that do not support Persistent.)
- SCSI resets can clear Simple reservations at the device.
- Even with Reserve/Release, there is no guarantee against data loss.
- If the operating system has its own Reserve/Release feature, that feature must be disabled in order for the NetWorker Reserve/Release feature to work.

- Even if all of the enterprise's NetWorker storage nodes have this feature enabled, then it is possible that, on the storage node where a backup operation is run, data loss can be caused by the operating system's utilities or by third-party programs.

DDS on NDMP nodes in a SAN environment

You can configure shared drives between NDMP nodes in a SAN environment.

Ensure that:

- All the components of a SAN configuration are compatible when DDS is enabled with the NetWorker NDMP feature.
- The Fibre Channel switches are compatible with any NDMP hosts within a SAN.
- NDMP hosts and libraries in the SAN are compatible with each other.
- The NDMP nodes that will share the drives are homogeneous.

Note

The current NDMP implementation does not allow the sharing of drives between non-homogeneous NDMP nodes. There is, however, no inherent limitation within DDS that would prevent this.

NetApp zoning requirements for DDS in a SAN environment

To configure DDS with NetApp filers, a zoned SAN configuration is required. Zoning is a feature of the Fibre Channel switch.

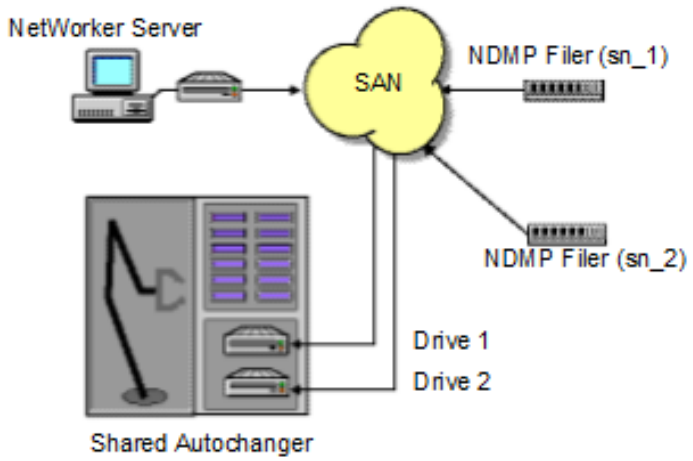
Consider the following when configuring DDS with NetApp filers:

- The NetApp zone, which contains only the NetApp filers and tape devices, must be configured on the Fibre Channel switch. This NetApp zone may also include the robotic arm and must also be configured in an arbitrated loop.
- All non-NetApp servers that are attached to the same Fibre Channel switch must be excluded from the NetApp zone. A separate zone must be configured for the non-NetApp servers, in which an arbitrated loop may, or may not be a requirement.
- The NetApp zone and all other zones can overlap on the tape devices within the SAN, so that the tape devices are visible to both zones.

This figure illustrates a basic DDS configuration with NDMP:

- Both the NDMP Filer (sn_1) node and the NDMP Filer (sn_2) node must be the same kind for DDS to be enabled.
- The hardware id for Drive 1 is drive_1
- The hardware id for Drive 2 is drive_2.

Figure 26 DDS with NDMP



DDS attributes in the device properties

Configure the attributes that DDS uses, in the **Properties** window for a device.

The attributes include:

- Hardware ID
- Shared Devices

Hardware ID attribute

The Hardware ID attribute tracks the drives that are shared between multiple hosts. Device instances that share the same physical drive across multiple hosts have the same hardware ID. The device autoconfiguration process automatically assigns the Hardware ID to a device, or it is added when manually configuring a device. Users cannot edit the Hardware ID.

You can view the Hardware ID in the **Properties** window for a device, on the **General** tab, in the **Device Sharing** area.

NetWorker generates the Hardware ID when a device is scanned or configured. The Hardware ID consists of the following components:

- Hardware serial number
- Device type
- Worldwide part number (WWPN)
- Worldwide name (WWN)

Shared Devices attribute

The Shared Devices attribute appears on the **Operations** tab of a device's **Properties** window when in diagnostic mode. It features values that can be used to manipulate all shared instances of a drive simultaneously. This attribute enables or disables all devices that share the same Hardware ID with a single action. The following table lists allowed values and descriptions for the attribute.

Table 44 Shared Devices attributes

Value	Description
Enable All	When selected, enables all devices with the same Hardware ID.
Disable All	When selected, disables all the devices with the same Hardware ID.
Done	This value is the default setting. After the server has enabled or disabled all devices with the same Hardware ID, the attribute value is reset to Done.

You cannot configure the Shared Devices attribute with the `jbconfig` program.

Idle Device Timeout attribute and DDS

A tape might remain mounted in a drive after a backup completes. Other requests for the drive from another device path must wait during this timeout period. Use the Idle Device Timeout attribute to adjust the timeout value.

The Idle Device Timeout attribute is not specifically a DDS attribute, but is useful in configuring shared drives. This attribute appears on the device **Properties** window on the **Advanced** tab when displayed in Diagnostic Mode. The default value is 0 (zero) minutes, which means that the device never times out and you must manually eject the tape.

If the device belongs to a library, you can also specify the Idle Device Timeout value for all devices in the library. However, the library value will take effect only on those devices whose **Idle Device Timeout** value is 0. The Idle Device Timeout value for a library is located on the **Timer** tab of the library **Properties** window.

Max active devices

In a DDS environment, use the Max active devices attribute, on the **General** tab of the Storage Node resource to define the maximum number of active devices for a storage node.

This attribute sets the maximum number of devices that NetWorker may use from the storage node in a DDS configuration. In large environments with media libraries that have a large number of devices, storage nodes might not have the ability to optimize all the drives in the library. The Max active devices attribute allows you to limit the number of devices that the storage node uses at a specified time, which allows the storage node to have access to all the devices in the library, but does not limit the storage node to the number of devices it can fully optimize.

Configuring NDMP devices

You can back up NDMP data to an NDMP or non-NDMP device in a standalone or library configuration. You can also back up NDMP data to ACSLS controlled silos.

Configuring NetApp in a cluster mode

For NetApp in a cluster mode, tape drivers are only attached to physical nodes. The tape drivers are not accessible from the Vserver. To enable backups to the tape drivers, you must configure a NAS client with a physical node on the NetWorker server. Meaning you must configure Device and storage pool with the physical node. The devices are also accessible from the cluster. Another option is to create a NAS client of the cluster, and configure Device and Storage pool with the cluster.

Configuring a standalone NDMP device

Use NMC to configure a standalone NDMP tape device for Direct NDMP backups.

Procedure

1. In the **Administration** window, click **Devices**.
2. Right-click **Devices** in the navigation tree, and select **New**.
3. In the **Name** attribute, specify the NDMP device in the format:

   `rd=`*`NAS_hostname`*`:`*`NAS_device_handle`* `(NDMP)`
   where:

   - *NAS_hostname* is the hostname of the NAS that has the NDMP device attached.
   - *NAS_device_handle* is the path of the device.

   Note

   Configure the NDMP device as a remote device and add **`(NDMP)`** after the pathname. Otherwise, you receive a message similar to the following:

   `NDMP device name shall be in rd=`*`snode`*`:`*`devname (NDMP)`* `format`

4. In the **Media Type** attribute, specify the device type.
5. Specify a valid NAS administrator account in the **Remote User** attribute.
6. Specify the password for the NAS administrator account in the **Password** attribute.
7. On the **Configuration** tab:
   a. Select the **NDMP** checkbox. You can only set this attribute when you create the device. You cannot change the NDMP attribute after you create the device. To change the device configuration, delete and re-create the device.
   b. Set the **Target Sessions** attribute to **`1`**. NDMP devices do not support multiplexing.
   c. The **Dedicated Storage Node** attribute must remain at the default value: **`No`**.
8. Under the **Advanced** tab, the **CDI** attribute must remain at the default value: **`Not used`**.
9. Optionally, change the block size used by the NDMP device.

   By default, NDMP devices use a block size of 60 KB. If required, select a different block size in the **Device block size** field. When you configure the NDMP client, set the *NDMP_AUTO_BLOCK_SIZE* environment variable in the **Application Information** attribute.
10. Click **OK**.

Configuring an NDMP autochanger

You can use an NDMP autochanger to manage Direct NDMP or Three-party backups with NDMP devices. To configure an NDMP autochanger, use NMC or the `jbconfig` command.

Configuring an NDMP autochanger with NMC

When you configure an NDMP autochanger in NMC, the NetWorker software first detects the NDMP devices and then configures the library.

Procedure

1. In the **NetWorker Administration** window, click **Devices**.
2. Right-click on the NetWorker Server and then select **Configure All Libraries**.
3. On the **Provide General Configuration Information** window, accept the default library type, **SCSI/NDMP**, and then click **Next**.
4. On the **Select Target Storage Nodes** window, click **Create a new Storage Node**.
5. On the **Storage Node Name** field, specify the hostname of the NAS.
6. In the **Device Scan Type** attribute, select **NDMP**.
7. In the **NDMP User Name** and **NDMP Password** fields, specify the NAS administrator account. If DinoStor TapeServer manages the autochanger, specify the DinoStor username and password.
8. Click **Start Configuration.**
9. Click **Finish**.
10. Monitor the **Log** window for the status of the device scan.

    When you specify an incorrect username and password combination:

    - The Log status window reports:

      ```
      No configured libraries detected on storage node
      storage_node_name
      ```

    - The `daemon.raw` file on the NetWorker server reports:

      ```
      NDMP Service Debug: The process id for NDMP service is
      0xb6c0b7b0
      42597:dvdetect: connect auth: connection has not been
      authorized
      42610:dvdetect: The NDMP connection is not successfully
      authorized on host 'storage_node_name'
      ```

      To resolve this issue, relaunch the **Configure All Libraries** wizard and correct the NDMP username and password combination.

Note

If the **Log** window reports that NetWorker cannot detect the serial numbers for the library, see Configuring an NDMP autochanger by using the jbconfig command on page 38 for detailed instructions.

Configuring an NDMP autochanger by using the jbconfig command

The NMC interface is the preferred method to configure an NDMP autochanger. Use the jbconfig command when you cannot configure the autochanger by using the NMC Configure Library wizard.

The *EMC NetWorker Command Reference Guide* or the UNIX man page provides more information about the `jbconfig` command.

Procedure

1. Log in to the NetWorker server as root on UNIX, or Administrator on Windows.
2. At the command prompt, type **`jbconfig`**
3. At the **What kind of jukebox are you configuring** prompt, type **`3`** to configure an autodetected NDMP SCSI jukebox.
4. When prompted for an NDMP username, specify the NAS administrator account.
5. When prompted for an NDMP password, specify the NAS administrator password.
6. When prompted for the NDMP Tape Server Name, specify the NAS filer hostname.
7. At the **What name do you want to assign to this jukebox device** prompt, provide a name to identify the autochanger.
8. To enable auto-cleaning, accept the default value of **Yes**, otherwise type **`No`**.
9. At the **Is (any path of) any drive intended for NDMP use? (yes / no) [no]** prompt, type **`Yes`**.
10. At the **Is any drive going to have more than one path defined? (yes / no) [no]** prompt, type **`No`** if you will not configure shared devices. Type **`Yes`** to configure shared drives.
11. When prompted, for the first pathname for the NDMP devices in the jukebox, perform the following steps.
    a. Specify the pathname in the following format:

       `NDMP_tape_server_name``:`***`device path`***

       where:

       - *NDMP_tape_server_name* is the hostname of the NDMP Server.
       - *device_path* is the first device path.

       Do not type a slash before the device name. Although the `jbconfig` command completes without errors, the NetApp filer will not recognize the tape device or autochanger.
12. Complete the prompts for the second device.
13. In the **Enter the drive type of drive 1** prompt, specify the number that corresponds to the NDMP device type.
14. If each drive in the autochanger is the same model, then type **`Yes`**. Otherwise, type **`No`**, and then specify the appropriate device types for each additional autochanger device.
15. When prompted to configure another autochanger, type **`No`**.

Changing the block size of an NDMP device

By default, the block size used to write data to an NDMP backup is 60KB. With the exception of EMC Celerra, when you specify the *NDMP_AUTO_BLOCK_SIZE=Y* variable for

an NDMP client, an NDMP device can use the value defined in its Device block size attribute.

Consult the applicable vendor documentation to determine the block sizes supported by the NDMP filer before setting the block size for an NDMP device.

To change the block size defined for the NDMP device, perform the following steps:

Procedure

1. From the **View** menu, select **Diagnostic Mode**.
2. In the **Devices** window, right-click the NDMP device and select **Properties**.
3. On the **Advanced** tab, select a value in the **Device block size** field.

   Note

   The selected block size must not exceed the block size configured on the NAS filer.

4. Click **Ok**.

Message displayed when CDI enabled on NDMP or file type device

If you enable the CDI feature for an NDMP tape device or file type device (FTD), a message similar to the following appears:

```
nsrd: media notice: The CDI attribute for device "/dev/rmt/
3cbn" has been changed to "Not used".
```

To avoid this message, do not enable the CDI attribute for these device types.

Configuring NDMP-DSA devices

When you use DSA, NetWorker sends the NDMP data to a NDMP-DSA device, which includes tape, virtual tape, AFTD, and Data Domain devices. The steps to configure a NDMP-DSA device for a specified device type is the same as configuring a non-NDMP device. The *EMC NetWorker Administration Guide* provides detailed information.

Configuring the Clone Storage Node

When cloning NDMP data, specify the destination storage node, called the clone “write source” (the device that receives the clone data), in the Clone storage nodes attribute. The "Determining the storage node for writing cloned data" section in the *EMC NetWorker Administration Guide* provides details.

Pools requirements for NDMP

When you create a pool for non-NDMP devices, select only the devices that are required by the NDMP clients.

NetWorker cannot send bootstrap and index backups to an NDMP device. When you do not configure a non-NDMP devices or a non-NDMP device is not available to receive the index and bootstrap backups, the NDMP client backup appears to hang. Configure a separate pool to direct the index and bootstrap to a non-NDMP device.

Auto media verification in the Pool resourcedoes not support NDMP.

When an NDMP client backup is a member of a clone-enabled group, configure a clone pool with non-NDMP devices that are local to the NetWorker server to receive the clone bootstrap and index.

Configure NetWorker for NDMP backup and clone operations

This section explains how to configure NetWorker for NDMP backup and clone operations.

Creating and configuring the NDMP client resource

Use the NMC Client Configuration Wizard to create the NDMP client or create the client manually. EMC recommends that you use the NMC Client Configuration Wizard to create NDMP clients.

Using the Client Configuration wizard

Use the NMC Client Configuration wizard to create the NDMP client.

Procedure

1. From the **Administration** window in NMC, click **Protection**.
2. In the expanded left pane, select **Clients** , and then select **Protection** › **New Client Wizard**.
3. On the **Specify Client Information** window:
   a. In the **Client Name** field, specify the hostname of the filer.
   b. Optionally, add comments in the **Comment** field.
   c. Optionally, in the **Tag** field, specify the name of the tag for the dynamic group in which you want to add this client.
   d. Optionally, in the **Groups** area, select an existing group, in which to add the client.
   e. In the **Type** area, select **NDMP**, and then click **Next**.
4. On the **Specify the NDMP Client Credentials** window:
   a. In the **NDMP User Name** field, specify a valid NAS administrator account.
   b. In the **NDMP Password** attribute, specify the password for the NAS administrator account, and then click **Next**.
5. In the **Specify the NDMP Client Backup Options** window:
   a. In the **NDMP backup type** attribute, select or specify the backup type:
      - `dump`— Traverses a file tree in mixed width first and depth-first order.
      - `smtape`—Performs a block-level backup of a SnapMirror volume.
   b. In the **NDMP Array Name** field, specify the logical name assigned to the NDMP NAS array.

      The **NDMP Array Name** field enables you to configure the same NAS device with multiple NDMP clients that have different host IDs.

      Note

      NDMP clients that use the same NAS device must have the same NDMP array name.

   c. Review the **App Info** options and disable options, as required. EMC recommends that the default options remain enabled.

App Info Type	Description
HIST	Enables the backup of index data. If you do not select this option, you can only perform full recoveries of the backup data.
UPDATE	Enables the backup process to update the last backup dates in database on the NDMP client, after the backup completes.
DIRECT	Enables DAR or DDAR support.
Use Token-Based Backup	Enables the NDMP backup to use last backup time tokens to decide what files to backup. Not all NDMP clients support token based backup. When you select this option and the NDMP data server on the client does not support token based backups, NetWorker performs the backup by using backup levels.

d. In the **Advanced App Info** field, specify additional NAS specific environments variables, one per line. The following table provides a list of the available **Application Information** environment variables for each NAS.

NOTICE

Environment variables are case-sensitive. Use an equal (=) sign to separate the environment variable name from its value.

Table 45 Vendor-specific Application Information variables

Variables	Definition
FILESYSYTEM=**`path`**	Optional. Use this variable to define the file system to back up and override the value in the Save set attribute of the client.
DIRECT=**`y/n`**	Optional. When you use DAR or DDAR, you must set this value to y.
EXCLUDE=**`string`**	Optional. This string specifies the files to exclude from backup. The following rules apply: • The string must be a file name. Use file names, not absolute paths. • You can use the asterisk (*) as a wildcard, only when * is the first or last character in the string, or both. • To list multiple files, separate each name with a comma. A comma cannot appear as part of the file name. You cannot use spaces. • You can specify up to 32 strings.
EXTRACT_ACL=**`y`**	Optional. Specify this variable to recover ACLs when you use DAR.

Table 45 Vendor-specific Application Information variables (continued)

Variables	Definition
SMTAPE_BREAK_MIRROR=Y	Optional when you use SMTape. During the recovery of the mirror, setting *SMTAPE_BREAK_MIRROR=Y* ensures that the mirror breaks and the volume becomes available for reuse. If you do not set the variable or you specify *SMTAPE_BREAK_MIRROR=N*, the mirror remains in the same state as at the time of backup.
SMTAPE_DELETE_SNAPSHOT=Y	Optional when you use SMTape. When backing up the filer volumes, setting *SMTAPE_DELETE_SNAPSHOT=Y* ensures the removal of the mirror created during the backup, at the end of backup. If you do not set the variable or you specify *SMTAPE_BREAK_MIRROR=N*, each backup attempt creates a new snap mirror image.
RECURSIVE=y	Optional for DAR and DDAR recoveries. *RECURSIVE=y* ensures the correct recovery of ACLs, permissions, and ownerships for all interim directories selected in the recover operation.
RECOVER_FULL_PATHS=y	Optional for DAR and DDAR recoveries. *RECOVER_FULL_PATHS=y* ensures that NetWorker recovers the ACLs, permissions, and ownerships for each interim directories selected in the recover operation.
USE_TBB_IF_AVAILABLE=n	Optional. The NetWorker software enables TBB automatically. Specify this variable to disable TBB support for incremental backups. This value reverts the backup to the native level-based backup of the NAS.
UTF8=n	Optional. Provides support for UTF-8 formatted data. When you do not define this variable, the default value is n. When you set *UTF8=Y* during an NDMP client backup and the backup contains path names with non-ASCII characters, an index-based recovery of this backup fails with the error: `RESTORE: could not create path pathname`
NSR_NDMP_RECOVER_NO_DAR=y	Optional. Specify this variable to perform a non-DAR recovery when you set the *DIRECT=y* variable during the backup.
NDMP_AUTO_BLOCK_SIZE=Y	Optional. Specify this variable to override the default block size of 60 KB when writing NDMP backups to an NDMP device. Uses the block

Table 45 Vendor-specific Application Information variables (continued)

Variables	Definition
	size value defined in the Device block size attribute when you labeled the NDMP volume.

6. Click **Next**.
7. On the **Select the NetWorker Client Properties** window:
   a. In the **Priority** field, specify the order in which the NetWorker server contacts clients in a protection group for backup. The attribute can contain a value between 1 and 1,000. The lower the value, the higher the priority.
   b. In the **Parallelism** attribute:
      - For Direct-NDMP, set the **Parallelism** attribute to 1.
      - For NDMP-DSA, the parallelism value depends on the NAS capabilities and set parallelism to a value that is appropriate for the NAS. Parallelism values of 4 to 8 are common. In general, the best parallelism setting depends on filer configuration and the amount of installed RAM.
   c. In the **Remote Access** attribute:
      - Specify the root account on UNIX, or the administrator account on Windows of any computer that you use to browse entries for the NDMP computer.
      - Specify the NetWorker server administrator account on Windows, or the root account on UNIX.
        Use this format to specify each account:

        `account_name@hostname`
   d. Select the **Data Domain Interface**. This option specifies the protocol to use if you send the backup data to a Data Domain Device. Available selections are Any, Fibre Channel, or IP.
   e. To enable a block based backup for the host, select the **Block Based Backup** option . The *EMC NetWorker Administration Guide* provides more information about when to enable blocked based backups and the features that do not support block based backups. Block Based backups require the **Client Direct** option.
   f. Select the **Client Direct** option to allow the client to try to directly connect to the backup storage device, instead of connecting to a NetWorker storage node. If a direct connection is not possible, the backup operation connects to the NetWorker storage node that you configure to accept data from the client.
8. Click **Next**.
9. On the **Client Configuration Summary** window, review the attributes, and then click **Create**.
10. On the **Client Configuration Results** window, review the results, and then click **Finish** to exit the wizard.

    Troubleshooting NDMP configuration and backup failures on page 75 describes how to resolve errors that you may experience when you configure the NDMP client.

Performing post Client Configuration Wizard steps

After the Client Configuration wizard creates the NDMP client, modify the properties of the new NDMP client.

Modifying the Storage Node

On the **Globals (2 of 2)** tab, specify the appropriate storage node in the **Storage Nodes** attribute.

The attribute value depends on the type of backup:

- When you perform Direct-NDMP backups with NDMP devices, specify the hostname of the NAS that manages the tape device or autochanger.
- For three-party backups, specify the destination host first.
- For NDMP-DSA backups, specify the hostname of the storage node that manages the tape device or autochanger. If the NetWorker server is the storage node, specify *nsrserverhost*.
- For a DinoStor-managed NAS, specify the hostname of the DinoStor server first.

  NOTICE

  For NDMP-DSA backups, the NetWorker software uses the **Storage Node** attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they will override the **Storage Node** attribute value.

Enabling Checkpoint Restart

To allow a failed backup for a client to restart from a known good point, you must enable Checkpoint Restart for the NetWorker client resource and configure the number of automatic retries for the backup action in the data protection policy.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, select **Clients**.
3. Right-click the client resource and select **Properties**.

   The **Client Properties** dialog box appears.
4. On the **General** tab, select the **Checkpoint enabled** checkbox.

   Note

   When you enable **Diagnostic Mode** the **Checkpoint granularity** attribute appears. This attribute does not apply to NDMP.

5. Define the interval at which checkpoints are written during the backup:
   a. Select the **Apps & Modules** tab on the **Client Properties** dialog box.
   b. In the **Application information** attribute, specify the `CHECKPOINT_INTERVAL_IN_BYTES` variable.

      For example, to write a checkpoint after every 1,000,000 bytes, type:

      ***CHECKPOINT_INTERVAL_IN_BYTES*=1000000**

      To define the value by using a different multiplier, specify the multiplier with the numeric value. Supported multipliers include `KB`, `MB`, `GB`, `TB`, `kb`, `mb`, `gb`, and `tb`. For example, to write a checkpoint after every 1 GB, type:

CHECKPOINT_INTERVAL_IN_BYTES=1GB

Note

The checkpoint interval value is automatically rounded up to a multiple of the tape block size.

6. Click **OK** on the **Client Properties** dialog box.

Adding NDMP Client Properties

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, select **Clients**.
3. Right-click a **Client** and select **New Client Properties**. The **Client Properties** screen appears.
4. Select the **Apps & Modules** tab. Select the **NDMP** attributes of the **Client**. The **NDMP** options are as follows:
   - **NDMP**—Check this box to indicate whether this client is an NDMP client.
   - **NDMP multistreams enabled**—Check this box to indicate whether the Isilon client is using the NDMP multistream feature.

     Note

     Only Isilon supports multistreaming.

     Increasing the number of streams does not always increase performance. Depending on your environment, performance might be reduced when the number of streams is increased, especially for a high density file system backup and recover.

     - To start a multistream backup from the command line interface, add option **-A multistreams=<n>** to the command `nsrndmp_save` where n=Number of streams. For example:

       ```
       nsrndmp_save -T <Backup_type> -c <Isilon_client> -A
       multistreams=<n> <Backup_Path>
       ```

     - To start a multistream backup from NMC GUI or a scheduled backup, set the **Parallelism** value in the **Globals (1 of 2)** tab.
   - **NDMP log successful file recovery**— By default, NetWorker does not print each successfully recovered file name in the log messages, because this logging impacts performance and takes up space. To enable the logging of successful recoveries for each file, select this checkbox.
   - **Disable IPv6**—Check this box to disable IPv6 on NDMP backup and recovery.
   - **NDMP array name**—This name is the logical name assigned to the array in NDMP NAS array configurations.
   - **NDMP vendor information**—This attribute contains NDMP client vendor information.
5. Click **OK**.

Configuring the NDMP client manually

EMC recommends that you create NDMP client by using the Client Configuration wizard. If you create the NDMP client manually, then the configuration details for each attribute in the Client Configuration wizard apply when you create the client manually.

Review this information before you configure an NDMP client manually.

- For an NDMP configuration that includes Storage Node resources, configure a Client resource for each storage node that you define for an NDMP backup and clone operation.
- For NDMP three-party storage nodes that use NDMP devices, repeat these steps for each NDMP storage node.
- For NDMP-DSA storage nodes, create the NetWorker Client resources in the same manner as non-NDMP clients. The *EMC NetWorker Administration Guide* provides details on how to create a non-NDMP Client resource.
- NDMP does not support the use of directives including AES encryption. The NetWorker software ignores any value that you define in the **Directives** attribute for an NDMP client.
- When you select **Checkpoint enabled** on the **General** tab, do not modify the **Checkpoint granularity** attribute. NDMP backups do not support checkpoint granularity and the NetWorker software ignores any value that you define for this attribute.

  Note

  VNX does not support checkpoint restart.

- If the NAS supports the NDMP snapshot management extension, then you can browse and mark individual file systems for backup instead of specifying the save sets in the **Save set** attribute. You cannot use the **Save set browse** icon to browse the NDMP file system until you:
  - Select the **NDMP** checkbox, on the **Apps & Modules** tab.
  - Specify the NDMP username and password in the **Remote user and password** fields on the **Apps and Modules** tab.

Note

Snapshot Management Extension is not supported by Celerra, VNX, VNXe, and NetApp C-mode. Only NetApp 7-mode supports Snapshot Management Extension.

Note

Isilon, Celerra, VNX, VNXe, and NetApp C-mode filers do not allow you to browse. Only NetApp 7-mode allows you to browse.

Performing schedule backup and clone operations

Data Protection Policies provide you with the ability to schedule backup and clone operations, to protect NDMP data.

You can use the NDMP protocol to protect data on NAS devices.

For a detailed overview about creating, editing, and deleting groups and policies, refer to the Data Protection Policies chapter in the *EMC NetWorker Administration Guide*. NDMP backup configuration follows the traditional backup strategy.

Overview of data protection policies

Data protection policy is a concept that provides you with the ability to design a data protection solution for the environment at the data level instead of at the host level. With a data protection policy, each client in the environment is a backup object and not simply a host.

Data protection policies enable you to back up and manage data in a variety of environments, as well as to perform system maintenance tasks on the NetWorker server.

A data protection policy solution encompasses the configuration of the following key NetWorker resources:

Policies

Policies provide you with the ability to develop a service-catalogue approach to the configuration of a NetWorker datazone. Policies enable you to manage all data protection tasks and the data protection lifecycle from a central location.

Policies provide an organizational container for the workflows, actions, and groups that support and define the backup, management, and system maintenance actions that you want to perform.

Workflows

Workflows define the start time for a series of actions, the frequency in which the actions run, the order of actions in a sequence, and the protection group to which the workflow applies.

A workflow can be as simple as a single action that applies to a finite list of Client resources, or a complex chain of actions that apply to a dynamically changing list of resources. In a workflow, some actions can be set to occur sequentially, and others can occur concurrently.

You can create multiple workflows in a single policy. However, each workflow can belong to only one policy. When you add multiple workflows to the same policy, you can logically group data protection activities with similar service level provisions together, to provide easier configuration, access, and task execution.

Protection groups

Protection groups define a set of static or dynamic Client resources or save sets to which a workflow applies. There are also dedicated protection groups for backups in a VMware environment or for snapshot backups on a NAS device. Review the following information about protection groups:

- Create one protection group for each workflow. Each group can be assigned to only one workflow.
- You can add the same Client resources and save sets to more than one group at a time.
- You can create the group before you create the workflow, or you can create the group after you create the workflow and then assign the group to the workflow later.

Actions

Actions are the key resources in a workflow for a data protection policy and define a specific task, for example, a backup, clone, or snapshot. NetWorker uses a work list to the define task. A work list is composed of one or several work items. Work items include client resources, virtual machines, save sets, or tags. You can chain multiple actions together to occur sequentially or concurrently in a workflow. All chained actions use the same work list.

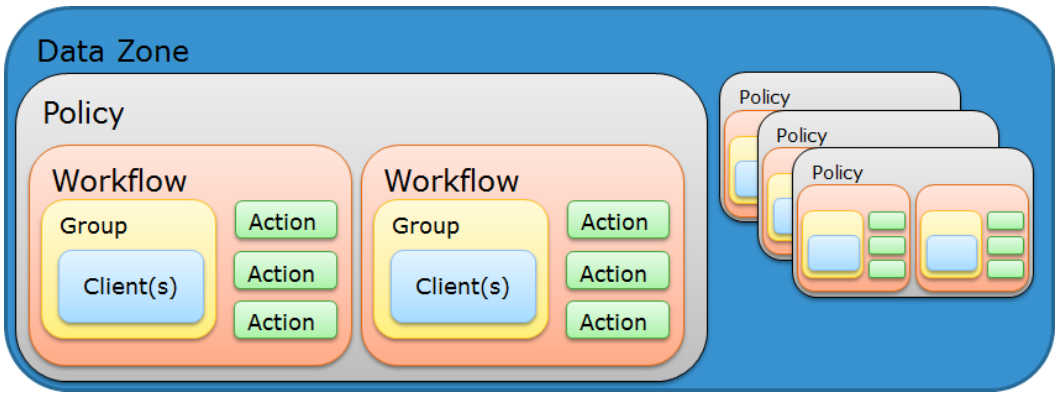
When you configure an action, you define the days on which to perform the action, as well as other settings specific to the action. For example, you can specify a destination

pool, a retention period, and a target storage node for the backup action, which can differ from the subsequent action that clones the data.

You can create multiple actions for a single workflow. However, each action applies to a single workflow and policy.

The following figure provides a high level overview of the components that make up a data protection policy in a datazone.

Figure 27 Data Protection Policy



Default data protection policies

NetWorker provides you with preconfigured data protection polices resources that you can use immediately to protect your environment, modify to suit your environment, or use an example to create new resource configurations. To use these policy resources, you must add clients to the appropriate group resource.

Each protection policy provides an example of the EMC best practices that you should follow when you design your data protection solution:

- Separate file system backups from application database backups, to provide ease of access at recovery time.
- Stagger the start times for file system backup from the application database backups, to prevent disk contention on the target hosts.

The default data protection policy resources mimic the requirements of a service provider, with different policies to that are designed to provide protection based on service level agreements.

Platinum policy

The Platinum policy provides you with an example of a data protection policy for an environment that contains EMC storage arrays or appliances and requires backup data redundancy. The policy contains one workflow with two actions, a snapshot backup action, followed by a clone action.

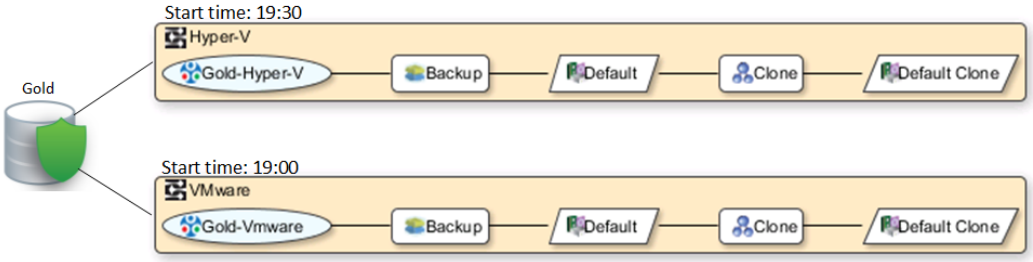
Figure 28 Platinum policy configuration

Gold policy

The Gold policy provides an example of a data protection policy for an environment that contains virtual machines and requires backup data redundancy. The policy contains two

workflows, one to protect Hyper-V hosts and one to protect VMware hosts. Each workflow contains a backup action followed by a clone action.

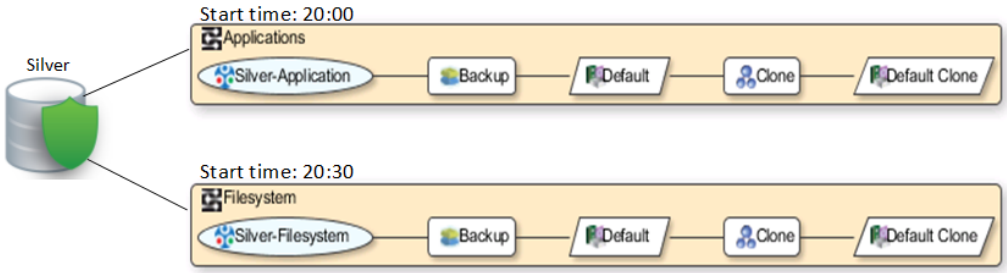
Figure 29 Gold policy configuration



Silver policy

The Silver policy provides an example of a data protection policy for an environment that contains non-virtualized machines and requires backup data redundancy. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action followed by a clone action.

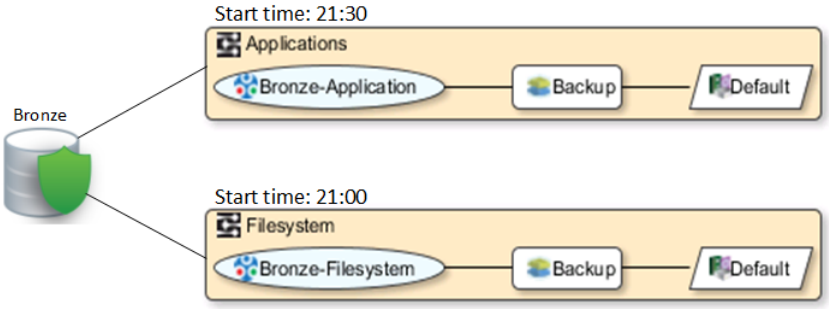
Figure 30 Silver policy configuration



Bronze policy

The Bronze policy provides an example of a data protection policy for an environment that contains non-virtualized machines. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action.

Figure 31 Bronze policy configuration



Road map for configuring a new data protection policy

Procedure

1. Create a policy.

When you create a policy, you specify the name and notification settings for the policy.

2. Within the policy, create a workflow for each data type.

   For example, create one workflow to protect file system data and one workflow to protect application data. When you create a workflow, you specify the name of the workflow, the time to start the workflow, notification settings for the workflow, and the protection group to which the workflow applies.

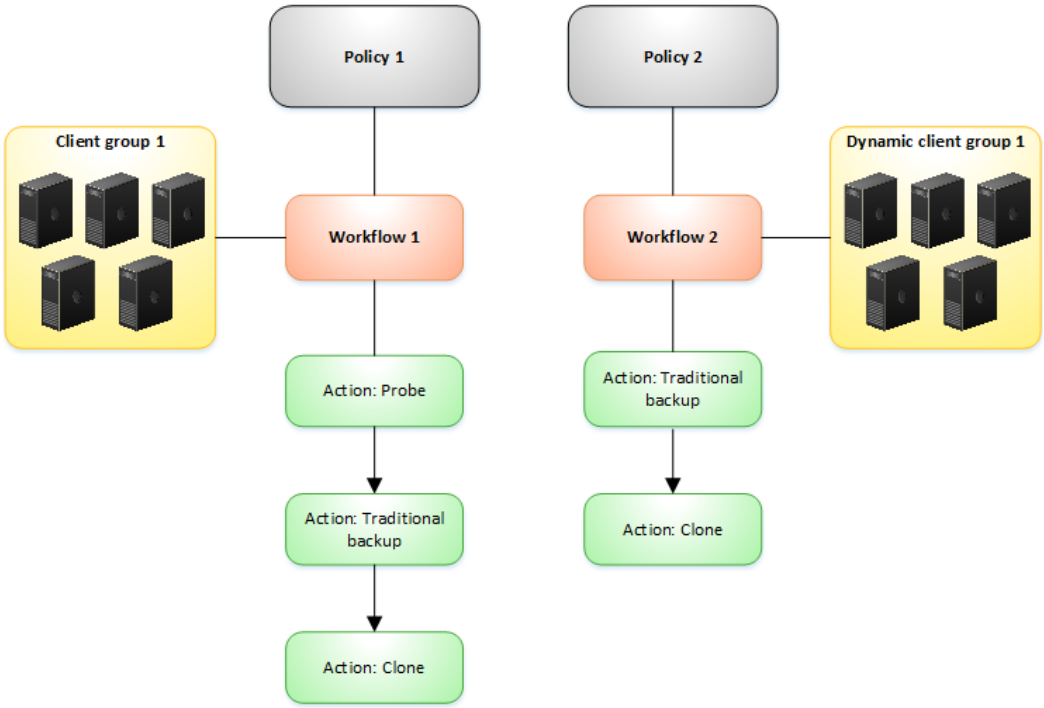
3. Create a protection group.

   The type of group that you create depends on the types of clients and data that you want to protect. The actions that appear for a group depend on the group type.

4. Create one or more actions for the workflow.
5. To define the backup data that you want to protect, configure Client resources, and then assign the client resources to a protection group.

The following figure illustrates a policy with two different workflows. Workflow 1 performs a probe and then a backup of the Client resources in Client group 1, and then clones the save sets from the backups. Workflow 2 performs a backup of the Client resources in Dynamic client group 1, and then clones the save sets from the backups.

Figure 32 Data protection policy example



Strategies for traditional backups

The primary considerations for a traditional backup strategy are the groups of Client resources, the workflows that define the series of actions that are associated with the backup, and the schedule for the backup.

Creating a policy

Procedure

1. On the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Policies**, and then select **New**.

   The **Create Policy** dialog box appears.
3. On the **General** tab, in the **Name** field type a name for the policy.

   The maximum number of characters for the policy name is 128.

   Note

   After you create a policy, the **Name** attribute is read-only.
4. In the **Comment** box, type a description for the policy.
5. From the **Send Notifications** list, select whether to send notifications for the policy:
   - To avoid sending notifications, select **Never**.
   - To send notifications with information about each successful and failed workflow and action after all the actions in the policy complete, select **On Completion**.
   - To send a notification with information about each failed workflow and action after all the actions in the policy complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:
   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```
   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```
   - On Windows, to send a notification email, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:

- **-s *subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
- **-h *mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
- *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. To specify the Restricted Data Zone (RDZ) for the policy, select the **Restricted Data Zones** tab, and then select the RDZ from the list.
8. Click **OK**.

After you finish

Create the workflows and actions for the policy.

Creating a workflow in a new policy

A policy must contain one or more workflows.

Procedure

1. In the left pane of the **Protection** window, expand **Policies**, and then select the policy that you created.
2. In the right pane of the **Protection** window, select **Create a new workflow**.
3. In the **Name** field, type the name of the workflow.

   The maximum number of characters for the name of the group is 64.
4. In the **Comment** box, type a description for the workflow. The maximum number of characters for the **Comment** field is 128.
5. From the **Send Notifications** list, select how to send notifications for the workflow:
   - To use the notification configuration that is defined in the policy resource to determine when to send the notification, select **Set at policy level**.
   - To send notifications with information about each successful and failed workflow and action, after all the actions in the workflow complete, select **On Completion**.
   - To send notifications with information about each failed workflow and action, after all the actions in the workflow complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:

   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```

- On Linux, to send a notification email, type the following command:

  ```
  mail -s subject recipient
  ```

- On Windows, type the following command:

  ```
  smtpmail -s subject -h mailserver recipient1@mailserver
  recipient2@mailserver...
  ```

  where:

  - **-s *subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
  - **-h *mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
  - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. In the **Running** group box, define when and how often the workflow runs.

   a. To ensure that the actions contained in the workflow run when the policy or workflow is started, in the **Enabled** box, leave the option selected. To prevent the actions in the workflow from running when the policy or workflow that contains the action is started, clear this option.

   b. To ensure that the workflow starts at the time that is specified in the **Start time** attribute, on the days that are defined in the action resource, in the **AutoStart Enabled** box, leave the option selected. To prevent the workflow from running at the time that is specified in the **Start time** attribute, clear this option.

   c. To define the time to start the actions in the workflow, in the **Start Time** attribute, use the spin boxes.

      The default value is 9:00 P.M.

   d. To define how frequently to repeat the actions that are defined in the workflow over a 24 hour period, In the **Interval** attribute, use the spin boxes.

      The default value is 24 hours, or once a day. When you select a value that is less than 24 hours, the **Interval End** attribute appears. To define the last time to start a workflow in a defined interval period, use the spin boxes .

   e. To define the duration of time in which NetWorker can manually or automatically restart a failed or canceled workflow, in the **Restart Window** attribute, use the spin boxes.

      If the restart window has elapsed, NetWorker considers the restart as a new run of the workflow. NetWorker calculates the restart window from the start of the last incomplete workflow. The default value is 24 hours.

   For example, when you set the **Start Time** to 7:00 PM, the **Interval** to 1 hour, and the **Interval end time** to 11:00 P.M., then the workflow automatically starts every hour beginning at 7:00 P.M. and the last start time is 11:00 PM.

8. To create the workflow, click **OK**.

After you finish

Create the actions that will occur in the workflow, and then assign a group to the workflow. If a workflow does not contain a group, a policy does not perform any actions.

Protection groups for traditional backups

Create protection groups for traditional backups, which identifies the Client resources to back up.

You can create two types of protection groups for a traditional backup:

- Basic client group—Defines a static list of Client resources to back up.
- Dynamic client group—Specifies a dynamic list of Client resources to back up. A dynamic client group automatically generates a list of Client resources that use client tag which matches the client tag that is specified for the group.

Create multiple groups to perform different types of backups for different Client resources, or to perform backups on different schedules. For example:

- Create one group for backups of clients in the Accounting department, and another group for backups of clients in the Marketing department.
- Create one group for file system backups and one group for backups of Microsoft Exchange data with the NetWorker Module for Microsoft.
- Create one group for a workflow with backups actions that start at 11 p.m., and another group for a workflow with backup actions that start at 2 a.m.

Note

A Client resource can belong to more than one group.

Creating a client group

Basic client groups define a static list of Client resources for a traditional backup, check connectivity, or probe action.

Before you begin

Create the Client resources for the data to include in a protection group.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, leave the default selection of **Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.

7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group.

Creating a dynamic client group

Dynamic client groups prevent you from having to edit group settings when you add Client resources to the NetWorker datazone. You can configure a dynamic group to include all the clients on the NetWorker server or you can configure the dynamic group to perform a query that generates a list of clients that is based on a matching tag value. A tag is a string attribute that you define in a Client resource. When an action starts in a workflow that is a member of a tagged dynamic protection group, the policy engine dynamically generates a list of Client resources that match the tag attribute value.

Use dynamic client groups to specify a dynamic list of Client resources for a traditional backup, probe, check connectivity, or server backup action.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, select **Dynamic Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.
7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group and define one or more tags.

Actions sequences in traditional backup workflows

Workflows enable you to chain together multiple actions and run them sequentially or concurrently.

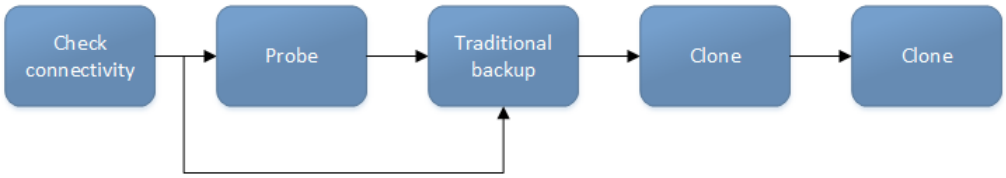
A workflow for a traditional backup can optionally include a probe or check connectivity action before the backup, and a clone action either concurrently with or after the backup.

The following sections provide details on supported actions that can follow the lead action and other actions in a workflow.

All possible workflow actions for a traditional backup

The following figure illustrates the possible workflow actions that are associated with a traditional backup.

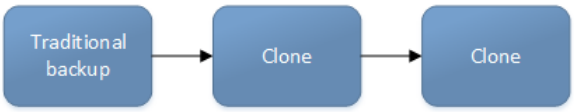
Figure 33 All possible workflow actions for a traditional backup



Workflow path from a traditional backup action

The only action that can follow a traditional backup is a clone action.

Figure 34 Workflow path from a traditional backup action



Creating a check connectivity action

A check connectivity action tests connectivity between clients and the NetWorker server, usually before another action such as a backup occurs.

Before you begin

Create the policy and workflow that contain the action. The check connectivity action should be the first action in the workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Check Connectivity**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.

7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to check connectivity with the client.

   The following table provides details on the icons.

   Table 46 Schedule icons

Icon	Label	Description
	Execute	Check connectivity on this day.
	Skip	Do not check connectivity on this day.

   To check connectivity every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Connectivity Options** page appears.
11. Select the success criteria for the action:
    - To specify that the connectivity check is successful only if successful connectivity is achieved with all clients in the assigned group, select the **Succeed only after all clients succeed** checkbox.
    - To specify that the connectivity check is successful if connectivity is achieved with one or more clients in the assigned group, clear the checkbox.
12. Click **Next**.

    The **Specify the Advanced Options** page appears.
13. Optionally, configure advanced options and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, **Inactivity Timeout**, or the **Send Notification** options appear, the Check Connectivity action does not support these options and ignores the values.

14. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

For NetApp clients that use checkpoint restart, set the value of the Client retries attribute under the Advanced tab to a number greater than 0.

15. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.
    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

16. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
17. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
18. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:
    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

19. Click **Next**.

    The **Action Configuration Summary** page appears.
20. Review the settings that you specified for the action, and then click **Configure**.

After you finish

Optionally, create one of the following actions to automatically occur after the check connectivity action:

- Probe
- Traditional backup

  Note

  This option is not available for NAS snapshot backups.

- Snapshot backup

Creating a probe action

A probe action runs a user-defined script on a NetWorker client before the start of a backup. A user-defined script is any program that passes a return code. If the return code is 0 (zero), then a client backup is required. If the return code is 1, then a client backup is not required.

Before you begin

- Create the Probe resource script on the clients that use the probe. Create a client Probe resource on the NetWorker server, and then associate the client Probe resource with the Client resource on the NetWorker server.
- Create the policy and workflow that contain the action.
- (Optional) Create a check connectivity action to precede the probe action in the workflow. A check connectivity action is the only supported action that can precede a probe action in a workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Probe**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:

- If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
- If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.

8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to probe the client.

   The following table provides details on the icons.

   Table 47 Schedule icons

Icon	Label	Description
	Execute	Perform the probe on this day.
	Skip	Do not perform a probe on this day.

   To perform a probe every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Probe Options** page appears.
11. Choose whether to start the subsequent backup action only after all probes succeed by selecting or clearing the **Start backup only after all probes succeed** checkbox.
    - To start the backup only if all the probes associated with Client resources in the assigned group succeed, select the checkbox.
    - To start the backup if any one of the probes are associated with a Client resource in the assigned group succeed, clear the checkbox.
12. Click **Next**.

    The **Specify the Advanced Options** page appears.
13. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

14. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

Note

The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

15. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

    Note

    The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

16. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

17. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

18. Leave the default selections for the Notification group box. NetWorker does not support notifications for probe actions and ignores the values that are defined in the attributes.
19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.
23. Review the settings that you specified for the action, and then click **Configure**.

Creating a traditional backup action

A traditional backup is a scheduled backup of the save sets defined for the Client resources in the assigned group for the workflow.

Before you begin

- Create the policy and workflow that contain the action.
- (Optional) Create actions to precede the backup action in the workflow. Supported actions that can precede a backup include:
  - Probe
  - Check connectivity

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

The **Specify the Action Information** page appears.

2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.

3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Backup**.
6. From the secondary action list, select the backup type, for example, **Traditional**.
7. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
8. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
9. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
10. Click the icon on each day to specify the backup level to perform.

    The following table provides details about the backup level that each icon represents.

Table 48 Schedule icons

Icon	Label	Description
	Full	Perform a full backup on this day. Full backups include all files, regardless of whether the files changed.
	Incr	Perform an incremental backup on this day. Incremental backups include files that have changed since the last backup of any type (full or incremental).
	Cumulative Incr	Perform a cumulative incremental backup. Cumulative incremental backups include files that have changed since the last full backup.
	Logs Only	Perform a backup of only database transaction logs.
	Synthetic Full	Perform a synthetic backup on this day. A synthetic full backup includes all data that changed since the last full backup and subsequent incremental backups to create a synthetic full backup.

Table 48 Schedule icons (continued)

Icon	Label	Description
	Note Not supported for NDMP.	
	Skip	Do not perform a backup on this day.

To perform the same type of backup on each day, select the backup type from the list and click **Make All**.

NetWorker does not support the use of synthetic full backup levels for NDMP data.

EMC Celerra, Isilon, VNX, and NetApp filers with NDMP version 4 or later support token-based backups (TBB) to perform NDMP full and incremental backups. NetWorker supports the same number of incremental levels that the NAS vendor supports. EMC Celerra, Isilon, and NetApp documentation provide the maximum number of incremental levels that the TBB incremental backup can support.

When you configure TBB after you update the NetWorker server from 7.6 SP1 or earlier, the first incremental backup does not occur until after one complete full backup.

Filers that do not support TBB, do not support incremental backups. If you select the level Incr, the NetWorker server performs a full backup.

Verify the NAS storage vendor supports NDMP incremental backups before you use this feature.

11. Click **Next**.

    The **Specify the Backup Options** page appears.

12. From the **Destination Storage Node** box, select the storage node with the devices on which to store the backup data.
13. From the **Destination Pool** box, select the media pool in which to store the backup data.
14. From the **Retention** boxes, specify the amount of time to retain the backup data.

    After the retention period expires, the save set is removed from the client file index and marked as recyclable in the media database during an expiration server maintenance task.

    When you define the retention policy an NDMP client, consider the amount of disk space that is required for the client file index. NDMP clients with several thousands of small files have significantly larger client file indexes on the NetWorker server than a non-NDMP client. A long retention policy for an NDMP client increases disk space requirements on the file system that contains the client file indexes.

15. From the **Client Override Behavior** box, specify how NetWorker uses certain client configuration attributes that perform the same function as attributes in the Action resource.

    - **Client Can Override**—The values in the Client resource for **Schedule**, **Pool**, **Retention policy**, and the **Storage Node** attributes will take precedence over the values that are defined in the equivalent Action resource attributes.

- **Client Can Not Override** —The values in the Action resource for the **Schedule**, **Destination Pool**, **Destination Storage Node**, and the **Retention** attributes take precedence over the values that are defined in the equivalent Client resource attributes.
- **Legacy Backup Rules**—This value only appears in actions that are created by the migration process. The updating process sets the **Client Override Behavior** for the migrated backup actions to **Legacy Backup Rules**.

16. Click **Next**.

    The **Specify the Advanced Options** page appears.

17. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

18. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

    Note

    The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

19. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

    Note

    The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

20. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

21. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.
    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

22. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
23. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
24. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:
    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

25. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.

- Select **On Completion** to send a notification on completion of the action.
- Select **On Failure** to send a notification only if the action fails to complete.

26. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      `nsrlog` **`-f policy_notifications.log`**

    - On Linux, to send a notification email, type the following command:

      `mail` **`-s`** ***`subject recipient`***

    - On Window, to send a notification email, type the following command:

      `smtpmail` **`-s`** ***`subject`*** **`-h`** ***`mailserver recipient1@mailserver recipient2@mailserver...`***

      where:

      - **`-s`** ***`subject`***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
      - **`-h`** ***`mailserver`***—Specifies the hostname of the mail server to use to relay the SMTP email message.
      - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

27. Click **Next**.

    The **Action Configuration Summary** page appears.

28. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets after the backup. A clone action is the only supported action after a backup action in a workflow.

Cloning NDMP save sets

You can clone Direct-NDMP and NDMP-DSA save sets by using the same methods used to clone non-NDMP save sets.

Before you clone NDMP save sets, review these requirements:

- To clone Direct-NDMP or Three-party backup data:

- The source NAS must run NDMP version 3 or later.
- The destination NAS can run any version of NDMP, but you cannot clone a volume cloned with NDMP earlier than version 3 to another volume.
- You cannot clone NDMP save sets to a non-NDMP device.
- You can clone NDMP tapes from one NDMP host to another NDMP host of the same type. For example, you can clone tapes from a NetApp filer with an attached library to another NetApp filer or to the same filer.

- You require two NDMP devices to clone the NDMP save sets, one device to perform the read operation and one device to perform the write operation.
- You must clone NDMP-DSA backups to non-NDMP devices. You can however, clone NDMP-DSA save from one type of tape device to another. For example you can clone save sets on a DLT device to an AIT device.
- Use the nsrclone program to clone NDMP save sets from a command prompt. The *EMC NetWorker Command Reference Guide* or the UNIX man pages provide more information on nsrclone usage.

Creating a clone action

A clone action creates a copy of one or more save sets. Cloning allows for secure offsite storage, the transfer of data from one location to another, and the verification of backups.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Clone**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.

8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to perform cloning.

   The following table provides details on the icons.

   Table 49 Schedule icons

Icon	Label	Description
	Execute	Perform cloning on this day.
	Skip	Do not perform cloning on this day.

   To perform cloning every day, select **Execute** from the list and click **Make All**.

10. Click **Next**.

    The **Specify the Clone Options** page appears.

11. In the **Data Movement** group box, define the volumes and devices to which NetWorker sends the clone data.
    a. From the **Destination Storage Node** list, select the storage node with the devices on which to store the cloned save sets.
    b. In the **Delete source save sets after clone completes**, select the option to instruct NetWorker to remove the source save set information from the client file index, and to mark the save set as recyclable in the media database during a Server expiration maintenance action. Clear this option to allow the source save sets to expire based on the defined retention time.
    c. From the **Destination Pool** list, select the target media pool for the cloned save sets.
    d. From the **Retention** list, specify the amount of time to retain the cloned save sets.

       After the retention period expires, the save sets are marked as recyclable during an expiration server maintenance task.

12. In the **Filters** group box, define the criteria that NetWorker uses to create the list of eligible save sets to clone. The eligible save sets must match the requirements that are defined in each filter. NetWorker provides the following filter options:
    a. Time filter—Use the **Time** section to define the time range in which NetWorker should inspect, when searching for eligible save sets to clone in the media database. Use the spin boxes to specify the start of the time range and the end of the time range. The **Time** filter list includes three options, which define how NetWorker determines save set eligibility, based on the time criteria:
       - **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
       - **Accept**—The clone save set list includes save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.

- **Reject**—The clone save set list does not include save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.

b. Save Set filter—Use the **Save Set** section to instruct NetWorker to include or exclude ProtectPoint and Snapshot save sets, when searching for eligible save sets to clone in the media database. The **Save Set** filter list includes three options, which define how NetWorker determines save set eligibility, based on the save set criteria:

- **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible ProtectPoint or Snapshot save sets, when you also enable the ProtectPoint or Snapshot checkboxes.
- **Reject**—The clone save set list does not include eligible ProtectPoint and Snapshot save sets when you also enable the ProtectPoint and Snapshot checkboxes.

c. Clients filter—Use the **Client** section to define a list of clients to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Client** list includes three options, which define how NetWorker determines save set eligibility, based on the client criteria:

- **Do Not Filter**—NetWorker inspects save sets that are associated with the clients in the media database, to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible save sets for the selected clients.
- **Reject**—The clone save set list does not include eligible save sets for the selected clients.

d. Levels filter—Use the **Levels** section to define a list of backup levels to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Levels** filter list includes three options, which define how NetWorker determines save set eligibility, based on the level criteria:

- **Do Not Filter**—NetWorker inspects save sets regardless of level in the media database, to create a clone save set list that meets all the filter criteria.
- **Accept**—The clone save set list includes eligible save sets with the selected backup levels.
- **Reject**—The clone save set list does not include eligible save sets with the selected backup levels.

13. Click **Next**.

    The **Specify the Advanced Options** page appears.

14. Configure advanced options, including notifications and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, or the **Inactivity Timeout** options appear, the clone action does not support these options and ignores the values.

15. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

Note

The **Parallelism** value should not exceed 25.

For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

16. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.
    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

17. From the **Send Notifications** list box, select whether to send notifications for the action:
    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.
18. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

- To log notifications to a file named `policy_notifications.log`, type the following command:

  ```
  nsrlog -f policy_notifications.log
  ```

- On Linux, to send a notification email, type the following command:

  ```
  mail -s subject recipient
  ```

- On Window, to send a notification email, type the following command:

  ```
  smtpmail -s subject -h mailserver recipient1@mailserver
  recipient2@mailserver...
  ```

  where:

  - **-s *subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
  - **-h *mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
  - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.

23. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets again after this clone action. Another clone action is the only supported action after a clone action in a workflow.

Visual representation of traditional backup workflows

Figure 35 Traditional backup workflow

When you create actions for a workflow, a map provides a visual representation of the actions in the second right pane of the **Protection** window of the **Administration** interface.

The oval icon at the beginning of the visual representation specifies the group to which the workflow applies, the rounded rectangle icons identify actions, and the parallelogram icons identify the destination pool for the action.

You can work directly in the visual representation of a workflow to perform the following tasks:

- Adjust the display of the visual representation by right-clicking and selecting one of the following options:
  - **Zoom In**—Use to increase the size of the visual representation.
  - **Zoom Out**—Use to decrease the size of the visual representation.
  - **Zoom Area**—Use to limit the display to a single section of the visual representation.
  - **Fit Content**—Use to fit the visual representation to the window area.
  - **Reset**—Use to reset the visual representation to the default settings.
  - **Overview**—To view a separate dialog box with a high-level view of the visual representation and a legend of the icons.
- View and edit the properties for the group, action, or destination pool by right-clicking the icon for the item and selecting **Properties**.
- Create a group, action, or destination pool by right-clicking the icon for the item and selecting **New**.

Performing manual NDMP backups

After you configure the NetWorker server for NDMP backup data operations, you can perform manual NDMP backups.

On Windows, you can manually back up NDMP data by using the NetWorker User program. The method to backup NDMP data is the same as a non-NDMP local backup. You cannot perform a three-party backup with the NetWorker User program.

On Windows and UNIX, you can perform a manual backup from a command prompt by using the `nsrndmp_save` command. Performing an NDMP backup from the command line provides more information.

Before performing a manual backup by using the `nsrndmp_save` command or the NetWorker User program, review these requirements:

- You can only perform manual Direct-NDMP backups from a NetWorker server.
- You can start a manual NDMP-DSA backup from a NetWorker server, storage node, or client. When you do not start the NDMP-DSA backup from the NetWorker server, the `servers` file on the NetWorker server and storage node, must contain the hostname of the host that initiates the backup.
- Before you perform a manual backup, you must configure the NDMP client on the NetWorker server. Manual backups use client configuration information for example,

the variables that are defined in the **Application Information** attribute of an NDMP client.

- Direct-NDMP and three-party NDMP backups support manual DAR backups when the NDMP client contains the *DIRECT=Y* and *HIST=Y* environment variables in the **Application Information** attribute for the NDMP client.

  NOTICE

  To use DAR, the NAS filer must use NDMP version 4. The *EMC NetWorker Online Software Compatibility Guide* describes how to determine if a particular NDMP vendor supports DAR.

Performing an NDMP backup from the command line

Use the `nsrndmp_save` command to perform a manual command line NDMP backup.

The `nsrndmp_save` command does not back up the bootstrap. Without the bootstrap, you cannot perform a disaster recovery of the NetWorker server. To back up the bootstrap, run the `nsrpolicy` ***-G nsrpolicy policy_name start*** command from the NetWorker server. The `nsrpolicy` command uses the attribute values specified for the policy. For example, the pool and schedule values.

To perform an NDMP backup from the command prompt, use the following syntax:

`nsrndmp_save -T` ***backup_type*** `-s` ***NetWorker_servername*** `-c` ***clientname*** `-l` ***backup_level*** `-t` ***date_time*** `-g` ***nsrpolicy path***

where:

- *backup_type* is a supported backup type for the NAS filer:
  NetApp supports the `dump` and `smtape` backup types.
- *backup_level* is a full for a full backup, incr for an incremental backup. Each NAS supports full backups.

  Note

  EMC Celerra, Isilon, and NetApp filers only support full and incremental level backups.

- *date_time* is the date and time of the last backup, which is enclosed in double quotes. Specify this value for incr level backups. When you do not specify the date and time, the backup is a native NDMP level-based backup.

  NOTICE

  During a NetWorker scheduled policy backup, the NetWorker software supplies the date and the time information, and incremental and level backups work as expected.

  Use one of these methods to determine the date and time of the last NDMP backup:

  - Review the `daemon.raw` file on the NetWorker server or the savegroup completion report for a line similar to the following:

    ```
    42920:nsrndmp_save: browsable savetime=1296694621
    ```

    Use the value after `savetime=` with the `-t` option.
  - Specify the date and time of the last backup reported by the `mminfo` command for the NDMP save set.

Note

By default the backup operation uses IPv6 addressing, if enabled. NetApp always uses IPV6 if it is enabled, regardless if IPV6 is configured on the NetApp system or not. If the NetApp system is not configured with IPV6, NDMP backup and recovery displays the following error message:

```
42597:nsrndmp_save: mover listen: communication failure
```

```
42801:nsrndmp_save: Failed to send the MOVER_LISTEN message to
the NDMP tape server.
```

You can force the NDMP backup and recovery to ignore IPv6 and instead use IPv4 in one of two ways:

1. Add the `-f` option to the `nsrndmp_save` or the `nsrndmp_recover` commands as required.
2. Select the **Disable IPv6** checkbox on the Apps & Modules tab in the **Client Properties** window.

Example of an NDMP backup

To perform an incremental backup of a NetApp client that is named mynetapp, perform the following steps:

1. Determine the time of the last full backup:

   ```
   mminfo -v -c mynetapp
   ```

client	date	time	size	ssid	fl	lvl	name
mynetapp	08/16/15	15:23:58	1853MB	3864812701	cbNs	full	/.../set1
mynetapp	08/17/15	15:39:58	815MB	3848036430	cbNs	incr	/.../set2

2. Specify the last backup time in `nsrndmp_save` command:

   ```
   nsrndmp_save -T dump -s my_nwserver -c mynetapp -l incr -t
   "02/16/11 15:23:58" -g mygroup path
   ```

For NDMP-DSA backups, the NetWorker software uses the Storage Node attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they override the **Storage Node** attribute value. The *EMC NetWorker Command Reference Guide* and the `nsrndmp_save` man page on UNIX provide more information.

Troubleshooting NDMP configuration and backup failures for NetApp

This section provides a list of the possible causes and the resolutions for NDMP backup failures.

Unable to connect to NDMP host *hostname*

This message appears when the NetWorker server cannot create or modify an NDMP client.

To resolve this issue ensure that the environment meets the following requirements:

- Username and password specified for the client is correct and has sufficient permissions to perform NDMP operations.
- NDMP service is running on the filer.

NetWorker features not supported on NetApp NDMP v3 and earlier

Features such as Checkpoint restart require NDMP v4.

To verify the NDMP version, perform the following steps.

1. Log in to the NetApp host as root or as a Windows Administrator.
2. Display the NDMP version:

```
ndmpd version
```

To change the NDMP version:

1. Log in to the NetApp host as root or as Windows Administrator.
2. Stop the **NDMP** process:

```
ndmpd off
```

3. Change the **NDMP** version:

```
ndmpd version 4
```

4. Restart the **NDMP** process:

```
ndmpd on
```

Cannot perform NDMP backup after the NetWorker server licenses expire

If a NetWorker sever running in evaluation mode expires before you authorize the server, NDMP devices remain disabled after the addition of the required licenses and authorization of the NetWorker server.

To re-enable NDMP devices, perform the following steps.

1. Use NMC to connect to the NetWorker server and click the **Devices** button.
2. In the **Devices** windows, right-click the NDMP device and select **Properties**.
3. Click the **Configuration** tab and set the **Target Sessions** attribute to **1**.
4. Click the **General** tab and in the **Enabled** section, select **Yes**.
5. Click **Ok**.

Failed to store index entries

This error message occurs in the `daemon.raw` file when an index backups fails due to an insufficient amount of swap space.

To resolve this issue, increase the amount of swap space available to the NetWorker server.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

IO_WritePage write failed - No space left on device (28): No space left on device

This error message appears in the `daemon.raw` file when the index backup fails. There is insufficient temporary space to store the index entries before the NetWorker software commits the information into the client file index.

To resolve this issue, specify a new the temp directory with sufficient disk space in one of the following ways:

- Define the *NSR_NDMP_TMP_DIR* environment variable in the Application Information attribute of the client.
- Define the *NSR_NDMP_TMP_DIR* as an operating system environment variable on the NetWorker server.

Memory and space requirements for NDMP FH updates on page 23 describes how to determine the amount of disk space the NetWorker software requires to temporarily store client files index entries.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Error reading the FH entries from save through stdin

This error message appears in the `daemon.raw` file of the NetWorker server when there is a communication error between the `nsrndmp_save` and `nsrndmp_2fh` processes.

Resolve any communication or connection issues, then retry the backup.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Cannot find file history info for filename...You may still be able to recover this file with a saveset recovery

This error message appears in the `daemon.raw` file of the NetWorker server when FH information is missing or corrupted for the file specified in the error message. For example, NetWorker cannot update the client file index(CFI) with FH information when a backup process interruption occurs during the failover of a clustered NetWorker environment.

You cannot perform an NMDP file-by-file recover or a save set recover when the CFI does not contain the associated FH information.

To recover this file, perform a save set recover from the command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides for further information.

NOTICE

The NetWorker server does not delete the FH files stored in the `tmp` directory when the CFI updates fail.

nsrndmp_save: data connect: failed to establish connection

This error message appears in the `daemon.raw` file of the NetWorker server for several reasons:

- Network connectivity or name resolution issues exist between the NetWorker server and the NDMP client.
- You specified an incorrect NDMP username or password specified for the NDMP client.
- The NDMP service is not started on the NAS filer.
- The NetWorker server cannot communicate with the NAS filer over port 10000.
- A free port in the NetWorker server's default port range (7937-9936) is not available during an NDMP-DSA backup.
  The *EMC NetWorker Security Configuration Guide* provides more information about NDMP port requirements and configuration.
- A misconfigured loop router. For an EMC Celerra filer, the server route command utility configures the loop router. For NetApp, the route utility configures loop back router. The value of this setup is network-specific and depends on the number of switches and hubs between the NAS filer, NetWorker server, and NetWorker storage node.
- On the host where DSA is running, if the hostname is present in the hosts file, the `nsrdsa_save` process uses this name during backup. The DSA host passes the loopback entry to the NDMP data server and the connection fails. To resolve this issue, remove the hostname from the localhost list.

Knowledge base articles on the EMC Online Support Site provides detailed troubleshooting information for this error message and other failed to establish connection failures that you might encounter during an NDMP backup.

nsrndmp_save: get extension list: communication failure

This message appears during a NDMP local backup when NetWorker cannot determine the filer name.

To resolve this issue, perform the following steps.

1. From a command prompt on the NetWorker server, type:

   nsrndmpsup -c *NDMP_hostname* -o *output_filename*

   For example:

   nsrndmpsup -c myfiler.mnd.com -o nsrndmpsup.txt

2. Edit the output file that the `nsrndmpsup` command generates and search for the string **Vendor Name**. Make note of the reported Vendor Name.
   For example:

   `Vendor Name = BlueArc Corp`

3. Change to the `/nsr/debug` directory on UNIX or the `NetWorker_installation_dir\nsr\debug` directory on Windows.
4. Create new empty file and name it with the following format:

   ndmpgetextlist_disable_*VENDOR_NAME*

   where you replace *VENDOR_NAME* with the vendor name of the filer reported in the nsrndmpsup output file.

   For example, to create this file for a BlueArc filer on UNIX, type:

```
touch "ndmpgetextlist_disable_BlucArc Corp"
```

Monitoring NetWorker server activities in the Administration window

The **Monitoring** window in the NetWorker **Administration** application enables you to monitor the activities of an individual NetWorker server.

The **Monitoring** window provides the following types of activity and status information:

- Data protection policies, workflows, and individual actions.
- Cloning, recovering, synthetic full backups, and browsing of client file indexes.
- Operations that are related to devices and jukeboxes.
- Alerts and log messages.

You can also perform some management operations from the **Monitoring** window, for example, starting, stopping, or restarting a data protection policy.

Procedure

1. From the **NMC Console** window, click **Enterprise**.
2. In the **Enterprise** view, right-click the NetWorker server and select **Launch Application**.

   The **Administration** window appears.
3. Click **Monitoring** to view the **Monitoring** window.

About the Monitoring window

On the **Administration** window taskbar, select **Monitoring** to view the details of current NetWorker server activities and status, such as:

- Policies and actions.
- Cloning, recovering, synthetic backups, checkpoint restart backups, and browsing of client file indexes.
- Alerts and log messages, and operations that are related to devices and jukeboxes.

While the **Monitoring** window is used primarily to monitor NetWorker server activities, it can also be used to perform certain operations. These operations include starting, stopping, or restarting a workflow.

The **Monitoring** window includes a docking panel that displays specific types of information. Select the types of information you want to view from the docking panel.

A portion of the **Monitoring** window, which is known as the task monitoring area, is always visible across all windows. A splitter separates the task monitoring area from the rest of the window. You can click and move the splitter to resize the task monitoring area. The arrow icon in the upper right corner of the **Monitoring** window allows you to select which tasks you want to appear in this view.

Smaller windows appear within the **Monitoring** window for each window. Each smaller window, once undocked, is a floating window and can be moved around the page to customize the view. You can select multiple types from the panel to create multiple floating windows that can be viewed simultaneously. The following table describes the various types of information available in the docking panel, and the details each one provides.

Table 50 Monitoring window panel

Window	Information provided
Policies/Actions	The **Policies** tab provides you with status information about all configure policies and the associated workflows and actions. The **Actions** tab provides you with status information for all actions. Policies/Actions pane on page 81 provides more information.
Sessions	Allows you to customize whether to display all session types, or only certain session types. The information that is provided depends on which session type you select. For example, if you select **Save Sessions**, the window lists clients, save sets, groups, backup level, backup start time, duration of the backup, devices, rate, and size. Sessions pane on page 84 provides more information.
Alerts	Lists the priority, category, time, and message of any alerts. Alerts pane on page 85 provides more information.
Devices	Lists devices, device status, storage nodes, libraries, volumes, pools, and related messages. Devices pane on page 86 provides more information.
Operations	Lists the status of all library and silo operations, including `nsrjb` operations that are run from the command prompt. Also lists user input, libraries, origin, operation data, operation start time, duration of the operation, progress messages, and error messages. When displaying Show Details from the **Operations** window, the length of time that the window is displayed depends on the value that is typed in the **Operation Lifespan** attribute on the **Timers** tab of the **Properties** dialog box for the corresponding library. To access library properties, click **Devices** in the taskbar. By default, this pane is hidden.
Log	Lists messages that are generated by the NetWorker server, including the priority of each message, the time the message was generated, the source of the message, and the category. Log pane on page 89 provides more information.

Customizing the Monitoring window

This section describes how to customize the **Monitoring** window in the **Administration** interface.

Customizing tables

You can customize the organization and display of tabular information in the **Monitoring** window.

Sorting tables

You can change the display of tabular information that appears in the window. You can sort Table grids by column heading, and then by alphabetic or numeric order within those columns.

1. Drag-and-drop the column heading to its new position.
2. Click the column heading to sort the items into alphabetic and numeric order. An arrow appears in the column heading to indicate the sort order.

Sorting selected rows in a table

Selected rows are sorted to the top of the table. This is particularly useful when you select **Highlight All** from the Find panel to select all rows matching the Find criteria and then moving all selected rows to the top of the table to view the results.

1. From the **Edit** menu, select **Find**, or press **Ctl + F** to view the **Find** panel.
2. To select the rows, click each row or use the Find criteria.
3. Select **Sort Selected**.

Sorting multiple columns in a table

You can select the column that you want to use as the tertiary sort key, the secondary sort key, and the primary sort key.

1. Click the column that you want to use as the last sort key.
2. Click the column that you want to use as the next-to-last sort key, and so on, until you select the primary column.

Displaying columns in a table

You can select which columns to display in a table.

1. From the **View** menu, select **Choose Table Columns**.
2. Click a column name to select or clear the column and then click **OK**. You can also select the columns to display by right-clicking a table header and selecting **Add Column** from the drop-down.

Displaying panes

You can choose to show or hide panes in the **Monitoring** window.

Perform the following steps to hide or show a pane in the **Monitoring** window.

Procedure

1. From the **View** menu, select **Show**. A check mark appears beside the panes that appear in the **Monitoring** window.
2. To hide a pane, select a marked pane.

   A check mark does not appear beside the pane.
3. To show a pane, select an unmarked pane.

   A check mark appears beside the pane.

Policies/Actions pane

The **Policies/Actions** pane provides you with the ability to review status information about policies and actions.

This pane has two tabs:

- Policies—Provides a navigation tree that displays all configured policies on the NetWorker server. Expand each policy to display the workflows that are associated with each policy. Expand each workflow to display each action that is contained in the workflow.
- Actions—Provides a list of all Action resources.

Policies pane

The **Monitoring** window in the **NetWorker Administration** window enables you to monitor activities for specific policies, workflows, and actions.

The **Policies/Actions** pane at the top of the **Monitoring** window lists the policies on the NetWorker server by default. Click the + (plus) sign next to a policy in the list to view the workflows in the policy, and the + (plus) sign next to a workflow to view the actions for a workflow.

The **Policies** pane provides the following information for each item (where applicable):

- Overall status

  The following table provides details on the status icons that may appear in the **Policies** pane.

  Table 51 Policy status icons

Icon	Status
	Never run
	Running
	Succeeded
	Failed
	Probing
	Interrupted
	Queued
	Cloning
	Consolidating (NetWorker server 8.2.x and lower only)

- Most recent start time.
- Duration of the most recent run.
- Next scheduled runtime.
- Name of the assigned save set.
- Device on which the save set is stored.
- Backup level.
- Data transfer rate.
- Size of the save set.
- Messages that resulted from an action.

Right-click an action in the **Policies** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

When you sort the items on the **Policies/Actions** pane by using the **Status** column, NetWorker sorts the items in alphabetical order that is based on the label of the icon.

Consider the following when a policy/action is in a probing state:

- A message is sent when the group starts and finishes the probe operation.
- The results of the probe operation (run backup/do not run backup) are also logged.
- Probes do not affect the final status of the group, and the group status does not indicate the results of the probe.
- If probing indicates that a backup should not run, then the group status reverts to its state before the group running.
- Check the results of the probe in the **Log** window to ensure that the probe indicates that the backup can be taken.

Actions pane

To view a list of all actions, click the **Actions** tab at the bottom of the **Policies** pane. The **Policies** pane becomes the **Actions** pane.

The **Actions** pane provides the following information for each action:

- Overall status

  Note

  The **Actions** pane displays the same status icons as the **Policies** pane.

- Name
- Assigned policy
- Assigned workflow
- Type
- Date and time of the most recent run
- Duration of the most recent run
- Percent complete, for actions that are in progress
- Next scheduled runtime

Right-click an action in the **Actions** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

Workflow operations

This section describes how to use the **Monitoring** window to start, stop, and restart workflows.

Starting, stopping, and restarting data protection policies

The workflows in a data protection policy can run automatically, based on a schedule. You can also manually start, stop, and restart specific workflows, in the **Monitoring** window of the **NetWorker Administration** window.

Note

You cannot stop, restart, or start individual actions.

You can restart any failed or canceled workflow. However, the restart must happen within the restart window that you specified for the workflow.

You can also start specific policies and workflows in the **Protection** window by right-clicking the policy or workflow, and selecting **Start**.

Procedure

1. Select the workflow, or action in the **Monitoring** window.
2. Right-click and select **Start**, **Stop**, or **Restart**.

   A confirmation message appears.
3. Click **Yes**.

Viewing workflow backup details

Perform the following steps to view backup details for workflows.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Policies** in the docking panel, and expand the Policy that you want to monitor.
3. Right-click the workflow, and then select **Show Details**. The **Workflow Summary** window appears.
4. In the **Workflow runs** pane of the **Workflow Summary** window, select the workflow.
5. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
6. Click **OK** to close the **Workflow Summary** window.

Viewing action backup details

Perform the following steps to view backup details for actions.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Actions** in the docking panel.
3. In the **Actions** pane, right-click the action, and then select **Show Details**. The details window for the action appears.
4. Review the information in the **Actions Messages** pane. To display detailed information from the action log file, click **Show Action Logs**, and then select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
5. In one of the Actions detail panes, for example, the **Completed successfully** pane, select the action that you want to review.
6. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.

- Print—To print the log.
- Save—To save the log to a local file.
- OK—To close the **Show Messages** window.

7. Click **OK** to close the **Details** window.

Sessions window

Use the **Sessions** window to view the sessions that are running on a NetWorker server. You can change the view of this window to display these sessions:

The **Sessions** pane below the **Policies/Actions** pane provides details on individual save, recover, clone, and synthetic full sessions by client.

Click the tabs at the bottom of the **Sessions** pane to view all sessions or to limit the list of sessions by the session type. Session types include:

- Save
- Recover
- Clone
- Browse
- Synthetic Full/Rehydrated Sessions
- All

To change the displayed session types go to **View** › **Show**, and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the **Monitoring** window, even if the session was started by running the `savegrp` command.

To stop a session, right-click the session in the pane, and select **Stop** from the drop-down.

Changing displayed session types

The column headings displayed on this window will differ depending on the type of sessions you chose to display.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Sessions** in the docking panel.
3. Go to **View** › **Show** and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

Stopping a session

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the Monitoring window, even if the session was started by running `savegrp`.

To stop a session, right-click the session in the window and select Stop from the drop-down.

The following table provides a list of actions that can be stopped from NMC.

Table 52 Sessions that can be stopped from NMC

Session type	Stop from NMC?
Save by Savegroup	Yes
Synthetic Full by Savegroup	Yes
Clone by Savegroup	Yes
Schedule Clone	Yes
Manual Save	No
Manual Clone via NMC	No
Manual Clone via CLI	No
Winworker and CLI Recovery	No
Recovery started from Recover wizard	Yes
VMware Backup Appliance Save and Recover	No

NOTICE

Stopping a session from NMC does not affect any other group operations running.

Alerts pane

The **Alerts** pane displays alerts that are generated by a particular NetWorker server or Data Domain system that has devices that are configured on the NetWorker server. The **Alerts** pane includes priority, category, time, and message information.

An icon represents the priority of the alert. The following table lists and describes each icon.

Table 53 Alerts window icons

Icon	Label	Description
	Alert	Error condition detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.

Table 53 Alerts window icons (continued)

Icon	Label	Description
	Warning	A non-fatal error has occurred.

When items on the **Alerts** pane are sorted by the **Priority** column, they are sorted in alphabetical order based on the label of the icon.

Removing alerts

Remove individual alert messages from the **Events** tables by removing them from the **Events** table. To delete a message in the **Events** table, right-click the message, and select **Dismiss**.

Note

The alert message remains in the **Log** window in the NetWorker **Administration** program.

Devices pane

The **Devices** pane allows you to monitor the status of all devices, including NDMP devices. If the NetWorker server uses shared and logical devices, the window is adjusted dynamically to present a set of columns appropriate for the current configuration.

The **Devices** pane provides the following information:

- Status of the operation.
- Name of the device.
- Name of the storage node that contains the device.
- For tape devices, the name of the library that contains the device.
- Name of the volume in the device.
- Name of the pool that is associated with the volume.
- Last message generated for the device.
- Whether the operation requires user input.

  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape.
  Entering user input on page 89 provides instructions on how to deal with a user input notification.

If the current server configuration includes a shared device, a **Shared Device Name** column appears on the **Devices** pane. The name of the shared device appears in the **Shared Device Name** column. If other devices for that configuration are not shared devices, then the **Shared Device Name** column is blank for those devices. Since only a single device per hardware ID can be active at any particular moment, the information for inactive shared devices is filtered out, so only one device per hardware ID is presented on the window at any time.

An icon represents the device status. The following table lists and describes each icon.

Table 54 Devices status icons

Icon	Label	Description
	Library device active	The library device is active.
	Library device disabled	The library device is disabled.
	Library device idle	The library device is idle.
	Stand-alone device active	The stand-alone device is active.
	Stand-alone device disabled	The stand-alone device is disabled.
	Stand-alone device idle	The stand-alone device is idle.

When you sort items in the **Devices** pane by the **Status** column, NetWorker sorts the devices in alphabetical order based on the label name of the icon.

Operations window

The **Operations** window displays information about device operations. It provides the following information:

- Status of the operation.
- Name of the library.
- Whether the operation requires user input.
  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape. Entering user input on page 89 provides instructions on how to deal with a user input notification.
- The origin, or source, of the operation.
  For example, the interface, nsrjb or the NetWorker server.
- Time the operation started.
- Type of operation.
- Duration of the operation.
- Status messages from the operation.
- Any error messages.

  NOTICE

  Only the last error message of the operation appears in the **Error Messages** column. Move the mouse pointer over the cell containing the last error message to display the entire list of error messages.

The operation status is represented by an icon. The following table lists and describes each of the icons.

Table 55 Operations window icons

Icon	Label	Description
	Failed	The operation failed.
	Queued	The operation is waiting in the queue to run.
	Retry	The operation failed, but may work if you try again.
	Running	The operation is running.
	Successful	The operation completed successfully.
	User Input	The operation requires user input.

When items on the **Operations** window are sorted by the Status column, they are sorted in alphabetical order based on the label of the icon.

Viewing operation details

The **Operation Details** dialog box opens, providing information about the completion of the operation. The **Completion Time** displays the time that the operation finished. The time that it took to complete the operation is the difference between the completion and start times of the operation.

To save operation details to a file, click **Save** in the **Operation Details** dialog box. When prompted, identify a name and location for the file.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation, then select **Show Details**.

Stopping an operation

Certain operations can be stopped from the **Operations** window.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation to stop, then select **Stop**.
4. Click **Yes** to confirm the stop.

Note

Operations that were started from a command line program, such as the `nsrjb` command, cannot be stopped from the **Operations** window. To stop these operations, press **`Ctrl-c`** from the window where the command was started.

Entering user input

If the system requires user input, select the labeling operation in slow/verbose mode and the Supply User Input icon appears.

Procedure

1. Right-click the operation, then select **Supply Input**.
2. Confirm whether or not to supply input.
   - If **Yes**, and input is supplied, the icon in the User Input column disappears.

     If two users attempt to respond to the same user input prompt, the input of the first user will take precedence, and the second user will receive an error message.
   - If **No**, and input is not supplied, the operation will time out and fail.

Log window

To view the most recent notification logs, click the **Log** window from the docking panel in the **Monitoring** window. The **Log** window provides the priority, time, source, category, and message for each log.

Note

If a particular log file is no longer available, check the log file on the NetWorker server. The log files are located in `NetWorker_install_path\logs` directory.

An icon represents the priority of the log entry. The following table lists and describes each icon.

Table 56 Icons in the Log pane

Icon	Label	Description
	Alert	Error condition that is detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.
	Warning	Non-fatal error has occurred.

When you sort items on the **Log** pane by using the **Priority** column, NetWorker sorts the icons in alphabetical order based on the name of the label.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 57 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 58 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 59 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Monitoring checkpoint-enabled backups

You can view detailed information about a checkpoint-enabled backup.

Procedure

1. From the **Administration** window, select **Monitoring** › **Groups**.
2. Right-click the group to which the checkpoint enabled client belongs, then select **Show Details**.
3. View the detailed information related to the group backups:
   - If the partial save set is in the work list for the group, the save set appears in the **Waiting to Run** section.
   - If the partial save set is running, the save set appears in the **Currently Running** section.
   - If the entire partial save sets sequence of the savegroup is complete, the save set appears in the **Completed Successfully** section.
   - If the entire partial save sets sequence of the savegroup is not complete, the save set appears in the **Failed** section.

     NOTICE

     If any messages are generated, the Show Messages button is enabled. Click Show Messages to view the messages.
4. Click **OK** to close the **Group Details** window.

Query the media database for partial save sets

The savegrp completion report does not provide detailed information about partial save sets that might be necessary to perform a recovery.

Querying partial save sets from the Console

You can view information about the partial save sets by using the NetWorker Console.

NOTICE

If no partial save sets are found that match the query, ensure that the backup of the partial save sets was started within the Save Time period. To change the values for the Save Time attribute, open the Save Set Query tab and select a date and time from the Save Time calendar.

Procedure

1. In the **Administration** window, click **Media**. Media-related topics appear in the navigation tree.
2. Select **Save Sets**. The following tabs appear in the **Save Sets** window:
   - Query Save Set
   - Save Set List
3. Select the **Query Save Set** tab, to query:
   - All partial save sets, select **Checkpoint Enabled**.
   - All partial save sets with the same Checkpoint ID, in the **Checkpoint ID** field, type the **Checkpoint ID** of the partial save set on which you want to perform the query.

4. Select the **Save Set List** tab to view the result of the save set query:
   - The **Checkpoint ID** column displays the partial save set **Checkpoint ID** and its Sequence ID. The **Checkpoint ID** is listed first followed by the **Sequence ID**, which is encased within brackets.
   - Sort the **Checkpoint ID** column to view the complete sequence of partial save sets.
   - The **Status** column displays the status of the partial save sets:
     - A Checkpoint browsable status indicates that the save sets can be browsed for recover.
     - A Checkpoint aborted status indicates that the backup of the partial save set was stopped or aborted. A save set recover is used to recover the partial save set.
       Consider the following:
     - When a checkpoint-enabled backup completes successfully, the status of the last partial save set is Checkpoint browsable.
     - When a checkpoint-enabled backup completes successfully, on the first backup attempt, the save set status is Checkpoint browsable. Only one Sequence id is associated with the Checkpoint ID. The Sequence id is 1. If the Sequence id is 2, the first partial save set in the checkpoint-enabled backup is missing.

Querying partial save sets by using the `mminfo` command

By default, the `mminfo` command output only displays the browsable save sets. The first and intermediate partial save sets are not displayed. Only complete checkpoint-enabled save sets or final partial save sets are displayed.

Use the `mminfo` command with specific queries to display more information about checkpoint-enabled save sets.

The following table lists the new media attributes support the Checkpoint Restart feature.

Table 60 New Checkpoint Restart media attributes

Media attribute	Description
checkpoint_id	Displays the checkpoint restart id of the partial save set in the chkpt_id column.
checkpoint_seq	Displays the partial save set sequence id in the chkpt_seq column.
checkpoint-restart	This flag attribute is used to only display checkpoint restart enabled save sets.

Also, several media sumflags are used with the Checkpoint Restart feature:

- k—Indicates this is a checkpoint enabled save set.
- a—The first and all intermediate partial save sets of a checkpoint sequence will have aborted status.
- b—The last partial or complete save set of a checkpoint sequence will be marked browsable.

Displaying checkpoint enabled save sets

Display all checkpoint enabled save sets by using the following `mminfo` command:

```
# mminfo -q 'checkpoint-restart' -r 'client,nsavetime,ssid(11),
sumflags(3),name,checkpoint_id,checkpoint_seq'
```

client	save time	ssid	ssflags	filename	chkpt_id	chkpt_seq
plapew	1251910303	4204700319	cak	/space	1251910303	1
plapew	1251910327	4187923127	cbk	/space	1251910303	2
plapew	1251910710	4087260214	cak	/space	1251910710	1
plapew	1251910725	4070483013	cbk	/space	1251910710	2

Displaying all partial save sets for the checkpoint id

Display all partial savesets for the checkpoint id by using the following `mminfo` command:

```
mminfo -q "checkpoint_id=1251910303"
```

volume	client	date	size	level	name
plapew.001	plapew	08/02/15	17 MB	full	/space
plapew.001	plapew	08/02/15	799 MB	full	/space

Reporting NDMP Data

The NetWorker software reports information about NDMP clients, data, and volumes in two ways.

- The NMC reporting feature—Reports NDMP data in the same manner as non-NDMP data. The *EMC NetWorker Administration Guide* provides more information.
- The `mminfo` command. Use the `mminfo` program to query the media database for NDMP volume or save set information.

Querying the NDMP volumes by backup type with the mminfo command

You can query save sets by backup format (NDMP or DSA) to display volume information.

- For example, to query NDMP volumes, type `mminfo -q ndmp`. Output similar to the following appears:

```
volume client date size level name
005D0000 sim1cifs1 6/22/2011 1036 MB full /fs1
005D0001 sim1cifs1 6/22/2011 173 MB full /fs1
005D0001 sim1cifs1 6/22/2011 862 MB full /fs1
005D0002 sim1cifs1 6/22/2011 348 MB full /fs1
```

- For example, to query NDMP -DSA volumes, type `mminfo -q dsa`. Output similar to the following appears:

```
volume client date size level name
NDMP.001 10.8.67.219 12/13/2011 644 MB full /vol/vol0
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 36 MB full /vol/vol2
```

Querying the NDMP save sets with the mminfo command

Query the media database to determine which save sets are NDMP save sets and the status of an NDMP save set in the media database. NDMP save set status information is important when performing NDMP recoveries.

- To perform a browseable NDMP recover, the ssflags (fl) field for an NDMP save set must contain a (b). The b value denotes a browsable save set.
- To perform a save set recover from the NetWorker User program, the ssflags (fl) field for an NDMP save set must contain either (r) or (b).
- An NDMP save set contains an N attribute in the ssflags (fl) field.
- An NDMP-DSA save set contains an s attribute in the ssflags (fl) field.

In the following example, the NDMP save set status is recoverable (r). To recover the data, you can only perform a save set recovery from a command line.

```
mminfo -av
```

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 1036MB 3842140553 hrN full /fs1
```

In the following example, the NDMP-DSA save set status is brows able (b). Recover the data by using the NetWorker User program, or from the command line. A browseable NDMP-DSA save set supports brows able and save set recoveries.

```
mminfo -av
```

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 36MB 4259813785 cbNs full /fs1
```

Performing NDMP recoveries

NetWorker uses the `nsrndmp_recover` program to coordinate recover operations between the NetWorker software and the NDMP client. The `nsrndmp_recover` program does not move data to the NDMP client. When the `nsrndmp_recover` program identifies an NDMP-DSA save set, `nsrndmp_recover` automatically runs the `nsrdsa_recover` program on the same host that runs the `nsrndmp_recover` command.

To recover NDMP data, you can run the `nsrndmp_recover` program from a command prompt, or use one of following programs, which automatically starts `nsrndmp_recover`:

- `recover`—The command line program on Windows and UNIX.
- `winworkr`—The NetWorker User GUI on Windows.
- The NMC Recovery wizard.

During the recovery process, the `nsrndmp_recover` program passes nlist information to the NDMP client. There are three methods to recover NDMP backups:

- Index-based file-by-file recover — The nlist includes file offset and ACL information. When you recover many files, the recover process uses a significant amount of system resources on both the NetWorker server and the NDMP client to build and process the nlist information.
- Full save set recovery—The nlist only includes the path to the recovery directory, down to and including the mount point. When you recover many files, the recover

process uses less system resources than an index-based NDMP recover to build and process the nlist information.

- NDMP directory restore — A partial save set recovery of a single file or single directory.

For example, when the NetWorker software writes NDMP data to a remote storage node, start the `recover` program on the NetWorker storage node to prevent the data from traversing the network.

Note

When you start the `recover` program on the NetWorker server, the data flows from the storage node to the NetWorker server and from the NetWorker server to the NDMP client, over the network.

NDMP recovery requirements for NetApp

The following list summarizes the requirements:

`scanner`

You cannot use the `scanner` command with the `-i`, `-f` and `-r` options on an NDMP volume. You cannot use the `scanner` command on a volume that contains NDMP and non-NDMP save sets when you load the volume in an NDMP device. The *Scanner command usage* technical note provides more information about using the `scanner` command with NDMP data.

Cross platform recoveries

You can recover NDMP data to different NDMP client however, you cannot perform a cross platform recover. Recover NDMP data to an NDMP client that is the same brand, a compatible model, and the same operating system as the original NDMP client.

Devices

Recover Direct-NDMP and Three-party backups performed to an NDMP device from an NDMP device. To improve recover performance from an NDMP tape device, configure the tape device to support variable length records. Recover NDMP-DSA backups from a non-NDMP device.

Localized environments

When recovering data in a localized NDMP environment, the Index Recover status window shows the process in English and not the localized language.

NDMP-DSA

For better recovery performance, start the recover process on the NetWorker host where the backup volume resides.

Immediate recoveries

Run the `nsrndmp_recover` program on the storage node with the locally attached backup device to perform an immediate recovery of NDMP-DSA data.

Note

When you select to restore multiple files, NetWorker sends multiple NDMP recover requests to the NAS client, if the files are on different save sets. With NetApp 8.2 and later releases, the ability to run parallel recoveries if the files are restored to the same destination volume is disabled, and the restore fails.
You can configure the number of sessions on the NetWorker server using the `NDMP_RECOVER_LIMIT` parameter. For NetApp 8.2 and later releases, set the parameter as follows:

```
NDMP_RECOVER_LIMIT=1
```

DAR and DDAR

By default, the NDMP recover process reads an entire tape from start to finish. The recover process extracts the data as it encounters the data on the tape. For large backup images, recovery is slow.

The DAR/DDAR recovery process:

- Provides the ability to recover a file or directory from the exact location on a tape.
- DDAR only passes the directory path to the NAS filer. DAR passes the paths of each file individually.
- Reduces the size of the nlist information that the recover process stores in memory. During the recover process, the NAS filer (DDAR) assumes that the directory path includes all cataloged files and directories. However, DAR mentions each file that it wants recovered.
- Does not sequentially read the file or record numbers on the tape to locate the data, which reduces the amount of time that you require to recover specific files from a backup.

Note

Creating and configuring the NDMP client resource on page 67 describes how to configure the DAR and DDAR Application Information attributes for NDMP clients.

Use the `recover` command or the NetWorker User program to perform DAR and DDAR recoveries. You cannot use the `nsrndmp_recover` program to perform DAR/DDAR recoveries.

When not to use DAR or DDAR

DAR and DDAR recoveries send multiple pathnames across the network to the NDMP Data Server and, in three-party configurations, to the NetWorker server. The recover process stores the pathnames in memory on the NDMP Data Server. Recoveries of a large amount of data from a large save set can negatively affect the network and the NDMP Data Server resources.

Do not use DAR and DDAR to recover the following objects:

- Several thousands of files in a single index-based recover operation.
- A specific directory structure containing several thousand or millions of files.

To perform a non-DAR-based recovery of a save set when you set the *DIRECT=y* at the time of backup, first define the *NSR_NDMP_RECOVER_NO_DAR=y* variable in the Application Information attribute of the NDMP client.

Recovering data from partial save sets

If there is a complete sequence of partial save sets that span the original save set, then you can browse to and recover individual files and directories. If the sequence of partial save sets is incomplete and does not make up the original save set, then you must perform a save set recovery to recover the data from the partial save set.

To recover data from partial save sets that span the original save sets, perform a query for all partial save sets, and then use either the NetWorker User program on Windows or the `recover` program on UNIX to restore the data.

The steps to recover data from a single partial save set are the same as save set recovery from a complete save set. The partial save set contains only files that were successfully backed up. You cannot browse partial save sets.

When you perform a save set recovery of a partial NDMP save set, the recovery process recovers all partial save sets in the checkpoint sequence. You cannot recover data in a partial save set separately from other partial save sets in the checkpoint sequence.

Use the `nsrinfo` command to display the contents of a partial save set.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 61 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.

Table 61 Recovery toolbar options (continued)

Button	Function
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.

- Start Time
- End Time
- Start date

Table 62 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 63 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Performing an NDMP index-based file-by-file data recovery

Perform an NDMP index based file-by-file recover in the same manner as a non-NDMP data recover. You can restore the data to the original NDMP client or perform a directed recovery to a different NDMP client.

Before you perform an index-based file-by-file recover, review the following information.

- Set the *HIST=y* in the Application Information attribute of the NDMP client at the time of the backup.
- The NDMP save set must be browsable. You cannot perform a browsable recover of a recoverable or recyclable save set. Reporting NDMP Data on page 93 describes how to determine the status of an NDMP save set.
- Do not use an index-based recovery to recover a large numbers of files or directories. For better recovery performance, use a save set recover. Performing a full or Directory Restore of NDMP data by using a save set recovery on page 104 provides more information.
- To perform an index-based file-by-file recover:
  - Use the NetWorker User program on a Windows host. Performing an NDMP index-based file-by-file recover using the NetWorker User program on page 101 provides detailed information.
  - Use the `recover` program. Performing an NDMP index-based file-by-file recover from a command prompt on page 103 provides detailed information.

Performing an NDMP index-based file-by-file recover using the NetWorker User program

On Windows, to recover data to the original NDMP client or to a different NDMP client, perform the following steps.

Procedure

1. Open the NetWorker User program and connect to the NetWorker server.

   NOTICE

   If you receive the error:

   ```
   No file indexes were found for client client_name on server
   server_name
   ```

   Try connecting to a different NetWorker server and you selected the correct NetWorker server, then ensure that you selected a browsable save set. Alternatively, perform a save set recover.

2. Select **Recover** to open the **Source Client** window.
3. Select source NDMP client and click **OK**. The local client is the default selection.
4. Select the destination client for the recovered data and click **OK**. If the destination client is not the source client, ensure the NAS filer is the same brand, a compatible model and the same operating system as the source NDMP client.
5. (Optional) Recover the data from an earlier backup time. The **Recover** window appears with the latest version of the backup files. To recover data from an earlier backup, change the date and time of backup using one of the following methods:

   a. Change the browse time for all files in the recover window:

      - From the **View** menu, select **Change Browse Time**.
      - In the **Change Browse Time** window, select a new day within the calendar. Select **Previous Month** or **Next Month** to change from the current month.
      - In the **Time** field, change the time of day by typing an hour, a minute, and the letter a for A.M. or p for P.M. Use the 12-hour format.
      - Click **OK**.

   b. View all versions of the selected file system object:

      - Highlight the file or directory for review.
      - From the **View** menu select **Versions**.
      - Once you locate the version to recover, change the browse time. To change the browse time, highlight the volume, directory, or file and click **Change Browse Time**. The **Version** window closes and the **Recover** window reflects the new browse time.

6. (Optional) Search for the files. To search for and recover the most recently backed-up version of a file or directory:

   a. From the **File** menu, select **Find**.

   b. Type the name of the file or directory. Use wildcards to expand the search; without wildcards, partial filenames do not provide any results.

7. Mark the data to recover. To select file system objects to recover:

a. In the left pane of the **Recover** window, click the appropriate directory folder.

b. Mark each directory or file to recover by selecting the checkbox next to each directory or file.

8. (Optional) Relocate the data to a different location. By default, the recover process recovers the selected files to the original location.

Note

The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

To relocate the files to a different location:

a. Select **Recover Options** from the **Options** menu.

NDMP recoveries do not support the following options:

- Rename recovered file
- Discard recovered file
- Prompt for every file conflict
  NDMP recoveries will always overwrite existing files. EMC recommends that you relocate the NDMP data to a different location, to avoid data loss.

b. In the **Relocate Recovered Data To** field, type the full path name of the target directory, click **OK**.

The target directory is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the recover process uses the original location and overwrites existing files with the same name.

9. (Optional) To view the volumes required to recover the marked file system objects, from the **View** menu, select **Required Volumes**.

10. Click **Start** to begin the recovery. If any required volume is not available to the NetWorker server, a volume status warning appears.

When this warning appears:

a. Click **No**.

b. From the **View** menu, select **Required Volumes**.

c. Ensure that the NetWorker software can mount each listed volume into an available device.

d. Attempt the recover operation again.

The NetWorker server takes a few moments to recover the files, depending on file size, network traffic, server load, and tape positioning. During this time, messages appear so that you can monitor the progress of the recovery.

When the recovery completes successfully, a message similar to the following appears:

```
Received 1 file(S) from NSR server
server Recover completion time: Tue Jan 21 08:33:04 2009
```

Performing an NDMP index-based file-by-file recover from a command prompt

This section applies to command line recoveries from a Windows and UNIX client.

To avoid using the Windows version of `recover.exe` on Windows operating systems, perform one of the following actions:

- Specify the full path to the recover program. For example: `C:\Program Files\EMC NetWorker\nsr\bin\recover.exe`.
- Ensure that the *$PATH* environment variable contains the `NetWorker_install_path\bin directory before %SystemRoot%\System32`.

To recover NDMP data from a command prompt on a UNIX or Windows NetWorker host, perform the following steps:

Procedure

1. From the command prompt, type:

   `recover -s` *NetWorker_servername* `-c` *client_name*

   where:

   - the `-s` *NetWorker_servername* option specifies a particular NetWorker server on the network to use when recovering data.

     When you do not use the `-s` option, the `recover` program tries to connect to the first computer listed in the servers file. When the servers file does not contain any servers, or lists more than one server, the **Change Server** window appears, and you can select the server.
   - the **-c***client_name* option specifies the source NDMP client.
2. When prompted, type the directory to browse, for example:

   ```
   cd /mydirectory
   ```

3. Use the `add` command to add the required files or folders to the recover list. The *EMC NetWorker Command Reference Guide* provides a complete list of options for the `recover` command.
4. When restoring NDMP data, EMC recommends that you relocate the NDMP data to a different location.

   Note

   The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

   - To relocate the data to a different directory, type:

     `relocate` ***destination_directory_name***

     The target pathname for *destination_directory_name* is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the

recover operation uses the original location and overwrites existing files with the same name.

- To recover the data to a different host, type:

  `relocate` ***`target_hostname`***`::`***`/mount_point`***

  Data ONTAP may require you to add a backslash (\) after the mount point. For example, *target_hostname::\mount_point*.

5. After you add all of the required files, type:

   `recover`

Performing a full or Directory Restore of NDMP data by using a save set recovery

You perform an NDMP save set recover in the same manner as a non-NDMP save set recovery. You can recover data to the original NDMP client or perform a directed recovery of the data to a different NDMP client of the same platform.

Before you perform a full save set recover, review the following information.

- Use a full save set recovery to recover all files and folders in an NDMP data save set, or to recover an entire directory within an NDMP save set. You cannot use the NetWorker User program to perform an NDMP Directory Restore.
- To use the NetWorker User program on Windows, a client file index entry for the save set must exist. When the index entry for the save set does not exist, the recover fails with an `index not found` error. When the client file index entries do not exist for the save set, use the `nsrndmp_recover` program with the '-v off' option.
- You cannot perform a save set recover from the NetWorker User program when the save set status is eligible for recycling (E). The recover process requires a recoverable (r) or brows able (b) save set status. The *EMC NetWorker Administration Guide* provides information on how to change the status of a save set. A save set recover reads the entire tape, from beginning to end, to find and recover the requested files. The recovery process completes when the recover operations reads all required tapes in their entirety.
- As each file recovers, the file name appears on the target share but the file size is 0 KB. The actual file size update occurs after the recovery completes.

Performing an NDMP save set recover by using the NetWorker User in Windows

NOTICE

When the recover operations fails with the error:

```
Failed to propagate handle <number> to child process: Access is
denied
```

The save set is not in the client file index of the NDMP client. Perform a save set recover from a command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides more information.

Procedure

1. Start the NetWorker User program.
2. On the **Change Server** window, select the NetWorker server and click **Ok**.
3. Select **Options** › **Recover Save Sets**.

4. On the **Source Client** window, select the appropriate NDMP client, and then click **Ok**.
5. On the **Save Sets** window, select the name of the save set.
6. Select the version of the save set, if there are multiple versions. You can also select the cloned version of a save set, if applicable.
7. To recover specific files and directories instead of the entire save set:
   a. Click **Files**.
   b. Specify the files and directories, one per line.
   c. Click **OK**.

   NOTICE

   Do not use this method to mark tens of thousands of files. Instead, perform an NDMP Directory Restore. Marking many files and directories generates a large nlist and requires intensive resources on both the NetWorker server and the NAS filer.

8. Click **Recover Options**.

   An NDMP data recovery does not support the following options:

   - Rename recovered file
   - Discard recovered file
   - Prompt for every file conflict

   NOTICE

   EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries *always* overwrite existing files.

9. To recover the data to a pathname that is different from the original backup location, in the **Relocate Recovered Data To** field, type the full pathname of the destination directory, then click **Ok**.

   For NDMP data recoveries, the target pathname is a literal string and *must* exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

10. To recover the data to a different NDMP client, specify the name of the client to receive the NDMP data in the **Destination Client** field.
11. To view the volumes required to perform the recover, select **View** › **Required Volumes**
12. Click **OK** to begin the recovery. The recovery status appears in the **Recover Status** window.

Performing an NDMP save set recovery from the command prompt

To perform a save set recovery to the original NDMP client or to a different NDMP client, use the `nsrndmp_recover` command.

Note

By default the backup operation uses IPv6 addressing, if enabled. NetApp always uses IPV6 if it is enabled, regardless if IPV6 is configured on the NetApp system or not. If the NetApp system is not configured with IPV6, NDMP backup and recovery displays the following error message:

```
42597:nsrndmp_recover: mover listen:communication failure
```

```
42801:nsrndmp_recover: Failed to send the MOVER_LISTEN message
to the NDMP tape server.
```

You can force the NDMP backup and recovery to ignore IPv6 and instead use IPv4 in one of two ways:

1. Add the `-f` option to the `nsrndmp_save` or the `nsrndmp_recover` commands as required.
2. Select the **Disable IPv6** checkbox on the Apps & Modules tab in the **Client Properties** window.

For example:

```
nsrndmp_recover -s NetWorker_server -c source_ndmp_client -S ssid/
cloneid -v off -m target_ndmp_client::/target_path /source_path
```

where:

- *source_ndmp_client* is the hostname of the source NDMP client.
- *target_ndmp_client* is the hostname of the destination NDMP client.
- */source_path* is the original location of the data.
- */target_path* is the location to recover the data.

  NOTICE

  EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries always overwrite existing files. The `/target_path` is a literal string and must exactly match the path as seen native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

- **-v off** allows you to restore data when client file index of the NDMP client does not contain information about the NDMP save set.
  In the following examples, the NetWorker server is mars and the backup client is venus.
  - To recover a mount point `/mnt` from a backup of NDMP host venus to a directory `/newmnt` on NDMP host jupiter, type: **`nsrndmp_recover -s mars -c venus -S 123456789 -v off -m jupiter::/newmnt`**
  - To recover a mount point `/mnt`from a backup of NDMP host venus to NDMP host pluto, type:

```
nsrndmp_recover –s mars -c venus -R pluto -S 123456789 -v off -
m /mnt
```

Data ONTAP may require you to add a slash (/) after the mount point. For example, *target_hostname*::/*mount_point*/.

Troubleshooting NDMP recover

This section provides a list of the possible causes and the possible resolutions for NDMP recovery issues.

RESTORE: could not create path *pathname*

This error message appears when restoring NetApp data. This error, when encountered, appears in the `daemon.raw` file of the NetWorker server and the recovery output.

To resolve this issue:

- Ensure that you specify a source and a target path during the recover that exists on the target filer.
- If you set the *UTF8=Y* application information variable during an NDMP client backup and the backup contains path names with non-ASCII characters, then perform a save set recover. Index-based recoveries will fail with this error message.

These files were not restored (Restore failed with error, or file/directory specified but not found in backup)

This error message appears in the `daemon.raw` file of the NetWorker server and the in the recovery output.

To resolve this issue:

- Ensure that the file or directory specified during the recover, exists in the save set.
- Ensure that the pathname specified to relocate the data exists on the destination filer. For NDMP data recoveries, the target pathname is a literal string and must exactly match the path as seen by the native OS on the NAS filer.

CHAPTER 5

Other filers

This section includes the following topics:

- Configuring devices for NDMP operations 276
- Configure NetWorker for NDMP backup and clone operations 287
- Monitoring NetWorker server activities in the Administration window 324
- Reporting NDMP Data 342
- Performing NDMP recoveries 343

Configuring devices for NDMP operations

Review this section for information about how to configure the NetWorker environment for NDMP data operations.

The *EMC NetWorker Hardware Compatibility Guide* on the EMC Online Support web site provides a list of NDMP devices that the NetWorker software supports.

NDMP device limitations

Review these limitations before you configure NDMP devices.

- The timeout of the NetWorker server resource attribute, `nsrmmd`, does not apply to NDMP devices, but it does apply to storage nodes devices.
- You cannot use the `jbexercise` utility with an NDMP autochanger.
- You cannot configure NDMP devices on a dedicated storage node.
- You must use a non-rewind device handle for the NDMP media device handle.
- You cannot configure Advanced file type devices and file type devices as an NDMP device.
- You cannot configure an NDMP Autochanger when the NDMP protocol is before version 3. You must determine the NDMP device handles, then use the `jbconfig` command to configure the autochanger.

DinoStor-managed jukeboxes

The DinoStor software provides a web-based interface for administering and controlling the TapeServer settings.

Review this information before you use a DinoStor-managed jukebox with NetWorker:

- When you configure the DinoStor TapeServer, set the port number to 10000 on the NDMP page of the **Configure** tab.
- NetWorker supports:
  - SCSI tape devices.
  - GigE and 10/100 Base-T networks.
- You cannot use DDS because the DinoStor TapeServer is not fibre-equipped.

Determining NDMP device path names

To configure an NDMP standalone device or NDMP jukebox, you must first determine the path names of the media devices. If the NAS filer does not support the NDMP_CONFIG interface or uses NDMP version 3, you must also determine the library device handle.

To determine the NDMP device path names and the library handle, use the `inquire` command or vendor-specific commands.

Determining the NDMP device path names by using inquire

Use the `inquire` command to determine the path names and library handle.

Procedure

1. From a command prompt on the NetWorker server, type:

   ```
   inquire -N NAS_hostname -T
   ```

2. When prompted, specify the NAS username and password.

NOTICE

Use the `inquire` command with caution. When you run `inquire`, the command sends the `SCSI inquiry` command to all devices detected on the SCSI bus. If you use the `inquire` command during normal operations, then unforeseen errors can occur, resulting in possible data loss.

Determining the NDMP device pathname for DinoStor-managed

Before you configure an NDMP autochanger, determined the device pathnames of NDMP devices and the robotic arm.

Procedure

1. Access the DinoStor TapeServer interface.
2. Click the **Configure** page.
3. Click the **SCSI** tab.
4. Make note of the device names and device handles.

Determining the NDMP device pathname for MiraPoint

Before you configure an NDMP autochanger, determined the device pathnames of NDMP devices and the robotic arm.

Procedure

1. On the MiraPoint filer, type:

   `diag tape inquiry ** ** **`

   The device pathname is in the format `/dev/nrst n`, where n starts at 0 and increases one number for each tape drive. This value is constant.

   When the filer uses NDMP v2, or does not support the NDMP_CONFIG interface, you must specify the autochanger handle, /dev/ch0, when running the `jbconfig` command.

2. To determine the autochanger handle, type:

   `diag changer inquiry ** ** **`

Determining the NDMP device pathname for Procom NetFORCE

Before you configure an NDMP autochanger, determined the device pathnames of NDMP devices and the robotic arm.

Procedure

1. Log in as root and type:

   `status dm`

2. If the filer uses NDMP v2 or does not support the NDMP_CONFIG interface, you must determine the autochanger handle.

   On a Procom NetFORCE filer, the SCSI device name format is isp1tSSL[L], where isp1 is the autochanger handle. The Fibre Channel device format is ffx1tSSL[L], where ffx1 is the autochanger handle.

Dynamic drive sharing

Dynamic Drive Sharing (DDS) is a feature that provides NetWorker software with the ability to recognize shared physical tape drives. DDS enables NetWorker software to perform the following operations:

- Skip the shared tape drives that are in use.
- Route the backups or recoveries to other available shared tape drives.

Introduction to DDS

DDS controls application requests for tape media and allows the NetWorker server and all storage nodes to access and share all attached devices.

A system administrator can configure DDS by setting a sharing policy for devices that are accessible from multiple storage nodes.

There are two terms that are central to the use of DDS are drive and device. Within the context of DDS, these terms are defined as follows:

- Drive—The physical backup object, such as a tape drive, disk, or file.
- Device—The access path to the physical drive.

Note

NetWorker only supports DDS in a storage area network (SAN) Fibre Channel environment and not in a direct-connect SCSI environment.

Benefits of DDS

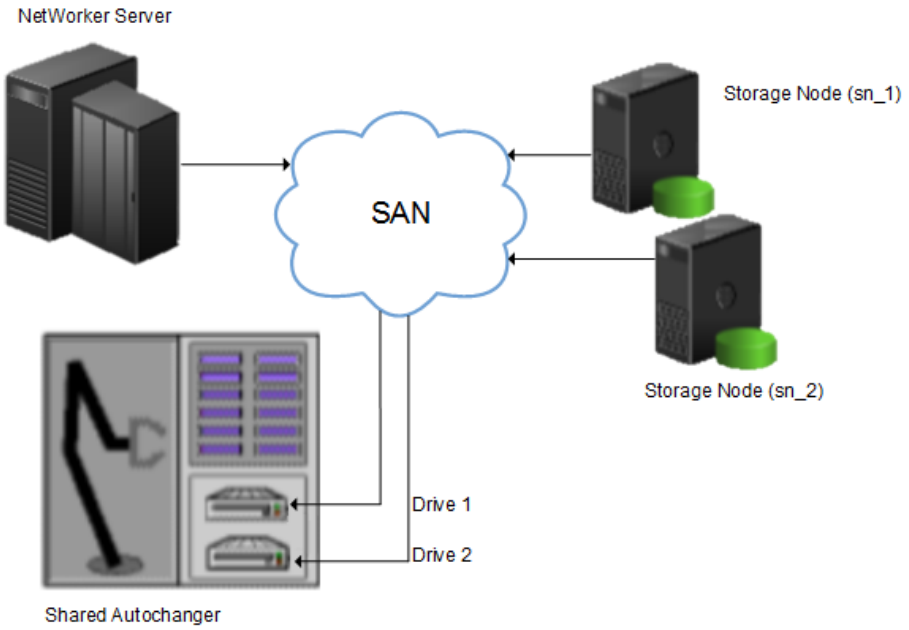
Enabling DDS on a NetWorker system provides these benefits:

- Reduces storage costs—You can share a single tape drive among several storage nodes. In fact, since NetWorker software uses the same open tape format for UNIX, Windows, NetWare and Linux, you can share the same tape between different platforms (assuming that respective save sets belong to the same pool).
- Reduces LAN traffic—You can configure clients as SAN storage nodes that can send save sets over the SAN to shared drives.
- Provides fault tolerance—Within a SAN environment, you can configure hardware to eliminate a single point of failure.
- Provides configuration over a greater distance—You can configure a system over a greater distance than with SCSI connections.

DDS configuration overview

The following figure illustrates the DDS process and potential device sharing configurations. This basic configuration consists of a server, two storage nodes, and a library with two tape drives.

Figure 36 Dynamic Drive Sharing



In this figure:

- Storage nodes sn_1 and sn_2 are attached to the library.
- Each storage node, on its own, has access to drive_1 and drive_2.
- With DDS enabled, both storage nodes have access to both drives and can recognize when a shared drive is in use.

This configuration requires two DDS licenses, one for each drive.

Note

Ensure that all applicable devices can be seen from each storage node by running the `inquire -l` command locally on each storage node.

DDS block-size compatibility between UNIX and Windows

With DDS enabled, drives can be shared between storage nodes on different platforms, such as UNIX and Microsoft Windows. For NetWorker software operations (such as backups and recoveries) to take place successfully, ensure that the block size is compatible between different platforms and/or hardware.

To ensure compatibility, make sure one of the following conditions is met:

- The various storage nodes sharing a drive support the same block sizes.
- When a tape is labeled on a drive, it is labeled with the block size defined on the storage nodes.

Block-size incompatibility between UNIX and Windows

Incompatible block-size settings between UNIX and Microsoft Windows storage nodes could result in any of these error scenarios:

- A backup taken on a UNIX node might not be recoverable on a Microsoft Windows node if the Windows node does not support large block sizes.
- A UNIX process labels and saves data to a tape and leaves the tape mounted. A Microsoft Windows process subsequently attempts to verify the label on this tape and fails because the label verification is done by reading a header from the data portion.
- A tape on a UNIX node is labeled with a large block size. The backup is started on a Microsoft Windows node and the Windows node attempts to write the backup by using the default block size. Internally, the backup on Windows is written by breaking down the big buffer of data into smaller segments of writable block sizes. Attempting to recover a specific file on Windows in this situation fails due to positioning errors on the tape. The data is still recoverable from the Windows side, since the NetWorker software will switch from using file and block positioning to reading the tape from the beginning to reach the correct position. The data might not, however, be recoverable from the UNIX side.

Unintended Access to DDS device prevention

The Reserve/Release attribute has been added to the Device resource for tape devices to support Reserve/Release, including the Persistent Reserve commands.

Reserve/Release is a mechanism that uses SCSI commands to attempt to prevent unintended access to tape drives that are connected by using a shared-access technology, such as Fibre Channel, iSCSI, or SCSI multiplexers. It is a “cooperative” and host-based mechanism, which means that all applications should respect the reservations and not purposely break them. Access is granted based on the host system that reserved the device. Other applications that run on that host cannot be prevented from accessing a reserved device.

Reserve/Release cannot prevent a malicious or badly behaved application from accessing a reserved device. It also cannot prevent all problems caused by hardware issues (such as SCSI resets or FC LIPs) from interrupting data access.

The basic sequence requires that a host reserve a tape drive (using specific SCSI commands) before attempting to access the tape drive. If this “reservation” succeeds, then the host can use the drive. If the reservation fails (usually because the device is reserved by someone else), then the host attempting the reservation should not attempt to use the drive. When a host has finished using a reserved drive, that host must release the drive by using the appropriate SCSI commands.

The reservation is maintained by the drive itself. With older (called “Simple” in NetWorker software) Reserve/Release, the reservation is based on the SCSI ID of the system that issued the reserve command. For tape drives connected to Fibre Channel (FC) using FC-SCSI bridges, the mapping between FC host and reservation is done inside the bridge, since the initiator on the SCSI side is always the bridge itself, regardless which host actually issued the reserve command.

For Persistent Reserve, the reservation is associated with a 64-bit “key” that is registered by the host. Several keys can be registered with a given drive at any given time, but only one may hold the active reservation. NetWorker software uses the “exclusive” reservation method for Persistent Reserve. Only the host that holds the active reservation is allowed to access the drive.

The Reserve/Release attribute does not support file type or advanced file type devices.

The settings that relate to Reserve/Release and Persistent Reserve are found in a device's Properties window, on the Advanced tab. They are visible only when diagnostic mode is turned on.

The default setting for Reserve/Release is None. Once any other Reserve/Release setting is selected, it works automatically, without further user intervention. The Reserve/Release attribute is supported only on Common Device Interface (CDI) platforms, so if the CDI attribute in a device's Properties is set to Not Used, then Reserve/Release settings are ignored.

For newer hardware, once a Reserve/Release setting (other than None) has been selected, the appropriate Persistent Reserve commands are automatically issued before a device is opened for reading or writing, and before the device is closed. With older hardware, a SCSI-2 Reserve command is issued before opening the device, and a SCSI-2 Release command is issued after the device is closed.

Reserve/Release has these possible settings:

- None (the default)
- Simple
- Persistent Reserve
- Persistent Reserve + APTPL (Activate Persist Through Power Loss)

The Persistent Reserve Key attribute has also been added. It is used with Persistent Reservation calls.

Restrictions for use of the SCSI Reserve/Release setting

There are restrictions for using the SCSI Reserve or Release setting.

Consider the following:

- It is available on CDI platforms only. Consequently, since CDI is not supported within an NDMP environment, Reserve/Release is not supported with NDMP.
- Not all drives support persistent Reserve/Release. (All drives support at least simple reserve release. The code automatically drops back from Persistent +APTPL or Persistent to Simple on drives that do not support Persistent.)
- SCSI resets can clear Simple reservations at the device.
- Even with Reserve/Release, there is no guarantee against data loss.
- If the operating system has its own Reserve/Release feature, that feature must be disabled in order for the NetWorker Reserve/Release feature to work.
- Even if all of the enterprise's NetWorker storage nodes have this feature enabled, then it is possible that, on the storage node where a backup operation is run, data loss can be caused by the operating system's utilities or by third-party programs.

DDS on NDMP nodes in a SAN environment

You can configure shared drives between NDMP nodes in a SAN environment.

Ensure that:

- All the components of a SAN configuration are compatible when DDS is enabled with the NetWorker NDMP feature.
- The Fibre Channel switches are compatible with any NDMP hosts within a SAN.
- NDMP hosts and libraries in the SAN are compatible with each other.
- The NDMP nodes that will share the drives are homogeneous.

Note

The current NDMP implementation does not allow the sharing of drives between non-homogeneous NDMP nodes. There is, however, no inherent limitation within DDS that would prevent this.

DDS attributes in the device properties

Configure the attributes that DDS uses, in the **Properties** window for a device.

The attributes include:

- Hardware ID
- Shared Devices

Hardware ID attribute

The Hardware ID attribute tracks the drives that are shared between multiple hosts. Device instances that share the same physical drive across multiple hosts have the same hardware ID. The device autoconfiguration process automatically assigns the Hardware ID to a device, or it is added when manually configuring a device. Users cannot edit the Hardware ID.

You can view the Hardware ID in the **Properties** window for a device, on the **General** tab, in the **Device Sharing** area.

NetWorker generates the Hardware ID when a device is scanned or configured. The Hardware ID consists of the following components:

- Hardware serial number
- Device type
- Worldwide part number (WWPN)
- Worldwide name (WWN)

Shared Devices attribute

The Shared Devices attribute appears on the **Operations** tab of a device's **Properties** window when in diagnostic mode. It features values that can be used to manipulate all shared instances of a drive simultaneously. This attribute enables or disables all devices that share the same Hardware ID with a single action. The following table lists allowed values and descriptions for the attribute.

Table 64 Shared Devices attributes

Value	Description
Enable All	When selected, enables all devices with the same Hardware ID.
Disable All	When selected, disables all the devices with the same Hardware ID.
Done	This value is the default setting. After the server has enabled or disabled all devices with the same Hardware ID, the attribute value is reset to Done.

You cannot configure the Shared Devices attribute with the `jbconfig` program.

Idle Device Timeout attribute and DDS

A tape might remain mounted in a drive after a backup completes. Other requests for the drive from another device path must wait during this timeout period. Use the Idle Device Timeout attribute to adjust the timeout value.

The Idle Device Timeout attribute is not specifically a DDS attribute, but is useful in configuring shared drives. This attribute appears on the device **Properties** window on the **Advanced** tab when displayed in Diagnostic Mode. The default value is 0 (zero) minutes, which means that the device never times out and you must manually eject the tape.

If the device belongs to a library, you can also specify the Idle Device Timeout value for all devices in the library. However, the library value will take effect only on those devices whose **Idle Device Timeout** value is 0. The Idle Device Timeout value for a library is located on the **Timer** tab of the library **Properties** window.

Max active devices

In a DDS environment, use the Max active devices attribute, on the **General** tab of the Storage Node resource to define the maximum number of active devices for a storage node.

This attribute sets the maximum number of devices that NetWorker may use from the storage node in a DDS configuration. In large environments with media libraries that have a large number of devices, storage nodes might not have the ability to optimize all the drives in the library. The Max active devices attribute allows you to limit the number of devices that the storage node uses at a specified time, which allows the storage node to have access to all the devices in the library, but does not limit the storage node to the number of devices it can fully optimize.

Configuring NDMP devices

You can back up NDMP data to an NDMP or non-NDMP device in a standalone or library configuration. You can also back up NDMP data to ACSLS controlled silos.

Configuring a standalone NDMP device

Use NMC to configure a standalone NDMP tape device for Direct NDMP backups.

Procedure

1. In the **Administration** window, click **Devices**.
2. Right-click **Devices** in the navigation tree, and select **New**.
3. In the **Name** attribute, specify the NDMP device in the format:

   `rd=`*`NAS_hostname`*`:`*`NAS_device_handle`* `(NDMP)`

   where:

   - *NAS_hostname* is the hostname of the NAS that has the NDMP device attached.
   - *NAS_device_handle* is the path of the device.

   Note

   Configure the NDMP device as a remote device and add **`(NDMP)`** after the pathname. Otherwise, you receive a message similar to the following:

   `NDMP device name shall be in rd=`*`snode`*`:`*`devname (NDMP)`* `format`

4. In the **Media Type** attribute, specify the device type.
5. Specify a valid NAS administrator account in the **Remote User** attribute.
6. Specify the password for the NAS administrator account in the **Password** attribute.
7. On the **Configuration** tab:
   a. Select the **NDMP** checkbox. You can only set this attribute when you create the device. You cannot change the NDMP attribute after you create the device. To change the device configuration, delete and re-create the device.
   b. Set the **Target Sessions** attribute to `1`. NDMP devices do not support multiplexing.
   c. The **Dedicated Storage Node** attribute must remain at the default value: **`No`**.
8. Under the **Advanced** tab, the **CDI** attribute must remain at the default value: **`Not used`**.
9. Optionally, change the block size used by the NDMP device.

   By default, NDMP devices use a block size of 60 KB. If required, select a different block size in the **Device block size** field. When you configure the NDMP client, set the *NDMP_AUTO_BLOCK_SIZE* environment variable in the **Application Information** attribute.
10. Click **OK**.

Configuring an NDMP autochanger

You can use an NDMP autochanger to manage Direct NDMP or Three-party backups with NDMP devices. To configure an NDMP autochanger, use NMC or the `jbconfig` command.

Configuring an NDMP autochanger with NMC

When you configure an NDMP autochanger in NMC, the NetWorker software first detects the NDMP devices and then configures the library.

Procedure

1. In the **NetWorker Administration** window, click **Devices**.
2. Right-click on the NetWorker Server and then select **Configure All Libraries**.
3. On the **Provide General Configuration Information** window, accept the default library type, **SCSI/NDMP**, and then click **Next**.
4. On the **Select Target Storage Nodes** window, click **Create a new Storage Node**.
5. On the **Storage Node Name** field, specify the hostname of the NAS.

   If a DinoStor TapeServer manages the autochanger, specify the DinoStor hostname.
6. In the **Device Scan Type** attribute, select **NDMP**.
7. In the **NDMP User Name** and **NDMP Password** fields, specify the NAS administrator account. If DinoStor TapeServer manages the autochanger, specify the DinoStor username and password.
8. Click **Start Configuration.**
9. Click **Finish**.
10. Monitor the **Log** window for the status of the device scan.

    When you specify an incorrect username and password combination:

    - The Log status window reports:

```
No configured libraries detected on storage node
storage_node_name
```

- The `daemon.raw` file on the NetWorker server reports:

```
NDMP Service Debug: The process id for NDMP service is
0xb6c0b7b0
42597:dvdetect: connect auth: connection has not been
authorized
42610:dvdetect: The NDMP connection is not successfully
authorized on host 'storage_node_name'
```

  To resolve this issue, relaunch the **Configure All Libraries** wizard and correct the NDMP username and password combination.

Note

If the **Log** window reports that NetWorker cannot detect the serial numbers for the library, see Configuring an NDMP autochanger by using the jbconfig command on page 38 for detailed instructions.

Configuring an NDMP autochanger by using the `jbconfig` command

The NMC interface is the preferred method to configure an NDMP autochanger. Use the `jbconfig` command when you cannot configure the autochanger by using the NMC Configure Library wizard.

The *EMC NetWorker Command Reference Guide* or the UNIX man page provides more information about the `jbconfig` command.

Procedure

1. Log in to the NetWorker server as root on UNIX, or Administrator on Windows.
2. At the command prompt, type **`jbconfig`**
3. At the **What kind of jukebox are you configuring** prompt, type **`3`** to configure an autodetected NDMP SCSI jukebox.
4. When prompted for an NDMP username, specify the NAS administrator account.

   If DinoStor Tape Server manages the jukebox, then specify the DinoStor account.
5. When prompted for an NDMP password, specify the NAS administrator password.

   If DinoStor manages the jukebox, then specify the DinoStor password.
6. When prompted for the NDMP Tape Server Name, specify the NAS filer hostname.

   If DinoStor manages the autochanger, then specify the DinoStor hostname.
7. At the **What name do you want to assign to this jukebox device** prompt, provide a name to identify the autochanger.
8. To enable auto-cleaning, accept the default value of **Yes**, otherwise type **`No`**.
9. At the **Is (any path of) any drive intended for NDMP use? (yes / no) [no]** prompt, type **`Yes`**.
10. At the **Is any drive going to have more than one path defined? (yes / no) [no]** prompt, type **`No`** if you will not configure shared devices. Type **`Yes`** to configure shared drives.
11. When prompted, for the first pathname for the NDMP devices in the jukebox, perform the following steps.

a. Specify the pathname in the following format:

NDMP_tape_server_name*:*device path
where:

- NDMP_tape_server_name is the hostname of the NDMP or DinoStor Tape Server.
- *device_path* is the first device path.

12. Complete the prompts for the second device.
13. In the **Enter the drive type of drive 1** prompt, specify the number that corresponds to the NDMP device type.
14. If each drive in the autochanger is the same model, then type **Yes**. Otherwise, type **No**, and then specify the appropriate device types for each additional autochanger device.
15. When prompted to configure another autochanger, type **No**.

Changing the block size of an NDMP device

By default, the block size used to write data to an NDMP backup is 60KB. With the exception of EMC Celerra, when you specify the *NDMP_AUTO_BLOCK_SIZE=Y* variable for an NDMP client, an NDMP device can use the value defined in its Device block size attribute.

Consult the applicable vendor documentation to determine the block sizes supported by the NDMP filer before setting the block size for an NDMP device.

To change the block size defined for the NDMP device, perform the following steps:

Procedure

1. From the **View** menu, select **Diagnostic Mode**.
2. In the **Devices** window, right-click the NDMP device and select **Properties**.
3. On the **Advanced** tab, select a value in the **Device block size** field.

   Note

   The selected block size must not exceed the block size configured on the NAS filer.

4. Click **Ok**.

Message displayed when CDI enabled on NDMP or file type device

If you enable the CDI feature for an NDMP tape device or file type device (FTD), a message similar to the following appears:

```
nsrd: media notice: The CDI attribute for device "/dev/rmt/
3cbn" has been changed to "Not used".
```

To avoid this message, do not enable the CDI attribute for these device types.

Configuring NDMP-DSA devices

When you use DSA, NetWorker sends the NDMP data to a NDMP-DSA device, which includes tape, virtual tape, AFTD, and Data Domain devices. The steps to configure a NDMP-DSA device for a specified device type is the same as configuring a non-NDMP device. The *EMC NetWorker Administration Guide* provides detailed information.

Configuring the Clone Storage Node

When cloning NDMP data, specify the destination storage node, called the clone “write source” (the device that receives the clone data), in the Clone storage nodes attribute. The "Determining the storage node for writing cloned data" section in the *EMC NetWorker Administration Guide* provides details.

Pools requirements for NDMP

When you create a pool for non-NDMP devices, select only the devices that are required by the NDMP clients.

NetWorker cannot send bootstrap and index backups to an NDMP device. When you do not configure a non-NDMP devices or a non-NDMP device is not available to receive the index and bootstrap backups, the NDMP client backup appears to hang. Configure a separate pool to direct the index and bootstrap to a non-NDMP device.

Auto media verification in the Pool resourcedoes not support NDMP.

When an NDMP client backup is a member of a clone-enabled group, configure a clone pool with non-NDMP devices that are local to the NetWorker server to receive the clone bootstrap and index.

Configure NetWorker for NDMP backup and clone operations

This section explains how to configure NetWorker for NDMP backup and clone operations.

Creating and configuring the NDMP client resource

Use the NMC Client Configuration Wizard to create the NDMP client or create the client manually. EMC recommends that you use the NMC Client Configuration Wizard to create NDMP clients.

Using the Client Configuration wizard

Use the NMC Client Configuration wizard to create the NDMP client.

Procedure

1. From the **Administration** window in NMC, click **Protection**.
2. In the expanded left pane, select **Clients** , and then select **Protection** › **New Client Wizard**.
3. On the **Specify Client Information** window:
   a. In the **Client Name** field, specify the hostname of the filer.
   b. Optionally, add comments in the **Comment** field.
   c. Optionally, in the **Tag** field, specify the name of the tag for the dynamic group in which you want to add this client.
   d. Optionally, in the **Groups** area, select an existing group, in which to add the client.
   e. In the **Type** area, select **NDMP**, and then click **Next**.
4. On the **Specify the NDMP Client Credentials** window:
   a. In the **NDMP User Name** field, specify a valid NAS administrator account.

b. In the **NDMP Password** attribute, specify the password for the NAS administrator account, and then click **Next**.

5. In the **Specify the NDMP Client Backup Options** window:

a. In the **NDMP backup type** attribute, select or specify the backup type:

- BlueArc: `dump`
- Mirapoint: `image`

b. In the **NDMP Array Name** field, specify the logical name assigned to the NDMP NAS array.

The **NDMP Array Name** field enables you to configure the same NAS device with multiple NDMP clients that have different host IDs.

Note

NDMP clients that use the same NAS device must have the same NDMP array name.

c. Review the **App Info** options and disable options, as required. EMC recommends that the default options remain enabled.

App Info Type	Description
HIST	Enables the backup of index data. If you do not select this option, you can only perform full recoveries of the backup data.
UPDATE	Enables the backup process to update the last backup dates in database on the NDMP client, after the backup completes.
DIRECT	Enables DAR or DDAR support.
Use Token-Based Backup	Enables the NDMP backup to use last backup time tokens to decide what files to backup. Not all NDMP clients support token based backup. When you select this option and the NDMP data server on the client does not support token based backups, NetWorker performs the backup by using backup levels.

d. In the **Advanced App Info** field, specify additional NAS specific environments variables, one per line. The following table provides a list of the available **Application Information** environment variables for each NAS.

NOTICE

Environment variables are case-sensitive. Use an equal (=) sign to separate the environment variable name from its value.

Table 65 Vendor-specific Application Information variables

NAS	Variables	Definition
Mirapoint	*MIRA_OPTIONS= (fromimagefull=)*	Required. The (fromimagefull=) value allows full image and message (file) based backups to use the date of the image when performing the selection.
	NDMP_AUTO_BLOCK_SIZE=Y	Optional. Specify this variable to override the default block size of 60 KB when writing NDMP backups to an NDMP device. Uses the block size value defined in the Device block size attribute when you labeled the NDMP volume.
BlueArc	*NDMP_BLUEARC_FH_NAMETYPE=UNIX*	Required. This variable requests that the BlueArc filer provide UNIX-style names when backing up a CIFS share.
	NDMP_AUTO_BLOCK_SIZE=Y	Optional. Specify this variable to override the default block size of 60 KB when writing NDMP backups to an NDMP device. Uses the block size value defined in the Device block size attribute when you labeled the NDMP volume.
	USE_TBB_IF_AVAILABLE=N	Optional. NetWorker enables Token-Based Backup (TBB) automatically if TBB is enabled from the NAS side. Specify this variable to disable TBB support for incremental backups. This value reverts the backup to the native level based backup of the NAS. If TBB is disabled from the NAS side, NetWorker will not enable TBB regardless what the value of *USE_TBB_IF_AVAILABLE* is set to.

6. Click **Next**.
7. On the **Select the NetWorker Client Properties** window:
   a. In the **Priority** field, specify the order in which the NetWorker server contacts clients in a protection group for backup. The attribute can contain a value between 1 and 1,000. The lower the value, the higher the priority.
   b. In the **Parallelism** attribute:
      - For Direct-NDMP, set the **Parallelism** attribute to 1.
      - For NDMP-DSA, the parallelism value depends on the NAS capabilities and set parallelism to a value that is appropriate for the NAS. Parallelism values of 4 to 8 are common. In general, the best parallelism setting depends on filer configuration and the amount of installed RAM.
   c. In the **Remote Access** attribute:

- Specify the root account on UNIX, or the administrator account on Windows of any computer that you use to browse entries for the NDMP computer.
- Specify the NetWorker server administrator account on Windows, or the root account on UNIX.
  Use this format to specify each account:

  `account_name@hostname`

d. Select the **Data Domain Interface**. This option specifies the protocol to use if you send the backup data to a Data Domain Device. Available selections are Any, Fibre Channel, or IP.

e. To enable a block based backup for the host, select the **Block Based Backup** option . The *EMC NetWorker Administration Guide* provides more information about when to enable blocked based backups and the features that do not support block based backups. Block Based backups require the **Client Direct** option.

f. Select the **Client Direct** option to allow the client to try to directly connect to the backup storage device, instead of connecting to a NetWorker storage node. If a direct connection is not possible, the backup operation connects to the NetWorker storage node that you configure to accept data from the client.

8. On the **Specify the File System Objects** window, select or specify objects to backup.
   - When the NAS supports NDMP snapshot management extension, you can browse and mark individual file systems to back up. When the client supports browsing, by default, NetWorker selects all objects.
   - When the client does not support browsing, specify the save sets to back up.
     - To back up all the file systems on the client, type **`ALL`**.
     - NAS versions earlier than 3 do not support the `ALL` save set. List the file systems one per line.
     - When you do not use the `ALL` save set, specify the file system name, as configured on the NAS.
     - File system names in the **Save set** field are case sensitive.
     - You cannot specify a share name.

   To back up large client file systems, optionally schedule each file system to back up separately. For example, create two separate clients with the same name, but with different save sets.

9. Click **Next**.
10. On the **Client Configuration Summary** window, review the attributes, and then click **Create**.
11. On the **Client Configuration Results** window, review the results, and then click **Finish** to exit the wizard.

    Troubleshooting NDMP configuration and backup failures on page 75 describes how to resolve errors that you may experience when you configure the NDMP client.

Performing post Client Configuration Wizard steps

After the Client Configuration wizard creates the NDMP client, modify the properties of the new NDMP client.

Modifying the Storage Node

On the **Globals (2 of 2)** tab, specify the appropriate storage node in the **Storage Nodes** attribute.

The attribute value depends on the type of backup:

- When you perform Direct-NDMP backups with NDMP devices, specify the hostname of the NAS that manages the tape device or autochanger.
- For three-party backups, specify the destination host first.
- For NDMP-DSA backups, specify the hostname of the storage node that manages the tape device or autochanger. If the NetWorker server is the storage node, specify *nsrserverhost*.
- For a DinoStor-managed NAS, specify the hostname of the DinoStor server first.

  NOTICE

  For NDMP-DSA backups, the NetWorker software uses the **Storage Node** attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options, they will override the **Storage Node** attribute value.

Adding NDMP Client Properties

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, select **Clients**.
3. Right-click a **Client** and select **New Client Properties**. The **Client Properties** screen appears.
4. Select the **Apps & Modules** tab. Select the **NDMP** attributes of the **Client**. The **NDMP** options are as follows:
   - **NDMP**—Check this box to indicate whether this client is an NDMP client.
   - **NDMP multistreams enabled**—Check this box to indicate whether the Isilon client is using the NDMP multistream feature.

     Note

     Only Isilon supports multistreaming.

     Increasing the number of streams does not always increase performance. Depending on your environment, performance might be reduced when the number of streams is increased, especially for a high density file system backup and recover.

     - To start a multistream backup from the command line interface, add option **`-A multistreams=<n>`** to the command `nsrndmp_save` where n=Number of streams. For example:

       ```
       nsrndmp_save -T <Backup_type> -c <Isilon_client> -A
       multistreams=<n> <Backup_Path>
       ```

  - To start a multistream backup from NMC GUI or a scheduled backup, set the **Parallelism** value in the **Globals (1 of 2)** tab.
- **NDMP log successful file recovery**— By default, NetWorker does not print each successfully recovered file name in the log messages, because this logging impacts performance and takes up space. To enable the logging of successful recoveries for each file, select this checkbox.
- **Disable IPv6**—Check this box to disable IPv6 on NDMP backup and recovery.
- **NDMP array name**—This name is the logical name assigned to the array in NDMP NAS array configurations.
- **NDMP vendor information**—This attribute contains NDMP client vendor information.

5. Click **OK**.

Configuring the NDMP client manually

EMC recommends that you create NDMP client by using the Client Configuration wizard. If you create the NDMP client manually, then the configuration details for each attribute in the Client Configuration wizard apply when you create the client manually.

Review this information before you configure an NDMP client manually.

- For an NDMP configuration that includes Storage Node resources, configure a Client resource for each storage node that you define for an NDMP backup and clone operation.
- For NDMP three-party storage nodes that use NDMP devices, repeat these steps for each NDMP storage node.
- For NDMP-DSA storage nodes, create the NetWorker Client resources in the same manner as non-NDMP clients. The*EMC NetWorker Administration Guide* provides details on how to create a non-NDMP Client resource.
- NDMP does not support the use of directives including AES encryption. The NetWorker software ignores any value that you define in the **Directives** attribute for an NDMP client.
- When you select **Checkpoint enabled** on the **General** tab, do not modify the **Checkpoint granularity** attribute. NDMP backups do not support checkpoint granularity and the NetWorker software ignores any value that you define for this attribute.

  Note

  VNX does not support checkpoint restart.

- If the NAS supports the NDMP snapshot management extension, then you can browse and mark individual file systems for backup instead of specifying the save sets in the **Save set** attribute. You cannot use the **Save set browse** icon to browse the NDMP file system until you:
  - Select the **NDMP** checkbox, on the **Apps & Modules** tab.
  - Specify the NDMP username and password in the **Remote user and password** fields on the **Apps and Modules** tab.

Note

Snapshot Management Extension is not supported by Celerra, VNX, VNXe, and NetApp C-mode. Only NetApp 7-mode supports Snapshot Management Extension.

Note

Isilon, Celerra, VNX, VNXe, and NetApp C-mode filers do not allow you to browse. Only NetApp 7-mode allows you to browse.

Performing schedule backup and clone operations

Data Protection Policies provide you with the ability to schedule backup and clone operations, to protect NDMP data.

You can use the NDMP protocol to protect data on NAS devices.

For a detailed overview about creating, editing, and deleting groups and policies, refer to the Data Protection Policies chapter in the *EMC NetWorker Administration Guide*. NDMP backup configuration follows the traditional backup strategy.

Overview of data protection policies

Data protection policy is a concept that provides you with the ability to design a data protection solution for the environment at the data level instead of at the host level. With a data protection policy, each client in the environment is a backup object and not simply a host.

Data protection policies enable you to back up and manage data in a variety of environments, as well as to perform system maintenance tasks on the NetWorker server.

A data protection policy solution encompasses the configuration of the following key NetWorker resources:

Policies
Policies provide you with the ability to develop a service-catalogue approach to the configuration of a NetWorker datazone. Policies enable you to manage all data protection tasks and the data protection lifecycle from a central location.

Policies provide an organizational container for the workflows, actions, and groups that support and define the backup, management, and system maintenance actions that you want to perform.

Workflows
Workflows define the start time for a series of actions, the frequency in which the actions run, the order of actions in a sequence, and the protection group to which the workflow applies.

A workflow can be as simple as a single action that applies to a finite list of Client resources, or a complex chain of actions that apply to a dynamically changing list of resources. In a workflow, some actions can be set to occur sequentially, and others can occur concurrently.

You can create multiple workflows in a single policy. However, each workflow can belong to only one policy. When you add multiple workflows to the same policy, you can logically group data protection activities with similar service level provisions together, to provide easier configuration, access, and task execution.

Protection groups
Protection groups define a set of static or dynamic Client resources or save sets to which a workflow applies. There are also dedicated protection groups for backups in a VMware environment or for snapshot backups on a NAS device. Review the following information about protection groups:

- Create one protection group for each workflow. Each group can be assigned to only one workflow.

- You can add the same Client resources and save sets to more than one group at a time.
- You can create the group before you create the workflow, or you can create the group after you create the workflow and then assign the group to the workflow later.

Actions

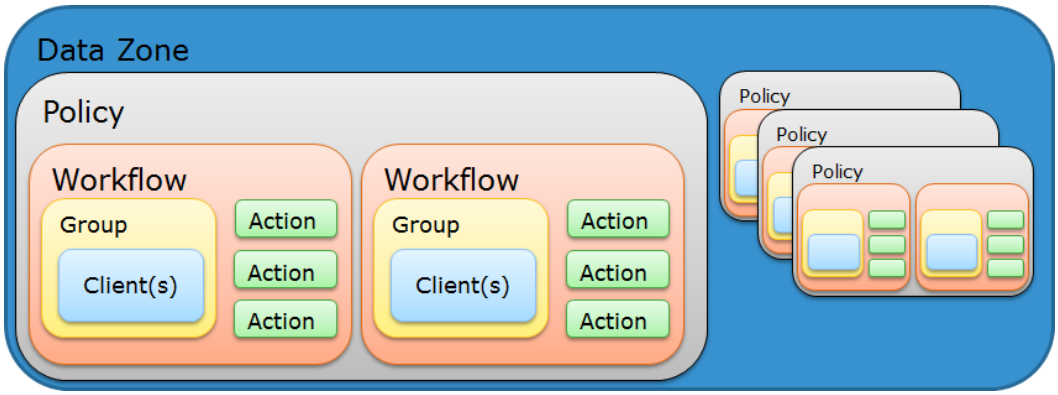
Actions are the key resources in a workflow for a data protection policy and define a specific task, for example, a backup, clone, or snapshot. NetWorker uses a work list to the define task. A work list is composed of one or several work items. Work items include client resources, virtual machines, save sets, or tags. You can chain multiple actions together to occur sequentially or concurrently in a workflow. All chained actions use the same work list.

When you configure an action, you define the days on which to perform the action, as well as other settings specific to the action. For example, you can specify a destination pool, a retention period, and a target storage node for the backup action, which can differ from the subsequent action that clones the data.

You can create multiple actions for a single workflow. However, each action applies to a single workflow and policy.

The following figure provides a high level overview of the components that make up a data protection policy in a datazone.

Figure 37 Data Protection Policy



Default data protection policies

NetWorker provides you with preconfigured data protection polices resources that you can use immediately to protect your environment, modify to suit your environment, or use an example to create new resource configurations. To use these policy resources, you must add clients to the appropriate group resource.

Each protection policy provides an example of the EMC best practices that you should follow when you design your data protection solution:

- Separate file system backups from application database backups, to provide ease of access at recovery time.
- Stagger the start times for file system backup from the application database backups, to prevent disk contention on the target hosts.

The default data protection policy resources mimic the requirements of a service provider, with different policies to that are designed to provide protection based on service level agreements.

Platinum policy

The Platinum policy provides you with an example of a data protection policy for an environment that contains EMC storage arrays or appliances and requires backup data

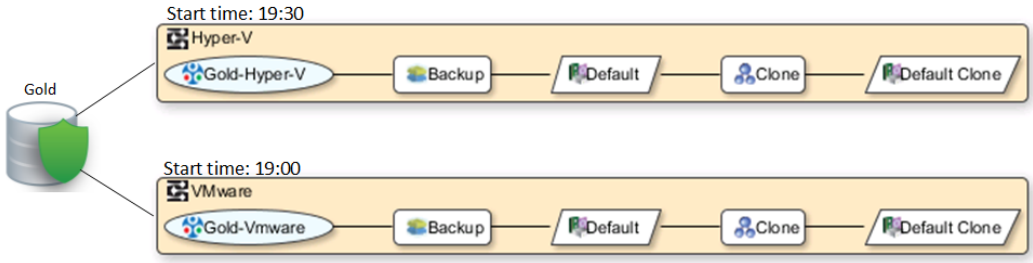
redundancy. The policy contains one workflow with two actions, a snapshot backup action, followed by a clone action.

Figure 38 Platinum policy configuration

Gold policy

The Gold policy provides an example of a data protection policy for an environment that contains virtual machines and requires backup data redundancy. The policy contains two workflows, one to protect Hyper-V hosts and one to protect VMware hosts. Each workflow contains a backup action followed by a clone action.

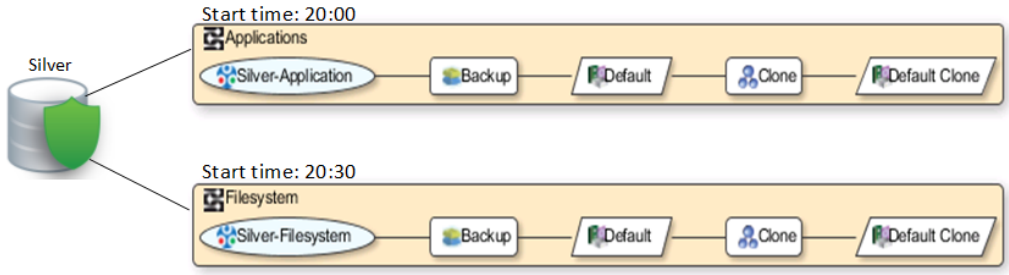
Figure 39 Gold policy configuration



Silver policy

The Silver policy provides an example of a data protection policy for an environment that contains non-virtualized machines and requires backup data redundancy. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action followed by a clone action.

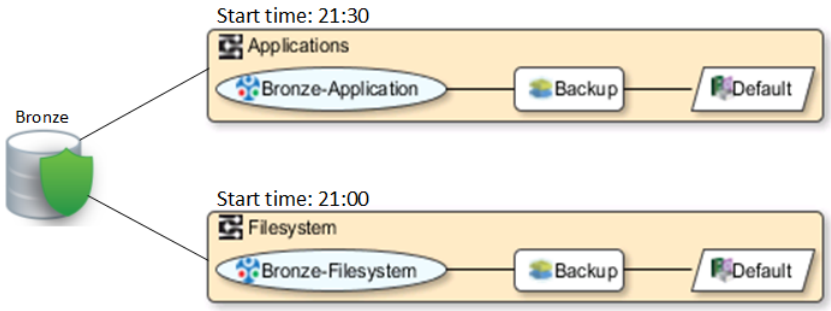
Figure 40 Silver policy configuration



Bronze policy

The Bronze policy provides an example of a data protection policy for an environment that contains non-virtualized machines. The policy contains two workflows, one to protect hosts file systems and one to protect database applications. Each workflow contains a backup action.

Figure 41 Bronze policy configuration



Road map for configuring a new data protection policy

Procedure

1. Create a policy.

   When you create a policy, you specify the name and notification settings for the policy.

2. Within the policy, create a workflow for each data type.

   For example, create one workflow to protect file system data and one workflow to protect application data. When you create a workflow, you specify the name of the workflow, the time to start the workflow, notification settings for the workflow, and the protection group to which the workflow applies.

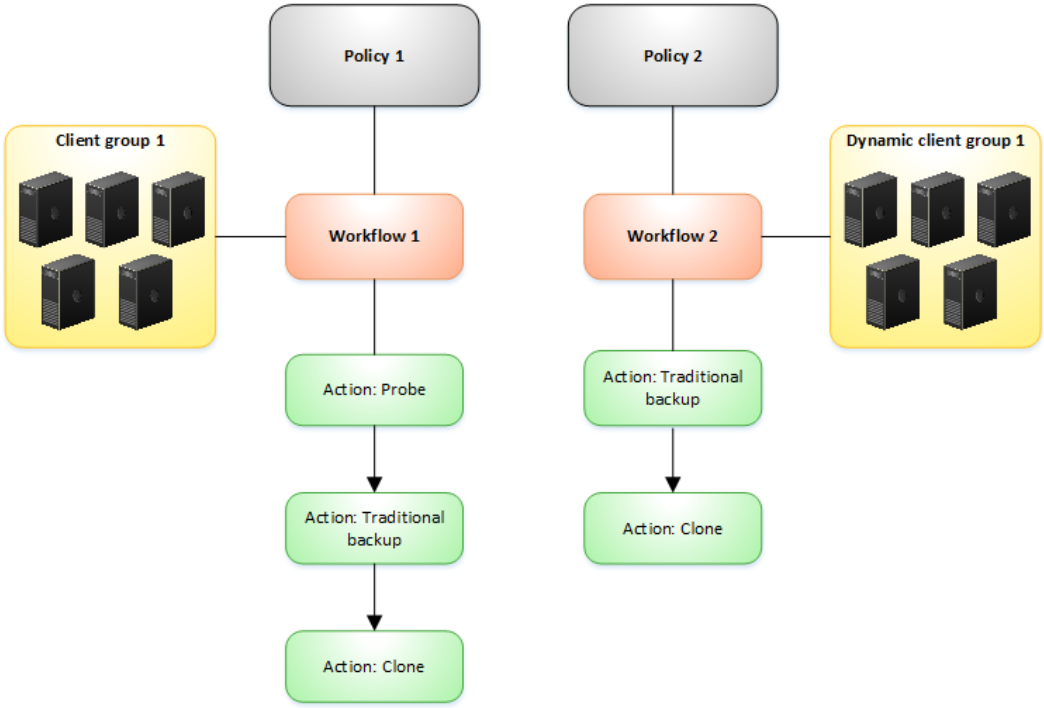
3. Create a protection group.

   The type of group that you create depends on the types of clients and data that you want to protect. The actions that appear for a group depend on the group type.

4. Create one or more actions for the workflow.
5. To define the backup data that you want to protect, configure Client resources, and then assign the client resources to a protection group.

The following figure illustrates a policy with two different workflows. Workflow 1 performs a probe and then a backup of the Client resources in Client group 1, and then clones the save sets from the backups. Workflow 2 performs a backup of the Client resources in Dynamic client group 1, and then clones the save sets from the backups.

Figure 42 Data protection policy example



Strategies for traditional backups

The primary considerations for a traditional backup strategy are the groups of Client resources, the workflows that define the series of actions that are associated with the backup, and the schedule for the backup.

Creating a policy

Procedure

1. On the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Policies**, and then select **New**.

   The **Create Policy** dialog box appears.
3. On the **General** tab, in the **Name** field type a name for the policy.

   The maximum number of characters for the policy name is 128.

   Note

   After you create a policy, the **Name** attribute is read-only.
4. In the **Comment** box, type a description for the policy.
5. From the **Send Notifications** list, select whether to send notifications for the policy:
   - To avoid sending notifications, select **Never**.

- To send notifications with information about each successful and failed workflow and action after all the actions in the policy complete, select **On Completion**.
- To send a notification with information about each failed workflow and action after all the actions in the policy complete, select **On Failure**.

6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:

   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```

   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```

   - On Windows, to send a notification email, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:

     - ***-s subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
     - ***-h mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
     - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

7. To specify the Restricted Data Zone (RDZ) for the policy, select the **Restricted Data Zones** tab, and then select the RDZ from the list.
8. Click **OK**.

After you finish

Create the workflows and actions for the policy.

Creating a workflow in a new policy

A policy must contain one or more workflows.

Procedure

1. In the left pane of the **Protection** window, expand **Policies**, and then select the policy that you created.

2. In the right pane of the **Protection** window, select **Create a new workflow**.
3. In the **Name** field, type the name of the workflow.

   The maximum number of characters for the name of the group is 64.
4. In the **Comment** box, type a description for the workflow. The maximum number of characters for the **Comment** field is 128.
5. From the **Send Notifications** list, select how to send notifications for the workflow:
   - To use the notification configuration that is defined in the policy resource to determine when to send the notification, select **Set at policy level**.
   - To send notifications with information about each successful and failed workflow and action, after all the actions in the workflow complete, select **On Completion**.
   - To send notifications with information about each failed workflow and action, after all the actions in the workflow complete, select **On Failure**.
6. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

   The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

   For example:
   - To log notifications to a file named `policy_notifications.log`, type the following command:

     ```
     nsrlog -f policy_notifications.log
     ```
   - On Linux, to send a notification email, type the following command:

     ```
     mail -s subject recipient
     ```
   - On Windows, type the following command:

     ```
     smtpmail -s subject -h mailserver recipient1@mailserver
     recipient2@mailserver...
     ```

     where:
     - **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
     - **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
     - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.
7. In the **Running** group box, define when and how often the workflow runs.
   a. To ensure that the actions contained in the workflow run when the policy or workflow is started, in the **Enabled** box, leave the option selected. To prevent the

actions in the workflow from running when the policy or workflow that contains the action is started, clear this option.

b. To ensure that the workflow starts at the time that is specified in the **Start time** attribute, on the days that are defined in the action resource, in the **AutoStart Enabled** box, leave the option selected. To prevent the workflow from running at the time that is specified in the **Start time** attribute, clear this option.

c. To define the time to start the actions in the workflow, in the **Start Time** attribute, use the spin boxes.

   The default value is 9:00 P.M.

d. To define how frequently to repeat the actions that are defined in the workflow over a 24 hour period, In the **Interval** attribute, use the spin boxes.

   The default value is 24 hours, or once a day. When you select a value that is less than 24 hours, the **Interval End** attribute appears. To define the last time to start a workflow in a defined interval period, use the spin boxes .

e. To define the duration of time in which NetWorker can manually or automatically restart a failed or canceled workflow, in the **Restart Window** attribute, use the spin boxes.

   If the restart window has elapsed, NetWorker considers the restart as a new run of the workflow. NetWorker calculates the restart window from the start of the last incomplete workflow. The default value is 24 hours.

For example, when you set the **Start Time** to 7:00 PM, the **Interval** to 1 hour, and the **Interval end time** to 11:00 P.M., then the workflow automatically starts every hour beginning at 7:00 P.M. and the last start time is 11:00 PM.

8. To create the workflow, click **OK**.

After you finish

Create the actions that will occur in the workflow, and then assign a group to the workflow. If a workflow does not contain a group, a policy does not perform any actions.

Protection groups for traditional backups

Create protection groups for traditional backups, which identifies the Client resources to back up.

You can create two types of protection groups for a traditional backup:

- Basic client group—Defines a static list of Client resources to back up.
- Dynamic client group—Specifies a dynamic list of Client resources to back up. A dynamic client group automatically generates a list of Client resources that use client tag which matches the client tag that is specified for the group.

Create multiple groups to perform different types of backups for different Client resources, or to perform backups on different schedules. For example:

- Create one group for backups of clients in the Accounting department, and another group for backups of clients in the Marketing department.
- Create one group for file system backups and one group for backups of Microsoft Exchange data with the NetWorker Module for Microsoft.
- Create one group for a workflow with backups actions that start at 11 p.m., and another group for a workflow with backup actions that start at 2 a.m.

Note

A Client resource can belong to more than one group.

Creating a client group

Basic client groups define a static list of Client resources for a traditional backup, check connectivity, or probe action.

Before you begin

Create the Client resources for the data to include in a protection group.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.
3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.
4. From the **Group Type** list, leave the default selection of **Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.
7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group.

Creating a dynamic client group

Dynamic client groups prevent you from having to edit group settings when you add Client resources to the NetWorker datazone. You can configure a dynamic group to include all the clients on the NetWorker server or you can configure the dynamic group to perform a query that generates a list of clients that is based on a matching tag value. A tag is a string attribute that you define in a Client resource. When an action starts in a workflow that is a member of a tagged dynamic protection group, the policy engine dynamically generates a list of Client resources that match the tag attribute value.

Use dynamic client groups to specify a dynamic list of Client resources for a traditional backup, probe, check connectivity, or server backup action.

Procedure

1. In the **Administration** window, click **Protection**.
2. In the expanded left pane, right-click **Groups**, and then select **New**.

   The **Create Group** dialog box appears, starting with the **General** tab.

3. In the **Name** attribute, type a name for the group.

   The maximum number of characters for the group name is 64.

   Note

   After you create a group, the **Name** attribute is read-only.

4. From the **Group Type** list, select **Dynamic Clients**.
5. In the **Comment** field, type a description of the group.
6. Select the workflow in which to assign the group from the **Policy-Workflow** list.

   Note

   You can also assign the group to a workflow when you create or edit a workflow.

7. (Optional) On the **Restricted Datazones** tab, to specify the Restricted Datazone (RDZ) for the group, select the RDZ from the list.
8. Click **OK**.

After you finish

Create Client resources. The Client Configuration wizard and **General** tab on the **Client Properties** dialog box properties page provide you with the ability to assign clients to a protection group and define one or more tags.

Actions sequences in traditional backup workflows

Workflows enable you to chain together multiple actions and run them sequentially or concurrently.

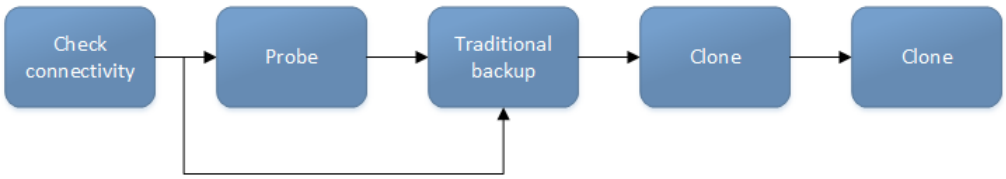
A workflow for a traditional backup can optionally include a probe or check connectivity action before the backup, and a clone action either concurrently with or after the backup.

The following sections provide details on supported actions that can follow the lead action and other actions in a workflow.

All possible workflow actions for a traditional backup

The following figure illustrates the possible workflow actions that are associated with a traditional backup.

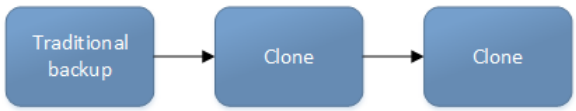
Figure 43 All possible workflow actions for a traditional backup



Workflow path from a traditional backup action

The only action that can follow a traditional backup is a clone action.

Figure 44 Workflow path from a traditional backup action



Creating a check connectivity action

A check connectivity action tests connectivity between clients and the NetWorker server, usually before another action such as a backup occurs.

Before you begin

Create the policy and workflow that contain the action. The check connectivity action should be the first action in the workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.
5. From the **Action Type** list, select **Check Connectivity**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to check connectivity with the client.

   The following table provides details on the icons.

Table 66 Schedule icons

Icon	Label	Description
	Execute	Check connectivity on this day.

Table 66 Schedule icons (continued)

Icon	Label	Description
	Skip	Do not check connectivity on this day.

To check connectivity every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Connectivity Options** page appears.

11. Select the success criteria for the action:
    - To specify that the connectivity check is successful only if successful connectivity is achieved with all clients in the assigned group, select the **Succeed only after all clients succeed** checkbox.
    - To specify that the connectivity check is successful if connectivity is achieved with one or more clients in the assigned group, clear the checkbox.

12. Click **Next**.

    The **Specify the Advanced Options** page appears.

13. (Optional) Configure advanced options and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, **Inactivity Timeout**, or the **Send Notification** options appear, the Check Connectivity action does not support these options and ignores the values.

14. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

15. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

16. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
17. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
18. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

19. Click **Next**.

    The **Action Configuration Summary** page appears.
20. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create one of the following actions to automatically occur after the check connectivity action:

- Probe
- Traditional backup

  Note

  This option is not available for NAS snapshot backups.

- Snapshot backup

Creating a probe action

A probe action runs a user-defined script on a NetWorker client before the start of a backup. A user-defined script is any program that passes a return code. If the return code is 0 (zero), then a client backup is required. If the return code is 1, then a client backup is not required.

Before you begin

- Create the Probe resource script on the clients that use the probe. Create a client Probe resource on the NetWorker server, and then associate the client Probe resource with the Client resource on the NetWorker server.

- Create the policy and workflow that contain the action.
- (Optional) Create a check connectivity action to precede the probe action in the workflow. A check connectivity action is the only supported action that can precede a probe action in a workflow.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.
2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.
3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Probe**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to probe the client.

   The following table provides details on the icons.

Table 67 Schedule icons

Icon	Label	Description
	Execute	Perform the probe on this day.
	Skip	Do not perform a probe on this day.

To perform a probe every day, select **Execute** from the list, and then click **Make All**.

10. Click **Next**.

    The **Specify the Probe Options** page appears.

11. Choose whether to start the subsequent backup action only after all probes succeed by selecting or clearing the **Start backup only after all probes succeed** checkbox.
    - To start the backup only if all the probes associated with Client resources in the assigned group succeed, select the checkbox.
    - To start the backup if any one of the probes are associated with a Client resource in the assigned group succeed, clear the checkbox.

12. Click **Next**.

    The **Specify the Advanced Options** page appears.

13. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

14. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

    Note

    The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

15. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

    If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

    Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

    Note

    The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

16. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

Note

The **Parallelism** value should not exceed 25.

For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

17. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.
    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

Note

If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

18. Leave the default selections for the Notification group box. NetWorker does not support notifications for probe actions and ignores the values that are defined in the attributes.
19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:
    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.

- In the **Override** field, type an override.

Note

To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.

23. Review the settings that you specified for the action, and then click **Configure**.

Creating a traditional backup action

A traditional backup is a scheduled backup of the save sets defined for the Client resources in the assigned group for the workflow.

Before you begin

- Create the policy and workflow that contain the action.
- (Optional) Create actions to precede the backup action in the workflow. Supported actions that can precede a backup include:
  - Probe
  - Check connectivity

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.

2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.

3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Backup**.
6. From the secondary action list, select the backup type, for example, **Traditional**.
7. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
8. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.

9. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
10. Click the icon on each day to specify the backup level to perform.

    The following table provides details about the backup level that each icon represents.

    Table 68 Schedule icons

Icon	Label	Description
	Full	Perform a full backup on this day. Full backups include all files, regardless of whether the files changed.
	Incr	Perform an incremental backup on this day. Incremental backups include files that have changed since the last backup of any type (full or incremental).
	Cumulative Incr	Perform a cumulative incremental backup. Cumulative incremental backups include files that have changed since the last full backup.
	Logs Only	Perform a backup of only database transaction logs.
	Synthetic Full **Note** Not supported for NDMP.	Perform a synthetic backup on this day. A synthetic full backup includes all data that changed since the last full backup and subsequent incremental backups to create a synthetic full backup.
	Skip	Do not perform a backup on this day.

    To perform the same type of backup on each day, select the backup type from the list and click **Make All**.

    NetWorker does not support the use of synthetic full backup levels for NDMP data.

    EMC Celerra, Isilon, VNX, and NetApp filers with NDMP version 4 or later support token-based backups (TBB) to perform NDMP full and incremental backups. NetWorker supports the same number of incremental levels that the NAS vendor supports. EMC Celerra, Isilon, and NetApp documentation provide the maximum number of incremental levels that the TBB incremental backup can support.

    When you configure TBB after you update the NetWorker server from 7.6 SP1 or earlier, the first incremental backup does not occur until after one complete full backup.

    Filers that do not support TBB, do not support incremental backups. If you select the level Incr, the NetWorker server performs a full backup.

    Verify the NAS storage vendor supports NDMP incremental backups before you use this feature.

11. Click **Next**.

    The **Specify the Backup Options** page appears.

12. From the **Destination Storage Node** box, select the storage node with the devices on which to store the backup data.
13. From the **Destination Pool** box, select the media pool in which to store the backup data.
14. From the **Retention** boxes, specify the amount of time to retain the backup data.

    After the retention period expires, the save set is removed from the client file index and marked as recyclable in the media database during an expiration server maintenance task.

    When you define the retention policy an NDMP client, consider the amount of disk space that is required for the client file index. NDMP clients with several thousands of small files have significantly larger client file indexes on the NetWorker server than a non-NDMP client. A long retention policy for an NDMP client increases disk space requirements on the file system that contains the client file indexes.

15. From the **Client Override Behavior** box, specify how NetWorker uses certain client configuration attributes that perform the same function as attributes in the Action resource.
    - **Client Can Override**—The values in the Client resource for **Schedule**, **Pool**, **Retention policy**, and the **Storage Node** attributes will take precedence over the values that are defined in the equivalent Action resource attributes.
    - **Client Can Not Override** —The values in the Action resource for the **Schedule**, **Destination Pool**, **Destination Storage Node**, and the **Retention** attributes take precedence over the values that are defined in the equivalent Client resource attributes.
    - **Legacy Backup Rules**—This value only appears in actions that are created by the migration process. The updating process sets the **Client Override Behavior** for the migrated backup actions to **Legacy Backup Rules**.
16. Click **Next**.

    The **Specify the Advanced Options** page appears.
17. In the **Retries** box, specify the number of times that NetWorker should retry a failed probe or backup action, before NetWorker considers the action as failed. When the **Retries** value is 0, NetWorker will not retry a failed backup or probe action.

    Note

    The **Retries** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

18. In the **Retry Delay** field, specify a delay in seconds to wait before retrying a failed backup or probe action. When the **Retry Delay** value is 0, NetWorker retries the failed backup or probe action immediately.

    Note

    The **Retry Delay** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

19. In the **Inactivity Timeout** field, specify the maximum number of minutes that a job run by an action is allowed to fail to communicate back to the server.

If the job fails to respond within the timeout value, the server considers the job a failure. If a job fails, NetWorker retries the job immediately. This ensures that no time is lost due to failures.

Increase the timeout value if a backup consistently aborts due to inactivity. Inactivity timeouts may occur for backups of large save sets, backups of save sets with large sparse files, and incremental backups of many small static files.

Note

The **Inactivity Timeout** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types. When you specify a value for this option in other actions, NetWorker ignores the values.

20. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

21. From the **Failure Impact** list, specify what to do when a job fails:
    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

22. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
23. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.

24. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.
      - To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
      - In the **Override** field, type an override.

        Note

        To remove an override, delete the entry from the **Override** field.

25. From the **Send Notifications** list box, select whether to send notifications for the action:

    - Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
    - Select **On Completion** to send a notification on completion of the action.
    - Select **On Failure** to send a notification only if the action fails to complete.

26. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

    - On Window, to send a notification email, type the following command:

      ```
      smtpmail -s subject -h mailserver recipient1@mailserver
      recipient2@mailserver...
      ```

      where:

      - **`-s subject`**—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail`

program assumes that the message contains a correctly formatted email header and nothing is added.

- **`-h mailserver`**—Specifies the hostname of the mail server to use to relay the SMTP email message.
- *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

27. Click **Next**.

    The **Action Configuration Summary** page appears.

28. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets after the backup. A clone action is the only supported action after a backup action in a workflow.

Cloning NDMP save sets

You can clone Direct-NDMP and NDMP-DSA save sets by using the same methods used to clone non-NDMP save sets.

Before you clone NDMP save sets, review these requirements:

- To clone Direct-NDMP or Three-party backup data:
  - The source NAS must run NDMP version 3 or later.
  - The destination NAS can run any version of NDMP, but you cannot clone a volume cloned with NDMP earlier than version 3 to another volume.
  - You cannot clone NDMP save sets to a non-NDMP device.
  - You can clone NDMP tapes from one NDMP host to another NDMP host of the same type. For example, you can clone tapes from a NetApp filer with an attached library to another NetApp filer or to the same filer.
- You require two NDMP devices to clone the NDMP save sets, one device to perform the read operation and one device to perform the write operation.
- You must clone NDMP-DSA backups to non-NDMP devices. You can however, clone NDMP-DSA save from one type of tape device to another. For example you can clone save sets on a DLT device to an AIT device.
- Use the nsrclone program to clone NDMP save sets from a command prompt. The *EMC NetWorker Command Reference Guide* or the UNIX man pages provide more information on nsrclone usage.

Creating a clone action

A clone action creates a copy of one or more save sets. Cloning allows for secure offsite storage, the transfer of data from one location to another, and the verification of backups.

Procedure

1. In the expanded left pane, select the workflow, and then perform one of the following tasks in the right pane to start the Policy Action wizard:
   - If this is the first action in the workflow, select **Create a new action**.
   - If the workflow has other actions, right-click an empty area of the **Actions** pane, and then select **New**.

   The **Specify the Action Information** page appears.

2. In the **Name** field, type the name of the action.

   The maximum number of characters for the action name is 64.

3. In the **Comment** field, type a description for the action.
4. To ensure that the action runs when the policy or workflow that contains the action is started, in the **Enabled** box, select the option. To prevent the action from running when the policy or workflow that contains the action is started, clear this option.

   Note

   When you clear the **Enabled** option, any action that occurs after a disabled action will not start, even if the succeeding options are enabled.

5. From the **Action Type** list, select **Clone**.
6. When you create the action as part of the workflow configuration, the workflow appears automatically in the **Workflow** box and the box is grayed out.
7. Specify the order of the action in relation to other actions in the workflow:
   - If the action is part of a sequence of actions in a workflow path, select the action that should precede this action from the **Previous** box.
   - If the action should run concurrently with an action, select the concurrent action from the **Previous** box, and then select the **Concurrent** checkbox.
8. Select whether to use a weekly or monthly schedule for the action:
   - To specify a schedule for each day of the week, select **Weekly by day**.
   - To specify a schedule for each day of the month, select **Monthly by day**.
9. Click the icon on each day to specify whether to perform cloning.

   The following table provides details on the icons.

   Table 69 Schedule icons

Icon	Label	Description
	Execute	Perform cloning on this day.
	Skip	Do not perform cloning on this day.

   To perform cloning every day, select **Execute** from the list and click **Make All**.

10. Click **Next**.

    The **Specify the Clone Options** page appears.

11. In the **Data Movement** group box, define the volumes and devices to which NetWorker sends the clone data.
    a. From the **Destination Storage Node** list, select the storage node with the devices on which to store the cloned save sets.
    b. In the **Delete source save sets after clone completes**, select the option to instruct NetWorker to remove the source save set information from the client file index, and to mark the save set as recyclable in the media database during a Server expiration maintenance action. Clear this option to allow the source save sets to expire based on the defined retention time.

c. From the **Destination Pool** list, select the target media pool for the cloned save sets.

d. From the **Retention** list, specify the amount of time to retain the cloned save sets.

After the retention period expires, the save sets are marked as recyclable during an expiration server maintenance task.

12. In the **Filters** group box, define the criteria that NetWorker uses to create the list of eligible save sets to clone. The eligible save sets must match the requirements that are defined in each filter. NetWorker provides the following filter options:

a. Time filter—Use the **Time** section to define the time range in which NetWorker should inspect, when searching for eligible save sets to clone in the media database. Use the spin boxes to specify the start of the time range and the end of the time range. The **Time** filter list includes three options, which define how NetWorker determines save set eligibility, based on the time criteria:

- **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.
- **Reject**—The clone save set list does not include save sets whose save time is within the time range that is specified by the spin boxes and meet all the other defined filter criteria.

b. Save Set filter—Use the **Save Set** section to instruct NetWorker to include or exclude ProtectPoint and Snapshot save sets, when searching for eligible save sets to clone in the media database. The **Save Set** filter list includes three options, which define how NetWorker determines save set eligibility, based on the save set criteria:

- **Do Not Filter**—NetWorker inspects the save sets in the media database to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible ProtectPoint or Snapshot save sets, when you also enable the ProtectPoint or Snapshot checkboxes.
- **Reject**—The clone save set list does not include eligible ProtectPoint and Snapshot save sets when you also enable the ProtectPoint and Snapshot checkboxes.

c. Clients filter—Use the **Client** section to define a list of clients to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Client** list includes three options, which define how NetWorker determines save set eligibility, based on the client criteria:

- **Do Not Filter**—NetWorker inspects save sets that are associated with the clients in the media database, to create a clone save set list that meets the filter criteria.
- **Accept**—The clone save set list includes eligible save sets for the selected clients.
- **Reject**—The clone save set list does not include eligible save sets for the selected clients.

d. Levels filter—Use the **Levels** section to define a list of backup levels to include or exclude, when NetWorker searches for eligible save sets to clone in the media database. The **Levels** filter list includes three options, which define how NetWorker determines save set eligibility, based on the level criteria:

- **Do Not Filter**—NetWorker inspects save sets regardless of level in the media database, to create a clone save set list that meets all the filter criteria.
- **Accept**—The clone save set list includes eligible save sets with the selected backup levels.
- **Reject**—The clone save set list does not include eligible save sets with the selected backup levels.

13. Click **Next**.

    The **Specify the Advanced Options** page appears.

14. Configure advanced options, including notifications and schedule overrides.

    Note

    Although the **Retries**, **Retry Delay**, or the **Inactivity Timeout** options appear, the clone action does not support these options and ignores the values.

15. In the **Parallelism** field, specify the maximum number of concurrent operations for the action.

    Note

    The **Parallelism** value should not exceed 25.

    For Direct-NDMP backups, set the parallelism value to the number of available NDMP drives.

    If you set the parallelism attribute to a higher value, there will not be enough drives to support all the queued backup save sets. Large save sets might fail due to the inactivity timeout limit.

    When NDMP groups back up simultaneously, divide the number of drives by the number of groups. Use this value for each of the parallelism attributes.

    Setting the parallelism value for the group overrides the parallelism value that is defined for the NDMP clients.

16. From the **Failure Impact** list, specify what to do when a job fails:

    - To continue the workflow when there are job failures, select **Continue**.
    - To abort the current action if there is a failure with one of the jobs, but continue with subsequent actions in the workflow, select **Abort action** .

      Note

      The **Abort action** option only applies to probe actions, and the backup actions for the Traditional and Snapshot action types.

    - To abort the entire workflow if there is a failure with one of the jobs in the action, select **Abort workflow**.

    Note

    If any of the actions fail in the workflow, the workflow status does not appear as interrupted or cancelled. NetWorker reports the workflow status as failed.

17. From the **Send Notifications** list box, select whether to send notifications for the action:

- Select **Set at policy level** to use the notification configuration that is defined in the Policy resource to send the notification.
- Select **On Completion** to send a notification on completion of the action.
- Select **On Failure** to send a notification only if the action fails to complete.

18. In the **Send notification** attribute when you select the **On Completion** or **On failure** option, the **Command** box appears. Use this box to configure how NetWorker sends the notifications. You can use the `nsrlog` action to write the notifications to a log file or configure an email notification.

    The default notification action is to log the information to the `policy_notifications.log` file. The `policy_notifications.log` file is located in the `/nsr/logs` directory on Linux and the `C:\Program Files\EMC NetWorker\nsr\logs` folder on Windows, by default. You can use the `smtpmail` application on Windows or the default mailer program on Linux to send email messages.

    For example:

    - To log notifications to a file named `policy_notifications.log`, type the following command:

      ```
      nsrlog -f policy_notifications.log
      ```

    - On Linux, to send a notification email, type the following command:

      ```
      mail -s subject recipient
      ```

    - On Window, to send a notification email, type the following command:

      ```
      smtpmail -s subject -h mailserver recipient1@mailserver
      recipient2@mailserver...
      ```

      where:

      - ***-s subject***—Includes a standard email header with the message and specifies the subject text for that header. Without this option, the `smtpmail` program assumes that the message contains a correctly formatted email header and nothing is added.
      - ***-h mailserver***—Specifies the hostname of the mail server to use to relay the SMTP email message.
      - *recipient1@mailserver*—Is the email address of the recipient of the notification. Multiple email recipients are separated by a space.

19. From the **Soft Limit** list, specify the amount of time after the action starts to stop the initiation of new activities. The default value of 0 (zero) indicates no limit.
20. From the **Hard Limit** list, specify the amount of time after the action starts to begin terminating activities. The default value of 0 (zero) indicates no limit.
21. (Optional) Configure overrides for the task that is scheduled on a specific day.

    To change the month on which to schedule the override, use the navigation buttons and the month list box. To change the year, use the spin boxes. You can set an override in the following ways:

    - Select the day in the calendar, which changes the action task for the specific day.
    - Use the action task list to select the task, then perform one of the following steps:
      - To define an override that occurs on a specific day of the week, every week, select **Specified day**, then use the drop downs. Click **Add Rules based override**.

- To perform the action task on the last day of the calendar month, select **Last day of the month**. Click **Add Rules based override**.
- In the **Override** field, type an override.

Note

To remove an override, delete the entry from the **Override** field.

22. Click **Next**.

    The **Action Configuration Summary** page appears.

23. Review the settings that you specified for the action, and then click **Configure**.

After you finish

(Optional) Create a clone action to automatically clone the save sets again after this clone action. Another clone action is the only supported action after a clone action in a workflow.

Visual representation of traditional backup workflows

Figure 45 Traditional backup workflow

When you create actions for a workflow, a map provides a visual representation of the actions in the second right pane of the **Protection** window of the **Administration** interface.

The oval icon at the beginning of the visual representation specifies the group to which the workflow applies, the rounded rectangle icons identify actions, and the parallelogram icons identify the destination pool for the action.

You can work directly in the visual representation of a workflow to perform the following tasks:

- Adjust the display of the visual representation by right-clicking and selecting one of the following options:
  - **Zoom In**—Use to increase the size of the visual representation.
  - **Zoom Out**—Use to decrease the size of the visual representation.
  - **Zoom Area**—Use to limit the display to a single section of the visual representation.
  - **Fit Content**—Use to fit the visual representation to the window area.
  - **Reset**—Use to reset the visual representation to the default settings.
  - **Overview**—To view a separate dialog box with a high-level view of the visual representation and a legend of the icons.
- View and edit the properties for the group, action, or destination pool by right-clicking the icon for the item and selecting **Properties**.
- Create a group, action, or destination pool by right-clicking the icon for the item and selecting **New**.

Performing manual NDMP backups

After you configure the NetWorker server for NDMP backup data operations, you can perform manual NDMP backups.

On Windows, you can manually back up NDMP data by using the NetWorker User program. The method to backup NDMP data is the same as a non-NDMP local backup. You cannot perform a three-party backup with the NetWorker User program.

On Windows and UNIX, you can perform a manual backup from a command prompt by using the `nsrndmp_save` command. Performing an NDMP backup from the command line provides more information.

Before performing a manual backup by using the `nsrndmp_save` command or the NetWorker User program, review these requirements:

- You can only perform manual Direct-NDMP backups from a NetWorker server.
- You can start a manual NDMP-DSA backup from a NetWorker server, storage node, or client. When you do not start the NDMP-DSA backup from the NetWorker server, the `servers` file on the NetWorker server and storage node, must contain the hostname of the host that initiates the backup.
- Before you perform a manual backup, you must configure the NDMP client on the NetWorker server. Manual backups use client configuration information for example, the variables that are defined in the **Application Information** attribute of an NDMP client.
- Direct-NDMP and three-party NDMP backups support manual DAR backups when the NDMP client contains the *DIRECT=Y* and *HIST=Y* environment variables in the **Application Information** attribute for the NDMP client.

  NOTICE

  To use DAR, the NAS filer must use NDMP version 4. The *EMC NetWorker Online Software Compatibility Guide* describes how to determine if a particular NDMP vendor supports DAR.

Performing an NDMP backup from the command line

Use the `nsrndmp_save` command to perform a manual command line NDMP backup.

The `nsrndmp_save` command does not back up the bootstrap. Without the bootstrap, you cannot perform a disaster recovery of the NetWorker server. To back up the bootstrap, run the `nsrpolicy` ***-G nsrpolicy policy_name start*** command from the NetWorker server. The `nsrpolicy` command uses the attribute values specified for the policy. For example, the pool and schedule values.

To perform an NDMP backup from the command prompt, use the following syntax:

`nsrndmp_save -T` ***backup_type*** `-s` ***NetWorker_servername*** `-c` ***clientname*** `-l` ***backup_level*** `-t` ***date_time*** `-g` ***nsrpolicy path***

where:

- *backup_type* is a supported backup type for the NAS filer:
  - BlueArc only supports the `dump` backup type.
  - MiraPoint only supports the `image` backup type.
- *backup_level* is a full for a full backup, incr for an incremental backup. Each NAS supports full backups.

Note

EMC Celerra, Isilon, and NetApp filers only support full and incremental level backups.

- *date_time* is the date and time of the last backup, which is enclosed in double quotes. Specify this value for incr level backups. When you do not specify the date and time, the backup is a native NDMP level-based backup.

  NOTICE

  During a NetWorker scheduled policy backup, the NetWorker software supplies the date and the time information, and incremental and level backups work as expected.

  Use one of these methods to determine the date and time of the last NDMP backup:

  - Review the `daemon.raw` file on the NetWorker server or the savegroup completion report for a line similar to the following:

    ```
    42920:nsrndmp_save: browsable savetime=1296694621
    ```

    Use the value after `savetime=` with the `-t` option.
  - Specify the date and time of the last backup reported by the `mminfo` command for the NDMP save set.

Note

You can force the NDMP backup and recovery to ignore IPv6 and instead use IPv4 in one of two ways:

1. Add the `-f` option to the `nsrndmp_save` or the `nsrndmp_recover` commands as required.
2. Select the **Disable IPv6** checkbox on the Apps & Modules tab in the **Client Properties** window.

Example of an NDMP backup

To perform an incremental backup of a NetApp client that is named mynetapp, perform the following steps:

1. Determine the time of the last full backup:

   ```
   mminfo -v -c mynetapp
   ```

client	date	time	size	ssid	fl	lvl	name
mynetapp	08/16/15	15:23:58	1853MB	3864812701	cbNs	full	/.../set1
mynetapp	08/17/15	15:39:58	815MB	3848036430	cbNs	incr	/.../set2

2. Specify the last backup time in `nsrndmp_save` command:

   ```
   nsrndmp_save -T dump -s my_nwserver -c mynetapp -l incr -t
   "02/16/11 15:23:58" -g mygroup path
   ```

For NDMP-DSA backups, the NetWorker software uses the Storage Node attribute field of the NDMP client to determine which host receives the backup data. The `nsrndmp_save` command does not require the `-M` and `-P` options. If you specify the `-M` and `-P` options,

they override the **Storage Node** attribute value. The *EMC NetWorker Command Reference Guide* and the `nsrndmp_save` man page on UNIX provide more information.

Troubleshooting NDMP configuration and backup failures for other filers

This section provides a list of the possible causes and the resolutions for NDMP backup failures.

Unable to connect to NDMP host *hostname*

This message appears when the NetWorker server cannot create or modify an NDMP client.

To resolve this issue ensure that the environment meets the following requirements:

- Username and password specified for the client is correct and has sufficient permissions to perform NDMP operations.
- NDMP service is running on the filer.

Cannot perform NDMP backup after the NetWorker server licenses expire

If a NetWorker sever running in evaluation mode expires before you authorize the server, NDMP devices remain disabled after the addition of the required licenses and authorization of the NetWorker server.

To re-enable NDMP devices, perform the following steps.

1. Use NMC to connect to the NetWorker server and click the **Devices** button.
2. In the **Devices** windows, right-click the NDMP device and select **Properties**.
3. Click the **Configuration** tab and set the **Target Sessions** attribute to **1**.
4. Click the **General** tab and in the **Enabled** section, select **Yes**.
5. Click **Ok**.

Failed to store index entries

This error message occurs in the `daemon.raw` file when an index backups fails due to an insufficient amount of swap space.

To resolve this issue, increase the amount of swap space available to the NetWorker server.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

IO_WritePage write failed - No space left on device (28): No space left on device

This error message appears in the `daemon.raw` file when the index backup fails. There is insufficient temporary space to store the index entries before the NetWorker software commits the information into the client file index.

To resolve this issue, specify a new the temp directory with sufficient disk space in one of the following ways:

- Define the *NSR_NDMP_TMP_DIR* environment variable in the Application Information attribute of the client.
- Define the *NSR_NDMP_TMP_DIR* as an operating system environment variable on the NetWorker server.

Memory and space requirements for NDMP FH updates on page 23 describes how to determine the amount of disk space the NetWorker software requires to temporarily store client files index entries.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

nsrndmp_save: get extension list: communication failure

This message appears during a NDMP local backup when NetWorker cannot determine the filer name.

To resolve this issue, perform the following steps.

1. From a command prompt on the NetWorker server, type:

   nsrndmpsup -c *NDMP_hostname* -o *output_filename*

   For example:

   nsrndmpsup -c myfiler.mnd.com -o nsrndmpsup.txt

2. Edit the output file that the `nsrndmpsup` command generates and search for the string **Vendor Name**. Make note of the reported Vendor Name.
   For example:

   `Vendor Name = BlueArc Corp`

3. Change to the `/nsr/debug` directory on UNIX or the `NetWorker_installation_dir\nsr\debug` directory on Windows.

4. Create new empty file and name it with the following format:

   ndmpgetextlist_disable_*VENDOR_NAME*

   where you replace *VENDOR_NAME* with the vendor name of the filer reported in the nsrndmpsup output file.

   For example, to create this file for a BlueArc filer on UNIX, type:

   touch "ndmpgetextlist_disable_BlucArc Corp"

Error reading the FH entries from save through stdin

This error message appears in the `daemon.raw` file of the NetWorker server when there is a communication error between the `nsrndmp_save` and `nsrndmp_2fh` processes.

Resolve any communication or connection issues, then retry the backup.

NOTICE

You cannot use the NetWorker User program to perform file-by-file and save set recoveries from a backup when the corresponding index update failed.

Cannot find file history info for filename...You may still be able to recover this file with a saveset recovery

This error message appears in the `daemon.raw` file of the NetWorker server when FH information is missing or corrupted for the file specified in the error message. For example, NetWorker cannot update the client file index(CFI) with FH information when a

backup process interruption occurs during the failover of a clustered NetWorker environment.

You cannot perform an NMDP file-by-file recover or a save set recover when the CFI does not contain the associated FH information.

To recover this file, perform a save set recover from the command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides for further information.

NOTICE

The NetWorker server does not delete the FH files stored in the `tmp` directory when the CFI updates fail.

nsrndmp_save: data connect: failed to establish connection

This error message appears in the `daemon.raw` file of the NetWorker server for several reasons:

- Network connectivity or name resolution issues exist between the NetWorker server and the NDMP client.
- You specified an incorrect NDMP username or password specified for the NDMP client.
- The NDMP service is not started on the NAS filer.
- The NetWorker server cannot communicate with the NAS filer over port 10000.
- A free port in the NetWorker server's default port range (7937-9936) is not available during an NDMP-DSA backup.
  The *EMC NetWorker Security Configuration Guide* provides more information about NDMP port requirements and configuration.
- A misconfigured loop router. For an EMC Celerra filer, the server route command utility configures the loop router. For NetApp, the route utility configures loop back router. The value of this setup is network-specific and depends on the number of switches and hubs between the NAS filer, NetWorker server, and NetWorker storage node.
- On the host where DSA is running, if the hostname is present in the hosts file, the `nsrdsa_save` process uses this name during backup. The DSA host passes the loopback entry to the NDMP data server and the connection fails. To resolve this issue, remove the hostname from the localhost list.

Knowledge base articles on the EMC Online Support Site provides detailed troubleshooting information for this error message and other failed to establish connection failures that you might encounter during an NDMP backup.

Monitoring NetWorker server activities in the Administration window

The **Monitoring** window in the NetWorker **Administration** application enables you to monitor the activities of an individual NetWorker server.

The **Monitoring** window provides the following types of activity and status information:

- Data protection policies, workflows, and individual actions.
- Cloning, recovering, synthetic full backups, and browsing of client file indexes.
- Operations that are related to devices and jukeboxes.

- Alerts and log messages.

You can also perform some management operations from the **Monitoring** window, for example, starting, stopping, or restarting a data protection policy.

Procedure

1. From the **NMC Console** window, click **Enterprise**.
2. In the **Enterprise** view, right-click the NetWorker server and select **Launch Application**.

   The **Administration** window appears.
3. Click **Monitoring** to view the **Monitoring** window.

About the Monitoring window

On the **Administration** window taskbar, select **Monitoring** to view the details of current NetWorker server activities and status, such as:

- Policies and actions.
- Cloning, recovering, synthetic backups, checkpoint restart backups, and browsing of client file indexes.
- Alerts and log messages, and operations that are related to devices and jukeboxes.

While the **Monitoring** window is used primarily to monitor NetWorker server activities, it can also be used to perform certain operations. These operations include starting, stopping, or restarting a workflow.

The **Monitoring** window includes a docking panel that displays specific types of information. Select the types of information you want to view from the docking panel.

A portion of the **Monitoring** window, which is known as the task monitoring area, is always visible across all windows. A splitter separates the task monitoring area from the rest of the window. You can click and move the splitter to resize the task monitoring area. The arrow icon in the upper right corner of the **Monitoring** window allows you to select which tasks you want to appear in this view.

Smaller windows appear within the **Monitoring** window for each window. Each smaller window, once undocked, is a floating window and can be moved around the page to customize the view. You can select multiple types from the panel to create multiple floating windows that can be viewed simultaneously. The following table describes the various types of information available in the docking panel, and the details each one provides.

Table 70 Monitoring window panel

Window	Information provided
Policies/Actions	The **Policies** tab provides you with status information about all configure policies and the associated workflows and actions. The **Actions** tab provides you with status information for all actions. Policies/Actions pane on page 81 provides more information.
Sessions	Allows you to customize whether to display all session types, or only certain session types. The information that is provided depends on which session type you select. For example, if you select **Save Sessions**, the window lists clients, save sets, groups, backup level, backup start time, duration of the backup,

Table 70 Monitoring window panel (continued)

Window	Information provided
	devices, rate, and size. Sessions pane on page 84 provides more information.
Alerts	Lists the priority, category, time, and message of any alerts. Alerts pane on page 85 provides more information.
Devices	Lists devices, device status, storage nodes, libraries, volumes, pools, and related messages. Devices pane on page 86 provides more information.
Operations	Lists the status of all library and silo operations, including `nsrjb` operations that are run from the command prompt. Also lists user input, libraries, origin, operation data, operation start time, duration of the operation, progress messages, and error messages. When displaying Show Details from the **Operations** window, the length of time that the window is displayed depends on the value that is typed in the **Operation Lifespan** attribute on the **Timers** tab of the **Properties** dialog box for the corresponding library. To access library properties, click **Devices** in the taskbar. By default, this pane is hidden.
Log	Lists messages that are generated by the NetWorker server, including the priority of each message, the time the message was generated, the source of the message, and the category. Log pane on page 89 provides more information.

Customizing the Monitoring window

This section describes how to customize the **Monitoring** window in the **Administration** interface.

Customizing tables

You can customize the organization and display of tabular information in the **Monitoring** window.

Sorting tables

You can change the display of tabular information that appears in the window. You can sort Table grids by column heading, and then by alphabetic or numeric order within those columns.

1. Drag-and-drop the column heading to its new position.
2. Click the column heading to sort the items into alphabetic and numeric order. An arrow appears in the column heading to indicate the sort order.

Sorting selected rows in a table

Selected rows are sorted to the top of the table. This is particularly useful when you select **Highlight All** from the Find panel to select all rows matching the Find criteria and then moving all selected rows to the top of the table to view the results.

1. From the **Edit** menu, select **Find**, or press **Ctl + F** to view the **Find** panel.
2. To select the rows, click each row or use the Find criteria.

3. Select **Sort Selected**.

Sorting multiple columns in a table

You can select the column that you want to use as the tertiary sort key, the secondary sort key, and the primary sort key.

1. Click the column that you want to use as the last sort key.
2. Click the column that you want to use as the next-to-last sort key, and so on, until you select the primary column.

Displaying columns in a table

You can select which columns to display in a table.

1. From the **View** menu, select **Choose Table Columns**.
2. Click a column name to select or clear the column and then click **OK**. You can also select the columns to display by right-clicking a table header and selecting **Add Column** from the drop-down.

Displaying panes

You can choose to show or hide panes in the **Monitoring** window.

Perform the following steps to hide or show a pane in the **Monitoring** window.

Procedure

1. From the **View** menu, select **Show**. A check mark appears beside the panes that appear in the **Monitoring** window.
2. To hide a pane, select a marked pane.

   A check mark does not appear beside the pane.
3. To show a pane, select an unmarked pane.

   A check mark appears beside the pane.

Policies/Actions pane

The **Policies/Actions** pane provides you with the ability to review status information about policies and actions.

This pane has two tabs:

- Policies—Provides a navigation tree that displays all configured policies on the NetWorker server. Expand each policy to display the workflows that are associated with each policy. Expand each workflow to display each action that is contained in the workflow.
- Actions—Provides a list of all Action resources.

Policies pane

The **Monitoring** window in the **NetWorker Administration** window enables you to monitor activities for specific policies, workflows, and actions.

The **Policies/Actions** pane at the top of the **Monitoring** window lists the policies on the NetWorker server by default. Click the + (plus) sign next to a policy in the list to view the workflows in the policy, and the + (plus) sign next to a workflow to view the actions for a workflow.

The **Policies** pane provides the following information for each item (where applicable):

- Overall status

  The following table provides details on the status icons that may appear in the **Policies** pane.

Table 71 Policy status icons

Icon	Status
	Never run
	Running
	Succeeded
	Failed
	Probing
	Interrupted
	Queued
	Cloning
	Consolidating (NetWorker server 8.2.x and lower only)

- Most recent start time.
- Duration of the most recent run.
- Next scheduled runtime.
- Name of the assigned save set.
- Device on which the save set is stored.
- Backup level.
- Data transfer rate.
- Size of the save set.
- Messages that resulted from an action.

Right-click an action in the **Policies** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

When you sort the items on the **Policies/Actions** pane by using the **Status** column, NetWorker sorts the items in alphabetical order that is based on the label of the icon.

Consider the following when a policy/action is in a probing state:

- A message is sent when the group starts and finishes the probe operation.
- The results of the probe operation (run backup/do not run backup) are also logged.
- Probes do not affect the final status of the group, and the group status does not indicate the results of the probe.
- If probing indicates that a backup should not run, then the group status reverts to its state before the group running.
- Check the results of the probe in the **Log** window to ensure that the probe indicates that the backup can be taken.

Actions pane

To view a list of all actions, click the **Actions** tab at the bottom of the **Policies** pane. The **Policies** pane becomes the **Actions** pane.

The **Actions** pane provides the following information for each action:

- Overall status

  Note

  The **Actions** pane displays the same status icons as the **Policies** pane.

- Name
- Assigned policy
- Assigned workflow
- Type
- Date and time of the most recent run
- Duration of the most recent run
- Percent complete, for actions that are in progress
- Next scheduled runtime

Right-click an action in the **Actions** pane and select **Show Details** to view details on currently running, successfully completed, and failed activities for the action.

Workflow operations

This section describes how to use the **Monitoring** window to start, stop, and restart workflows.

Starting, stopping, and restarting data protection policies

The workflows in a data protection policy can run automatically, based on a schedule. You can also manually start, stop, and restart specific workflows, in the **Monitoring** window of the **NetWorker Administration** window.

Note

You cannot stop, restart, or start individual actions.

You can restart any failed or canceled workflow. However, the restart must happen within the restart window that you specified for the workflow.

You can also start specific policies and workflows in the **Protection** window by right-clicking the policy or workflow, and selecting **Start**.

Procedure

1. Select the workflow, or action in the **Monitoring** window.
2. Right-click and select **Start**, **Stop**, or **Restart**.

   A confirmation message appears.
3. Click **Yes**.

Viewing workflow backup details

Perform the following steps to view backup details for workflows.

Procedure

1. From the **Administration** window, click **Monitoring**.

2. Click **Policies** in the docking panel, and expand the Policy that you want to monitor.
3. Right-click the workflow, and then select **Show Details**. The **Workflow Summary** window appears.
4. In the **Workflow runs** pane of the **Workflow Summary** window, select the workflow.
5. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
6. Click **OK** to close the **Workflow Summary** window.

Viewing action backup details

Perform the following steps to view backup details for actions.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Actions** in the docking panel.
3. In the **Actions** pane, right-click the action, and then select **Show Details**. The details window for the action appears.
4. Review the information in the **Actions Messages** pane. To display detailed information from the action log file, click **Show Action Logs**, and then select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
5. In one of the Actions detail panes, for example, the **Completed successfully** pane, select the action that you want to review.
6. Click **Show Messages**. In the **Show Messages** window, select one of the following options:
   - Get Full Log—To display all messages.
   - Print—To print the log.
   - Save—To save the log to a local file.
   - OK—To close the **Show Messages** window.
7. Click **OK** to close the **Details** window.

Sessions window

Use the **Sessions** window to view the sessions that are running on a NetWorker server. You can change the view of this window to display these sessions:

The **Sessions** pane below the **Policies**/**Actions** pane provides details on individual save, recover, clone, and synthetic full sessions by client.

Click the tabs at the bottom of the **Sessions** pane to view all sessions or to limit the list of sessions by the session type. Session types include:

- Save
- Recover
- Clone
- Browse
- Synthetic Full/Rehydrated Sessions
- All

To change the displayed session types go to **View** › **Show**, and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the **Monitoring** window, even if the session was started by running the `savegrp` command.

To stop a session, right-click the session in the pane, and select **Stop** from the drop-down.

Changing displayed session types

The column headings displayed on this window will differ depending on the type of sessions you chose to display.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Sessions** in the docking panel.
3. Go to **View** › **Show** and select the type of sessions to display. To display all sessions currently running on the NetWorker Server, regardless of type, select **All Sessions**.

Stopping a session

You can stop a session (backup, synthetic full backup, clone, and recovery sessions) from the Monitoring window, even if the session was started by running `savegrp`.

To stop a session, right-click the session in the window and select Stop from the drop-down.

The following table provides a list of actions that can be stopped from NMC.

Table 72 Sessions that can be stopped from NMC

Session type	Stop from NMC?
Save by Savegroup	Yes
Synthetic Full by Savegroup	Yes
Clone by Savegroup	Yes
Schedule Clone	Yes
Manual Save	No
Manual Clone via NMC	No
Manual Clone via CLI	No

Table 72 Sessions that can be stopped from NMC (continued)

Session type	Stop from NMC?
Winworker and CLI Recovery	No
Recovery started from Recover wizard	Yes
VMware Backup Appliance Save and Recover	No

NOTICE

Stopping a session from NMC does not affect any other group operations running.

Alerts pane

The **Alerts** pane displays alerts that are generated by a particular NetWorker server or Data Domain system that has devices that are configured on the NetWorker server. The **Alerts** pane includes priority, category, time, and message information.

An icon represents the priority of the alert. The following table lists and describes each icon.

Table 73 Alerts window icons

Icon	Label	Description
	Alert	Error condition detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.
	Warning	A non-fatal error has occurred.

When items on the **Alerts** pane are sorted by the **Priority** column, they are sorted in alphabetical order based on the label of the icon.

Removing alerts

Remove individual alert messages from the **Events** tables by removing them from the **Events** table. To delete a message in the **Events** table, right-click the message, and select **Dismiss**.

Note

The alert message remains in the **Log** window in the NetWorker **Administration** program.

Devices pane

The **Devices** pane allows you to monitor the status of all devices, including NDMP devices. If the NetWorker server uses shared and logical devices, the window is adjusted dynamically to present a set of columns appropriate for the current configuration.

The **Devices** pane provides the following information:

- Status of the operation.
- Name of the device.
- Name of the storage node that contains the device.
- For tape devices, the name of the library that contains the device.
- Name of the volume in the device.
- Name of the pool that is associated with the volume.
- Last message generated for the device.
- Whether the operation requires user input.

  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape.
  Entering user input on page 89 provides instructions on how to deal with a user input notification.

If the current server configuration includes a shared device, a **Shared Device Name** column appears on the **Devices** pane. The name of the shared device appears in the **Shared Device Name** column. If other devices for that configuration are not shared devices, then the **Shared Device Name** column is blank for those devices. Since only a single device per hardware ID can be active at any particular moment, the information for inactive shared devices is filtered out, so only one device per hardware ID is presented on the window at any time.

An icon represents the device status. The following table lists and describes each icon.

Table 74 Devices status icons

Icon	Label	Description
	Library device active	The library device is active.
	Library device disabled	The library device is disabled.
	Library device idle	The library device is idle.
	Stand-alone device active	The stand-alone device is active.

Table 74 Devices status icons (continued)

Icon	Label	Description
	Stand-alone device disabled	The stand-alone device is disabled.
	Stand-alone device idle	The stand-alone device is idle.

When you sort items in the **Devices** pane by the **Status** column, NetWorker sorts the devices in alphabetical order based on the label name of the icon.

Operations window

The **Operations** window displays information about device operations. It provides the following information:

- Status of the operation.
- Name of the library.
- Whether the operation requires user input.
  For example, a labeling operation may want the user to acknowledge whether the system should overwrite the label on a tape. Entering user input on page 89 provides instructions on how to deal with a user input notification.
- The origin, or source, of the operation.
  For example, the interface, nsrjb or the NetWorker server.
- Time the operation started.
- Type of operation.
- Duration of the operation.
- Status messages from the operation.
- Any error messages.

  NOTICE

  Only the last error message of the operation appears in the **Error Messages** column. Move the mouse pointer over the cell containing the last error message to display the entire list of error messages.

The operation status is represented by an icon. The following table lists and describes each of the icons.

Table 75 Operations window icons

Icon	Label	Description
	Failed	The operation failed.
	Queued	The operation is waiting in the queue to run.
	Retry	The operation failed, but may work if you try again.
	Running	The operation is running.

Table 75 Operations window icons (continued)

Icon	Label	Description
	Successful	The operation completed successfully.
	User Input	The operation requires user input.

When items on the **Operations** window are sorted by the Status column, they are sorted in alphabetical order based on the label of the icon.

Viewing operation details

The **Operation Details** dialog box opens, providing information about the completion of the operation. The **Completion Time** displays the time that the operation finished. The time that it took to complete the operation is the difference between the completion and start times of the operation.

To save operation details to a file, click **Save** in the **Operation Details** dialog box. When prompted, identify a name and location for the file.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation, then select **Show Details**.

Stopping an operation

Certain operations can be stopped from the **Operations** window.

Procedure

1. From the **Administration** window, click **Monitoring**.
2. Click **Operations** in the docking panel.
3. Right-click the operation to stop, then select **Stop**.
4. Click **Yes** to confirm the stop.

Note

Operations that were started from a command line program, such as the `nsrjb` command, cannot be stopped from the **Operations** window. To stop these operations, press **`Ctrl-c`** from the window where the command was started.

Entering user input

If the system requires user input, select the labeling operation in slow/verbose mode and the Supply User Input icon appears.

Procedure

1. Right-click the operation, then select **Supply Input**.
2. Confirm whether or not to supply input.
   - If **Yes**, and input is supplied, the icon in the User Input column disappears.

     If two users attempt to respond to the same user input prompt, the input of the first user will take precedence, and the second user will receive an error message.

- If **No**, and input is not supplied, the operation will time out and fail.

Log window

To view the most recent notification logs, click the **Log** window from the docking panel in the **Monitoring** window. The **Log** window provides the priority, time, source, category, and message for each log.

Note

If a particular log file is no longer available, check the log file on the NetWorker server. The log files are located in `NetWorker_install_path\logs` directory.

An icon represents the priority of the log entry. The following table lists and describes each icon.

Table 76 Icons in the Log pane

Icon	Label	Description
	Alert	Error condition that is detected by the NetWorker server that should be fixed by a qualified operator.
	Critical	Severe error condition that demands immediate attention.
	Emergency	Condition exists that could cause NetWorker software to fail unless corrected immediately. This icon represents the highest priority.
	Information	Information about the current state of the server. This icon represents the lowest priority.
	Notification	Important information.
	Waiting	The NetWorker server is waiting for an operator to perform a task, such as mounting a tape.
	Warning	Non-fatal error has occurred.

When you sort items on the **Log** pane by using the **Priority** column, NetWorker sorts the icons in alphabetical order based on the name of the label.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 77 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View › Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 78 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume

- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time
- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 79 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Monitoring checkpoint-enabled backups

You can view detailed information about a checkpoint-enabled backup.

Procedure

1. From the **Administration** window, select **Monitoring** › **Groups**.
2. Right-click the group to which the checkpoint enabled client belongs, then select **Show Details**.
3. View the detailed information related to the group backups:
   - If the partial save set is in the work list for the group, the save set appears in the **Waiting to Run** section.
   - If the partial save set is running, the save set appears in the **Currently Running** section.
   - If the entire partial save sets sequence of the savegroup is complete, the save set appears in the **Completed Successfully** section.
   - If the entire partial save sets sequence of the savegroup is not complete, the save set appears in the **Failed** section.

NOTICE

If any messages are generated, the Show Messages button is enabled. Click Show Messages to view the messages.

4. Click **OK** to close the **Group Details** window.

Query the media database for partial save sets

The savegrp completion report does not provide detailed information about partial save sets that might be necessary to perform a recovery.

Querying partial save sets from the Console

You can view information about the partial save sets by using the NetWorker Console.

NOTICE

If no partial save sets are found that match the query, ensure that the backup of the partial save sets was started within the Save Time period. To change the values for the Save Time attribute, open the Save Set Query tab and select a date and time from the Save Time calendar.

Procedure

1. In the **Administration** window, click **Media**. Media-related topics appear in the navigation tree.
2. Select **Save Sets**. The following tabs appear in the **Save Sets** window:
   - Query Save Set
   - Save Set List
3. Select the **Query Save Set** tab, to query:
   - All partial save sets, select **Checkpoint Enabled**.
   - All partial save sets with the same Checkpoint ID, in the **Checkpoint ID** field, type the **Checkpoint ID** of the partial save set on which you want to perform the query.
4. Select the **Save Set List** tab to view the result of the save set query:
   - The **Checkpoint ID** column displays the partial save set **Checkpoint ID** and its Sequence ID. The **Checkpoint ID** is listed first followed by the **Sequence ID**, which is encased within brackets.
   - Sort the **Checkpoint ID** column to view the complete sequence of partial save sets.
   - The **Status** column displays the status of the partial save sets:
     - A Checkpoint browsable status indicates that the save sets can be browsed for recover.
     - A Checkpoint aborted status indicates that the backup of the partial save set was stopped or aborted. A save set recover is used to recover the partial save set.
       Consider the following:
     - When a checkpoint-enabled backup completes successfully, the status of the last partial save set is Checkpoint browsable.
     - When a checkpoint-enabled backup completes successfully, on the first backup attempt, the save set status is Checkpoint browsable. Only one Sequence id is associated with the Checkpoint ID. The Sequence id is 1. If the

Sequence id is 2, the first partial save set in the checkpoint-enabled backup is missing.

Querying partial save sets by using the `mminfo` command

By default, the `mminfo` command output only displays the browsable save sets. The first and intermediate partial save sets are not displayed. Only complete checkpoint-enabled save sets or final partial save sets are displayed.

Use the `mminfo` command with specific queries to display more information about checkpoint-enabled save sets.

The following table lists the new media attributes support the Checkpoint Restart feature.

Table 80 New Checkpoint Restart media attributes

Media attribute	Description
checkpoint_id	Displays the checkpoint restart id of the partial save set in the chkpt_id column.
checkpoint_seq	Displays the partial save set sequence id in the chkpt_seq column.
checkpoint-restart	This flag attribute is used to only display checkpoint restart enabled save sets.

Also, several media sumflags are used with the Checkpoint Restart feature:

- k—Indicates this is a checkpoint enabled save set.
- a—The first and all intermediate partial save sets of a checkpoint sequence will have aborted status.
- b—The last partial or complete save set of a checkpoint sequence will be marked browsable.

Displaying checkpoint enabled save sets

Display all checkpoint enabled save sets by using the following `mminfo` command:

```
# mminfo -q 'checkpoint-restart' -r 'client,nsavetime,ssid(11),
sumflags(3),name,checkpoint_id,checkpoint_seq'
```

client	save time	ssid	ssflags	filename	chkpt_id	chkpt_seq
plapew	1251910303	4204700319	cak	/space	1251910303	1
plapew	1251910327	4187923127	cbk	/space	1251910303	2
plapew	1251910710	4087260214	cak	/space	1251910710	1
plapew	1251910725	4070483013	cbk	/space	1251910710	2

Displaying all partial save sets for the checkpoint id

Display all partial savesets for the checkpoint id by using the following `mminfo` command:

```
mminfo -q "checkpoint_id=1251910303"
```

volume	client	date	size	level	name
plapew.001	plapew	08/02/15	17 MB	full	/space

volume	client	date	size	level	name
plapew.001	plapew	08/02/15	799 MB	full	/space

Reporting NDMP Data

The NetWorker software reports information about NDMP clients, data, and volumes in two ways.

- The NMC reporting feature—Reports NDMP data in the same manner as non-NDMP data. The *EMC NetWorker Administration Guide* provides more information.
- The `mminfo` command. Use the `mminfo` program to query the media database for NDMP volume or save set information.

Querying the NDMP volumes by backup type with the mminfo command

You can query save sets by backup format (NDMP or DSA) to display volume information.

- For example, to query NDMP volumes, type `mminfo -q ndmp`. Output similar to the following appears:

```
volume client date size level name
005D0000 sim1cifs1 6/22/2011 1036 MB full /fs1
005D0001 sim1cifs1 6/22/2011 173 MB full /fs1
005D0001 sim1cifs1 6/22/2011 862 MB full /fs1
005D0002 sim1cifs1 6/22/2011 348 MB full /fs1
```

- For example, to query NDMP -DSA volumes, type `mminfo -q dsa`. Output similar to the following appears:

```
volume client date size level name
NDMP.001 10.8.67.219 12/13/2011 644 MB full /vol/vol0
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 402 MB full /vol/vol1
NDMP.001 10.8.67.219 12/13/2011 36 MB full /vol/vol2
```

Querying the NDMP save sets with the mminfo command

Query the media database to determine which save sets are NDMP save sets and the status of an NDMP save set in the media database. NDMP save set status information is important when performing NDMP recoveries.

- To perform a browseable NDMP recover, the ssflags (fl) field for an NDMP save set must contain a (b). The b value denotes a browsable save set.
- To perform a save set recover from the NetWorker User program, the ssflags (fl) field for an NDMP save set must contain either (r) or (b).
- An NDMP save set contains an N attribute in the ssflags (fl) field.
- An NDMP-DSA save set contains an s attribute in the ssflags (fl) field.

In the following example, the NDMP save set status is recoverable (r). To recover the data, you can only perform a save set recovery from a command line.

`mminfo -av`

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 1036MB 3842140553 hrN full /fs1
```

In the following example, the NDMP-DSA save set status is brows able (b). Recover the data by using the NetWorker User program, or from the command line. A browseable NDMP-DSA save set supports brows able and save set recoveries.

```
mminfo -av
```

```
volume type client date time size ssid fl lvl name
vol1 dlt clnt 6/22/2011 3:15:12 36MB 4259813785 cbNs full /fs1
```

Performing NDMP recoveries

NetWorker uses the `nsrndmp_recover` program to coordinate recover operations between the NetWorker software and the NDMP client. The `nsrndmp_recover` program does not move data to the NDMP client. When the `nsrndmp_recover` program identifies an NDMP-DSA save set, `nsrndmp_recover` automatically runs the `nsrdsa_recover` program on the same host that runs the `nsrndmp_recover` command.

To recover NDMP data, you can run the `nsrndmp_recover` program from a command prompt, or use one of following programs, which automatically starts `nsrndmp_recover`:

- `recover`—The command line program on Windows and UNIX.
- `winworkr`—The NetWorker User GUI on Windows.
- The NMC Recovery wizard.

During the recovery process, the `nsrndmp_recover` program passes nlist information to the NDMP client. There are three methods to recover NDMP backups:

- Index-based file-by-file recover — The nlist includes file offset and ACL information. When you recover many files, the recover process uses a significant amount of system resources on both the NetWorker server and the NDMP client to build and process the nlist information.
- Full save set recovery—The nlist only includes the path to the recovery directory, down to and including the mount point. When you recover many files, the recover process uses less system resources than an index-based NDMP recover to build and process the nlist information.
- NDMP directory restore — A partial save set recovery of a single file or single directory.

For example, when the NetWorker software writes NDMP data to a remote storage node, start the `recover` program on the NetWorker storage node to prevent the data from traversing the network.

Note

When you start the `recover` program on the NetWorker server, the data flows from the storage node to the NetWorker server and from the NetWorker server to the NDMP client, over the network.

NDMP recovery requirements for other filers

The following list summarizes the requirements:

`scanner`

You cannot use the `scanner` command with the `-i`, `-f` and `-r` options on an NDMP volume. You cannot use the `scanner` command on a volume that contains

NDMP and non-NDMP save sets when you load the volume in an NDMP device. The *Scanner command usage* technical note provides more information about using the `scanner` command with NDMP data.

Cross platform recoveries

You can recover NDMP data to different NDMP client however, you cannot perform a cross platform recover. Recover NDMP data to an NDMP client that is the same brand, a compatible model, and the same operating system as the original NDMP client.

Devices

Recover Direct-NDMP and Three-party backups performed to an NDMP device from an NDMP device. To improve recover performance from an NDMP tape device, configure the tape device to support variable length records. Recover NDMP-DSA backups from a non-NDMP device.

Localized environments

When recovering data in a localized NDMP environment, the Index Recover status window shows the process in English and not the localized language.

NDMP-DSA

For better recovery performance, start the recover process on the NetWorker host where the backup volume resides.

Immediate recoveries

Run the `nsrndmp_recover` program on the storage node with the locally attached backup device to perform an immediate recovery of NDMP-DSA data.

Blue Arc

The recover process creates a `$__NDMP__` directory at the root level of the recovery file system when you recover more than 1,024 files. The directory contains the file list that the NetWorker server uses for an index recovery. Do not change the directory and its contents during an active recovery operation. When a recovery is not in progress, you can delete the directory.

While performing NDMP backup and recover operations, a message similar to the following may appear:

```
NDMP session—Unknown environment variable name ignored.
```

You can ignore this message.

Mirapoint

After a full backup recovery for a Mirapoint system, reboot the Mirapoint system. An incremental recovery does not require a reboot.

DAR and DDAR

By default, the NDMP recover process reads an entire tape from start to finish. The recover process extracts the data as it encounters the data on the tape. For large backup images, recovery is slow.

The DAR/DDAR recovery process:

- Provides the ability to recover a file or directory from the exact location on a tape.
- DDAR only passes the directory path to the NAS filer. DAR passes the paths of each file individually.

- Reduces the size of the nlist information that the recover process stores in memory. During the recover process, the NAS filer (DDAR) assumes that the directory path includes all cataloged files and directories. However, DAR mentions each file that it wants recovered.
- Does not sequentially read the file or record numbers on the tape to locate the data, which reduces the amount of time that you require to recover specific files from a backup.

Note

Creating and configuring the NDMP client resource on page 67 describes how to configure the DAR and DDAR Application Information attributes for NDMP clients.

Use the `recover` command or the NetWorker User program to perform DAR and DDAR recoveries. You cannot use the `nsrndmp_recover` program to perform DAR/DDAR recoveries.

When not to use DAR or DDAR

DAR and DDAR recoveries send multiple pathnames across the network to the NDMP Data Server and, in three-party configurations, to the NetWorker server. The recover process stores the pathnames in memory on the NDMP Data Server. Recoveries of a large amount of data from a large save set can negatively affect the network and the NDMP Data Server resources.

Do not use DAR and DDAR to recover the following objects:

- Several thousands of files in a single index-based recover operation.
- A specific directory structure containing several thousand or millions of files.

To perform a non-DAR-based recovery of a save set when you set the *DIRECT=y* at the time of backup, first define the *NSR_NDMP_RECOVER_NO_DAR=y* variable in the Application Information attribute of the NDMP client.

Recover window

The **Recover** window displays information about recover configurations that are created with the NMC Recovery wizard.

You can use this window to:

- Start the **NMC Recovery** wizard to create recover configurations or modify saved recover configurations.
- Identify the status of a recover configuration that is created with the **NMC Recovery** wizard.
- Start and stop a recover job.

The **Recover** window is divided into five sections:

- Toolbar—The toolbar is hidden by default. To display the recovery toolbar, select **View › Show toolbar**
- Summary
- Configured Recovers
- Currently Running

A splitter separates the **Configured Recovers** section from **Currently running** window. You can click and move the splitter to resize these two windows.

Recover toolbar

The Recover toolbar provides you with the ability to quickly perform common recover operations. The following table summarizes the function of each toolbar button.

Table 81 Recovery toolbar options

Button	Function
	Starts the NMC **Recover** wizard to create recover configurations.
	Displays the **Properties** window for the saved recover configuration that you selected in the **Configured Recover** window.
	Deletes the saved recover configuration that you selected in the **Configured Recover** window.
	Displays online help for the **Recover** window.
	Displays the **Find** window at the bottom of the **Recover** window. The **Find** window allows you to perform keyword searches for messages that appear in the **Logs** window.
	Start the recover operation for a selected saved recover configuration. This option is only available for a recover configuration that has a Never run, or Failed status.
	Stop in-progress recover operation that you selected in the **Currently Running** window.

Note

The **Recover** toolbar does not appear by default. To display the **Recover** toolbar, select **View** › **Show toolbar**.

Recover Summary

The Recover Summary section displays a high-level overview of recover jobs.

This section includes the following information:

- Total Recovers—The total number of successful recover jobs.
- Since—The number of successful recover jobs since this date.

Configured Recovers

The **Configured Recovers** window displays a list of saved recover configurations in a tabular format. You can sort the information by column. The **Configured Recovers** table displays the following information for each saved recover configuration:

- Status—The job status of a saved recover configuration.
- Name
- Source client

- Destination client
- Recovery list
- Recover type—For example, file system or BBB.
- Comment
- OS—The operating system of the source host.
- Recover requestor—The Windows or UNIX account used to create the recover configuration.
- Start Time
- End Time
- Start date

Table 82 Save recover configuration job status

Icon	Description
	The last recover attempt failed.
	The last recover attempt completed successfully.
	The recover job has never run.
	The recover job is scheduled to run in the future.
	The recover job has expired.

Currently running

The **Currently Running** window displays a list of in progress recover jobs in a tabular format. You can sort the information by column. The Currently Running table displays the following information for each job:

- Status
- Name
- Source client
- Destination client
- Recovery list
- Recover type—For example, file system or BBB
- Volume
- Comment
- Device
- Size
- Total size
- % complete
- Rate (KB/s)
- Start time

- Duration
- Currently running

Find

The **Find** section appears along the bottom of the **Recover** window, after you select the **Find** button on the **Recover** toolbar. **Find** allows you to search for keywords in the **Configured Recovers** window. The following table summarizes the available find options.

Table 83 Find options

Find option	Description
Find	Highlight the first saved recover configuration that contains the specified keyword.
Prev	Highlight the previous saved recover configuration that contains the specified keyword.
Highlight All	Highlights each saved recover configuration that contains the specified keyword.
Sort Selected	Sorts each highlighted recover configuration in the Configured Recover table so that they appear at the top of the Configured Recover table.
Match case	Make the keyword search case sensitive.

Performing an NDMP index-based file-by-file data recovery

Perform an NDMP index based file-by-file recover in the same manner as a non-NDMP data recover. You can restore the data to the original NDMP client or perform a directed recovery to a different NDMP client.

Before you perform an index-based file-by-file recover, review the following information.

- Set the *HIST=y* in the Application Information attribute of the NDMP client at the time of the backup.
- The NDMP save set must be browsable. You cannot perform a browsable recover of a recoverable or recyclable save set. Reporting NDMP Data on page 93 describes how to determine the status of an NDMP save set.
- Do not use an index-based recovery to recover a large numbers of files or directories. For better recovery performance, use a save set recover. Performing a full or Directory Restore of NDMP data by using a save set recovery on page 104 provides more information.
- To perform an index-based file-by-file recover:
  - Use the NetWorker User program on a Windows host. Performing an NDMP index-based file-by-file recover using the NetWorker User program on page 101 provides detailed information.
  - Use the `recover` program. Performing an NDMP index-based file-by-file recover from a command prompt on page 103 provides detailed information.

Performing an NDMP index-based file-by-file recover using the NetWorker User program

On Windows, to recover data to the original NDMP client or to a different NDMP client, perform the following steps.

Procedure

1. Open the NetWorker User program and connect to the NetWorker server.

   NOTICE

   If you receive the error:

   ```
   No file indexes were found for client client_name on server
   server_name
   ```

   Try connecting to a different NetWorker server and you selected the correct NetWorker server, then ensure that you selected a browsable save set. Alternatively, perform a save set recover.

2. Select **Recover** to open the **Source Client** window.
3. Select source NDMP client and click **OK**. The local client is the default selection.
4. Select the destination client for the recovered data and click **OK**. If the destination client is not the source client, ensure the NAS filer is the same brand, a compatible model and the same operating system as the source NDMP client.
5. (Optional) Recover the data from an earlier backup time. The **Recover** window appears with the latest version of the backup files. To recover data from an earlier backup, change the date and time of backup using one of the following methods:

   a. Change the browse time for all files in the recover window:

      - From the **View** menu, select **Change Browse Time**.
      - In the **Change Browse Time** window, select a new day within the calendar. Select **Previous Month** or **Next Month** to change from the current month.
      - In the **Time** field, change the time of day by typing an hour, a minute, and the letter a for A.M. or p for P.M. Use the 12-hour format.
      - Click **OK**.

   b. View all versions of the selected file system object:

      - Highlight the file or directory for review.
      - From the **View** menu select **Versions**.
      - Once you locate the version to recover, change the browse time. To change the browse time, highlight the volume, directory, or file and click **Change Browse Time**. The **Version** window closes and the **Recover** window reflects the new browse time.

6. (Optional) Search for the files. To search for and recover the most recently backed-up version of a file or directory:

   a. From the **File** menu, select **Find**.

   b. Type the name of the file or directory. Use wildcards to expand the search; without wildcards, partial filenames do not provide any results.

7. Mark the data to recover. To select file system objects to recover:

a. In the left pane of the **Recover** window, click the appropriate directory folder.

b. Mark each directory or file to recover by selecting the checkbox next to each directory or file.

8. (Optional) Relocate the data to a different location. By default, the recover process recovers the selected files to the original location.

Note

The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

To relocate the files to a different location:

a. Select **Recover Options** from the **Options** menu.

NDMP recoveries do not support the following options:

- Rename recovered file
- Discard recovered file
- Prompt for every file conflict
  NDMP recoveries will always overwrite existing files. EMC recommends that you relocate the NDMP data to a different location, to avoid data loss.

b. In the **Relocate Recovered Data To** field, type the full path name of the target directory, click **OK**.

The target directory is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the recover process uses the original location and overwrites existing files with the same name.

9. (Optional) To view the volumes required to recover the marked file system objects, from the **View** menu, select **Required Volumes**.

10. Click **Start** to begin the recovery. If any required volume is not available to the NetWorker server, a volume status warning appears.

When this warning appears:

a. Click **No**.

b. From the **View** menu, select **Required Volumes**.

c. Ensure that the NetWorker software can mount each listed volume into an available device.

d. Attempt the recover operation again.

The NetWorker server takes a few moments to recover the files, depending on file size, network traffic, server load, and tape positioning. During this time, messages appear so that you can monitor the progress of the recovery.

When the recovery completes successfully, a message similar to the following appears:

```
Received 1 file(S) from NSR server
server Recover completion time: Tue Jan 21 08:33:04 2009
```

Performing an NDMP index-based file-by-file recover from a command prompt

This section applies to command line recoveries from a Windows and UNIX client.

To avoid using the Windows version of `recover.exe` on Windows operating systems, perform one of the following actions:

- Specify the full path to the recover program. For example: `C:\Program Files\EMC NetWorker\nsr\bin\recover.exe`.
- Ensure that the *$PATH* environment variable contains the `NetWorker_install_path\bin directory before %SystemRoot%\System32`.

To recover NDMP data from a command prompt on a UNIX or Windows NetWorker host, perform the following steps:

Procedure

1. From the command prompt, type:

   `recover -s` *NetWorker_servername* `-c` *client_name*

   where:

   - the `-s` *NetWorker_servername* option specifies a particular NetWorker server on the network to use when recovering data.

     When you do not use the `-s` option, the `recover` program tries to connect to the first computer listed in the servers file. When the servers file does not contain any servers, or lists more than one server, the **Change Server** window appears, and you can select the server.
   - the **-c***client_name* option specifies the source NDMP client.
2. When prompted, type the directory to browse, for example:

   ```
   cd /mydirectory
   ```

3. Use the `add` command to add the required files or folders to the recover list. The *EMC NetWorker Command Reference Guide* provides a complete list of options for the `recover` command.
4. When restoring NDMP data, EMC recommends that you relocate the NDMP data to a different location.

   Note

   The NDMP protocol does not support name conflict resolutions. NetWorker will always overwrite existing files that have the same name as the recovered file. EMC recommends that you recover the NDMP data to a different location, to avoid data loss.

   - To relocate the data to a different directory, type:

     `relocate` ***destination_directory_name***

     The target pathname for *destination_directory_name* is a literal string and must match the path as seen by the NAS filer in its native OS, exactly. Otherwise, the

recover operation uses the original location and overwrites existing files with the same name.

- To recover the data to a different host, type:

  ```
  relocate target_hostname::/mount_point
  ```

  Data ONTAP may require you to add a backslash (\) after the mount point. For example, *target_hostname::\mount_point*.

5. After you add all of the required files, type:

   ```
   recover
   ```

Performing a full or Directory Restore of NDMP data by using a save set recovery

You perform an NDMP save set recover in the same manner as a non-NDMP save set recovery. You can recover data to the original NDMP client or perform a directed recovery of the data to a different NDMP client of the same platform.

Before you perform a full save set recover, review the following information.

- Use a full save set recovery to recover all files and folders in an NDMP data save set, or to recover an entire directory within an NDMP save set. You cannot use the NetWorker User program to perform an NDMP Directory Restore.
- To use the NetWorker User program on Windows, a client file index entry for the save set must exist. When the index entry for the save set does not exist, the recover fails with an `index not found` error. When the client file index entries do not exist for the save set, use the `nsrndmp_recover` program with the '-v off' option.
- You cannot perform a save set recover from the NetWorker User program when the save set status is eligible for recycling (E). The recover process requires a recoverable (r) or brows able (b) save set status. The *EMC NetWorker Administration Guide* provides information on how to change the status of a save set. A save set recover reads the entire tape, from beginning to end, to find and recover the requested files. The recovery process completes when the recover operations reads all required tapes in their entirety.
- As each file recovers, the file name appears on the target share but the file size is 0 KB. The actual file size update occurs after the recovery completes.

Performing an NDMP save set recover by using the NetWorker User in Windows

NOTICE

When the recover operations fails with the error:

```
Failed to propagate handle <number> to child process: Access is
denied
```

The save set is not in the client file index of the NDMP client. Perform a save set recover from a command prompt. Performing an NDMP save set recovery from the command prompt on page 105 provides more information.

Procedure

1. Start the NetWorker User program.
2. On the **Change Server** window, select the NetWorker server and click **Ok**.
3. Select **Options** › **Recover Save Sets**.

4. On the **Source Client** window, select the appropriate NDMP client, and then click **Ok**.
5. On the **Save Sets** window, select the name of the save set.
6. Select the version of the save set, if there are multiple versions. You can also select the cloned version of a save set, if applicable.
7. To recover specific files and directories instead of the entire save set:
   a. Click **Files**.
   b. Specify the files and directories, one per line.
   c. Click **OK**.

   NOTICE

   Do not use this method to mark tens of thousands of files. Instead, perform an NDMP Directory Restore. Marking many files and directories generates a large nlist and requires intensive resources on both the NetWorker server and the NAS filer.

8. Click **Recover Options**.

   An NDMP data recovery does not support the following options:

   - Rename recovered file
   - Discard recovered file
   - Prompt for every file conflict

   NOTICE

   EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries *always* overwrite existing files.

9. To recover the data to a pathname that is different from the original backup location, in the **Relocate Recovered Data To** field, type the full pathname of the destination directory, then click **Ok**.

   For NDMP data recoveries, the target pathname is a literal string and *must* exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

10. To recover the data to a different NDMP client, specify the name of the client to receive the NDMP data in the **Destination Client** field.
11. To view the volumes required to perform the recover, select **View** › **Required Volumes**
12. Click **OK** to begin the recovery. The recovery status appears in the **Recover Status** window.

Performing an NDMP save set recovery from the command prompt

To perform a save set recovery to the original NDMP client or to a different NDMP client, use the `nsrndmp_recover` command.

For example:

```
nsrndmp_recover -s NetWorker_server -c source_ndmp_client -S ssid/
cloneid -v off -m target_ndmp_client::/target_path /source_path
```

where:

- *source_ndmp_client* is the hostname of the source NDMP client.

- *target_ndmp_client* is the hostname of the destination NDMP client.
- */source_path* is the original location of the data.
- */target_path* is the location to recover the data.

  NOTICE

  EMC recommends that you relocate the NDMP data to a different location. NDMP recoveries always overwrite existing files. The `/target_path` is a literal string and must exactly match the path as seen by the native OS on the NAS filer. Otherwise, the recover operation uses the original location and overwrites existing files with the same name.

- **-v off** allows you to restore data when client file index of the NDMP client does not contain information about the NDMP save set.
  In the following examples, the NetWorker server is mars and the backup client is venus.
  - To recover a mount point `/mnt` from a backup of NDMP host venus to a directory `/newmnt` on NDMP host jupiter, type:

    ```
    nsrndmp_recover –s mars -c venus -S 123456789 -v off –m
    jupiter::/newmnt
    ```

  - To recover a mount point `/mnt` from a backup of NDMP host venus to NDMP host pluto, type:

    ```
    nsrndmp_recover –s mars -c venus -R pluto -S 123456789 -v off -
    m /mnt
    ```

    Data ONTAP may require that you to add a slash (/) after the mount point. For example, *target_hostname*:/*mount_point*/.

Troubleshooting NDMP recover

This section provides a list of the possible causes and the possible resolutions for NDMP recovery issues.

RESTORE: could not create path *pathname*

This error message appears when restoring NetApp data. This error, when encountered, appears in the `daemon.raw` file of the NetWorker server and the recovery output.

To resolve this issue:

- Ensure that you specify a source and a target path during the recover that exists on the target filer.
- If you set the *UTF8=Y* application information variable during an NDMP client backup and the backup contains path names with non-ASCII characters, then perform a save set recover. Index-based recoveries will fail with this error message.

These files were not restored (Restore failed with error, or file/directory specified but not found in backup)

This error message appears in the `daemon.raw` file of the NetWorker server and the in the recovery output.

To resolve this issue:

- Ensure that the file or directory specified during the recover, exists in the save set.

- Ensure that the pathname specified to relocate the data exists on the destination filer. For NDMP data recoveries, the target pathname is a literal string and must exactly match the path as seen by the native OS on the NAS filer.