EMC® NetWorker®
Module for SAP with Oracle

Release 3.5
Multiplatform Version

Administration Guide

P/N 300-004-681
REV A01

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Published August, 2007

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Contents

Figures

Tables

Examples

Preface

As part of an effort to improve and enhance the performance and capabilities of its product lines, EMC periodically releases revisions of its hardware and software. Therefore, some functions described in this document may not be supported by all versions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes.

If a product does not function properly or does not function as described in this document, please contact your EMC representative.

Audience

This guide is part of the EMC NetWorker® Module for SAP with Oracle (NMSAP) documentation set, and is intended for use by system administrators during the configuration of the NMSAP software.

Readers of this document are expected to be familiar with the following topics:

- SAP terminology and concepts, especially those related to Oracle database backup and recovery.
- Backup and recovery procedures.
- Disaster recovery procedures.

Related documentation

Documentation related to the use of this product can be found at the EMC® website, http://Powerlink.EMC.com, including:

- The NetWorker Module for SAP with Oracle release 3.5 documentation set:
  - Administration guide
  - Installation guide
  - Release notes
  - Command reference guide
- The NetWorker documentation set:
  - Administration guide
  - Installation guide
  - Release notes
  - Command reference guide
  - Disaster recovery guide
- Other EMC documentation:
  - NetWorker PowerSnap Module documentation
  - Software compatibility guide
  - UNIX man pages

Conventions used in this document

EMC uses the following conventions for special notices.

Note: A note presents information that is important, but not hazard-related..

CAUTION

A caution contains information essential to avoid data loss or damage to the system or equipment.

IMPORTANT

An important notice contains information essential to operation of the software.

Typographical conventions

EMC uses the following type style conventions in this document:

Normal	Used in running (nonprocedural) text for: • Names of interface elements (such as names of windows, dialog boxes, buttons, fields, and menus) • Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, filenames, functions, utilities • URLs, pathnames, filenames, directory names, computer names, links, groups, service keys, file systems, notifications
Bold:	Used in running (nonprocedural) text for: • Names of commands, daemons, options, programs, processes, services, applications, utilities, kernels, notifications, system call, man pages Used in procedures for: • Names of interface elements (such as names of windows, dialog boxes, buttons, fields, and menus) • What user specifically selects, clicks, presses, or types
Italic:	Used in all text (including procedures) for: • Full titles of publications referenced in text • Emphasis (for example a new term) • Variables
`Courier:`	Used for: • System output, such as an error message or script • URLs, complete paths, filenames, prompts, and syntax when shown outside of running text
`Courier bold:`	Used for: • Specific user input (such as commands)
`Courier italic:`	Used in procedures for: • Variables on command line • User input variables
< >	Angle brackets enclose parameter or variable values supplied by the user
[ ]	Square brackets enclose optional values
|	Vertical bar indicates alternate selections - the bar means “or”
{ }	Braces indicate content that you must specify (that is, x or y or z)
...	Ellipses indicate nonessential information omitted from the example

Where to get help

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Product information — For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to the EMC Powerlink website (registration required) at:

http://Powerlink.EMC.com

Technical support — For technical support, go to EMC Customer Service on Powerlink. To open a service request through Powerlink, you must have a valid support agreement. Please contact your EMC sales representative for details about obtaining a valid support agreement or to answer any questions about your account.

Your comments

Comments and suggestions about our product documentation are always welcome.

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2. Click the **Feedback** link.

1 Introduction

This chapter describes the main features and components of the EMC NetWorker Module for SAP with Oracle (NMSAP), and the associated NetWorker, SAP, and Oracle systems. It also describes the EMC PowerSnap software, which is required for snapshot backups.

This chapter contains the following sections:

Naming conventions used in this guide

Table 1 on page 18 lists special terms that are are used in this guide.

Table 1 Description of terms that are specific to this guide

Term	Description
BRTools	The SAP backup utilities, specifically the **brbackup**, **brrestore**, **brarchive**, and **brrecover** programs.
NMSAP software	An abbreviation for NetWorker Module for SAP with Oracle software.
ORACLE_SID	The name of the Oracle database instance that you want to back up, usually the argument for the **brbackup** or **brarchive -u** option.
restore and recover	This guide follows Oracle terminology, which distinguishes between restoring and recovering a database. • Restore means to retrieve individual datafiles from backup media and store the files on disk. • Recover means to apply the *redo log* to make the database consistent. **Note:** This usage is unlike NetWorker terminology, which uses recover for *all* data retrieval activities.

Overview of the NMSAP environment

This section describes in general terms the types of software that are used in an NMSAP environment.

Typical requirements

Table 2 on page 18 lists the requirements for a simple network environment that uses the NMSAP software for backup and recovery services.

Table 2 Typical configuration of NMSAP backup environment

Computer or device	Required software or configuration
Each NMSAP database server	NetWorker client, NMSAP, SAP, and Oracle database software.
NetWorker storage management server	NetWorker server software.
Backup storage device	Device attached to the NetWorker server or to a separate NetWorker storage node server.

NetWorker software

The EMC NetWorker server software provides data storage management services that protect and manage data across an entire network.

The NMSAP software works together with the following NetWorker server features:

- Save group, pool, and client configuration
- Backup scheduling
- Authorization
- Online index maintenance (client file index and media database)

NMSAP software

The NMSAP software is an add-on module for NetWorker client software and provides a backup and restore interface between the SAP BRTools program and the NetWorker server. The main component of the NMSAP software is the **backint** program, which provides backup, inquiry, and restore processes for all Oracle and SAP files.

The NMSAP software enables you to perform the following operations for SAP data on Oracle databases:

- Manual backups (online and offline)
- Scheduled backups
- Inquiry of backed up data
- Restores of backed up data
- Automated media management
- Archive "redo logs"
- Snapshot backup and recovery
- Sapclone

SAP software

The following features of the SAP software enable backup, restore, and inquiry of SAP databases on Oracle:

- BRTools utilities, which consist of the **brbackup**, **brarchive**, **brrecover**, **brrestore**, and other utilities.
- BrGui, which is a menu-driven interface to BRTools.

Invoking the **brbackup** command directly, or from BrGui, passes the following types of data to **backint** for backup:

- Oracle datafiles
- Control files
- Any existing profiles or specified files
- SAP internal catalogs for backup sessions

Invoking the **brarchive** command directly, or from BrGui, passes the offline redo logs to **backint** for backup.

Oracle RMAN software

Use of Oracle Recovery Manager (RMAN) backup and restore utility is optional because you can use the NMSAP **backint** program as the sole backup and restore tool. You may use RMAN to back up Oracle databases, but you must still use the **backint** program to back up SAP configuration files, logs, and other files. For a description of RMAN features, refer to Oracle documentation.

NetWorker Module for PowerSnap

NetWorker backups can use the EMC PowerSnap software to create a *snapshot* (point-in-time copy) of a group of files or file systems on a client. The snapshot serves as an *instant backup*, which can then be:

- Backed up immediately to a traditional storage medium
- Backed up later

Many instant backups can be performed in a single day, thus reducing the exposure to data loss.

Instant backups protect only against logical failures. To protect against physical failures, such as disk failure, the snapshot must be backed up to a traditional storage medium.

Whether a backup uses the PowerSnap features is determined by the NetWorker Client, Group, and Policy resource configurations.

Internationalization and language packs

The NMSAP software provides internationalization (I18N) support, and can be installed with language packs for localization (L10N) in the supported languages.

Internationalization

The NMSAP software provides I18N support, which means non-ASCII data from NMSAP clients can be monitored, backed up, and restored. I18N support assumes the use of NMSAP software with the following I18N products:

- Internationalized operating system
- Unicode version of BRTools
- NetWorker release 7.4 and later server and client

Non-ASCII characters

The NMSAP client supports non-ASCII characters for the following:

- Full pathnames of configuration and parameter files, for example, init<ORACLE_SID>.sap, and init<ORACLE_SID>. utl.
- Full pathnames of operational log files, for example, SAPBACKUP and SAPTRACE.
- Full pathnames of variables that are set in the nsrsapsv.cfg file, for example, PATH, SAP_BIN, SAPBACKUP, SAPARCH, SAPCHECK, SAPREORG, and SAPTRACE.
- Most strings that are passed as command-line options to the NMSAP programs **nsrsapadm**, **nsrsapsv**, **sapclone**, and **backint**. Exceptions are the Oracle username and password, which is an Oracle limitation, and the full pathname of the NMSAP scheduled backup configuration file, which is a NetWorker 7.4 software limitation. "ASCII characters" on page 21 gives details.
- All NetWorker parameters that are supported by NetWorker 7.4 software. Currently the NMSAP uses only one of these parameters, the save set name.
- Environments configured by the scheduled backup wizard.

Note: The NLS_LANG=AMERICAN.AMERICA.US7ASCII parameter value, which is used in the sample backup configuration file (nsrsapsv.cfg) that is shipped with the product or generated by the NMSAP backup configuration wizard, is an example or default value. This value can, and in some cases should, be set to another value. Refer to the SAP documentation on how to set the NLS_LANG parameter.

ASCII characters

Some Oracle, BRTools, and NetWorker software configurations, used with the NMSAP client, do not support I18N and are required to use ASCII characters. Read the appropriate product documentation for complete details. Some examples are:

- Oracle requires ASCII characters for the following:
  - ORACLE_HOME environment variable.
  - Oracle instance name (ORACLE_SID).
- BRTools requires ASCII characters for the following:
  - Connection strings (database username and password) to the Oracle database.
  - Oracle datafiles, log files, control files, parameter filenames and paths.
  - Oracle tablespace names.
- NetWorker 7.4 and later software requires ASCII characters for the following:
  - The NetWorker client, server, pool, group, expiration policy, and email notification parameters, which are set in the NMSAP configuration file (init<ORACLE_SID>.utl).
  - The NMSAP scheduled backup configuration file pathname, which is passed to the Backup command attribute in the NetWorker Client resource.
- Snapshot-based NMSAP backups and restores are not supported for I18N and use ASCII characters only.

Language packs

NMSAP language packs provide localized operation in Japanese, Korean, Simplified Chinese, and French. The language packs enable NMSAP features such as wizard pages and error messages to be displayed in the localized languages and numerical formats. If the NMSAP software and a language pack are installed on a computer with an operating system localized for that language, then the NMSAP software detects the locale and runs in that language.

Localized log files

If the NMSAP installation had been localized, the operational log file, backint<ORACLE_SID>.log, which runs during normal NMSAP client operation when the debug level is not set, is also localized. This log can be translated into English or a different supported locale by the NetWorker nsr_render_log utility.

Debug logs are intended for technical support and engineering troubleshooting only and are English only and not localized.

NMSAP components

Table 3 on page 22 lists the NMSAP software components that are referred to in this guide. On Microsoft Windows systems, most of these files are located in the same directory as the NetWorker client programs.

Table 3 NMSAP components

UNIX	Windows	Description
backint	backint.exe	This backup, restore, and inquire program provides an interface to SAP BRTools. It uses configurations from the NMSAP parameter file, init<*ORACLE_SID*>.utl.
init.utl	init.utl	Parameter file that specifies the variables used by the **backint** program. Copy this template file and name it init<*ORACLE_SID*>.utl, where ORACLE_SID is the name of the Oracle database instance that is to be backed up.
libnworasap.xx	orasbt.dll nsrsbtcnsap.exe	RMAN utility.
libnmsapdc.xx nsrsapce	libnmsapdc.dll nsrsapce.dll	Backup configuration wizard back-end components. Optional on Windows systems.
libnmsapwiz.xx	libnmsapwiz.dll	Backup configuration wizard user interface. Installed by a separate package on UNIX systems. Optional on Windows systems.
log files	log files	Log files used for the NMSAP software. The default location is: On UNIX systems: /nsr/applogs On Microsoft Windows systems: C:\Program files\Legato\nsr\applogs
nsrsapsv	nsrsapsv.exe	The scheduled backup program, which invokes the appropriate BRTools executables. The program uses configurations from the nsrsapsv.cfg file, or a renamed copy of this file. This file should be specified as the backup command in the NetWorker Client resource.
nsrsapsv.cfg	nsrsapsv.cfg	Configuration file for the **nsrsapsv** scheduled backup program. Copy this template file and save the original. On UNIX systems, this file is located in the /etc directory.
nsrsapadm	nsrsapadm.exe	Encryption program for **nsrsapsv** operations, which encrypts logon information for the user who performs a scheduled backup.
sapclone	sapclone.exe	The save set cloning program. Provides an interface to the NetWorker **nsrclone** program.
man pages		Reference for NMSAP UNIX commands
nmsapps.cfg (sample name)	nmsapapps.cfg (sample name)	User-defined PowerSnap configuration file.

NMSAP Processes

The NMSAP software provides storage management services that connect NetWorker functionality to SAP servers that run Oracle databases. The backup and restore processes can be initiated from the following interfaces:

- SAP programs:
  - BRTools: **brbackup**, **brarchive**, **brrestore**, or **brrecover** commands
  - BrGui menu-driven interface
- Scheduled backup interface on the NetWorker server

Additionally, the Oracle RMAN can be invoked through these interfaces to back up and restore Oracle databases.

Note: PowerSnap backups must be initiated through the scheduled backup interface, and are not supported for manual backups. Chapter 7, "PowerSnap Backup and Data Restore," describes the processes.

Manual backup processes

A manual backup is initiated directly by an SAP backup utility, such as BrGui or **brbackup**. Chapter 3, "Configuring Manual Backups," describes how to configure and run manual backups.

Note: The NMSAP program considers a backup that is scheduled through the SAP CCMS monitor to be a manual backup.

Figure 1 on page 24 shows how the NetWorker services, processes, and programs interact during a manual backup. The interactions are described as follows:

Note: Some interactions between the processes, for example requests for NetWorker authorization, are omitted to simplify the description.

1. The **brbackup** or **brarchive** program invokes the **backint** program, and passes it a list of files to back up together with other parameters.
2. The **backint** program processes the parameters by using the NMSAP parameter file, init<ORACLE_SID>.utl, and spawns child **backint** processes to back up the data in parallel.
3. Each child **backint** program performs the following tasks:
   a. Contacts the main NetWorker service, **nsrd**, to obtain the identifier of the **nsrmmd** process that manages the requested backup device.
   b. Reads the data from the client disk and sends the data to the NetWorker media service, **nsrmmd**, to store on the appropriate backup volumes.
   c. Contacts the NetWorker index service, **nsrindexd**, and sends the service tracking information to be stored in the NetWorker client file index.
4. The **nsrmmd** service records tracking information in the NetWorker media database by using the **nsrmmdbd** service.
5. Steps 1-4 may be repeated one or more times, as required, to back up the requested Oracle datafiles, control files, online redo logs, and profiles.

6. The results of the backup are recorded in an SAP backup log file, backint<ORACLE_SID>.log, on the SAP server that runs Oracle. The default location for all logs is:
   - On Microsoft Windows systems: C:\Program Files\Legato\applogs
   - On UNIX or Linux systems: /nsr/applogs

Backup with RMAN

If the Oracle RMAN software is used for the backup, then the process is similar to the use of the **brbackup** program alone, except **brbackup** does the following:

1. Invokes RMAN to back up the Oracle database.
2. Invokes the **backint** program to back up the configuration files, logs, and other flat files that are specific to SAP.

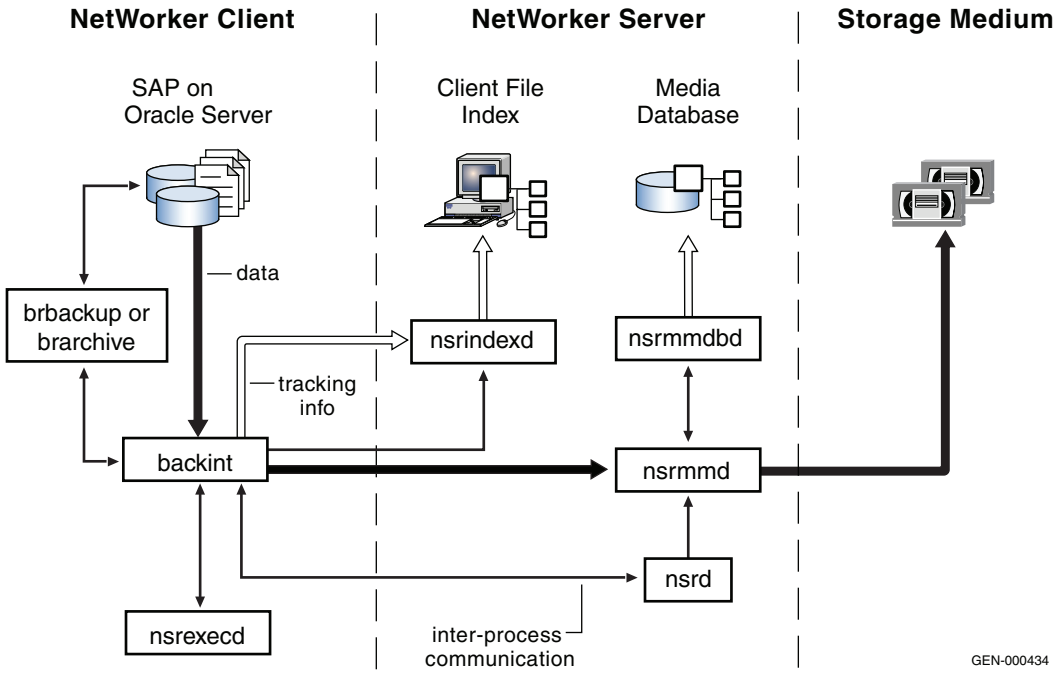

Figure 1 **NetWorker and database interaction during a backup**

Scheduled backup processes

At the scheduled backup start time, the main NetWorker service, **nsrd**, starts the backup of the configured group (that contains the NMSAP client) by invoking the **savegrp** program. The **savegrp** program contacts the NetWorker client-side service, **nsrexecd**, on each client in the backup group to start the backup.

Figure 2 on page 25 shows how the NetWorker services, processes, and programs interact with each NMSAP client in the backup group during a scheduled backup.

Note: Some interactions between the processes, for example, requests for NetWorker authorization, are omitted to simplify the description.

The interactions are described as follows:

1. The **nsrexecd** service starts the **nsrsapsv** program for the scheduled backup, as specified in the **Backup Command** attribute of the NetWorker Client resource.
2. The **nsrsapsv** program processes the backup parameters passed to it by the **savegrp** command, as set in the NMSAP scheduled backup configuration file, nsrsapsv.cfg.
3. The **nsrapsv** program invokes the **brbackup** or **brarchive** command specified in the nsrsapsv parameter in the nsrsapsv.cfg file.

From this point forward, the scheduled NMSAP backup processes follow the same steps as described in "Manual backup processes" on page 23.

Note: Note: At the end of a scheduled NMSAP backup, the **savegrp** program also automatically backs up the NetWorker server bootstrap and the NMSAP client file indexes. The bootstrap and client indexes are not automatically backed up at the end of a manual backup.

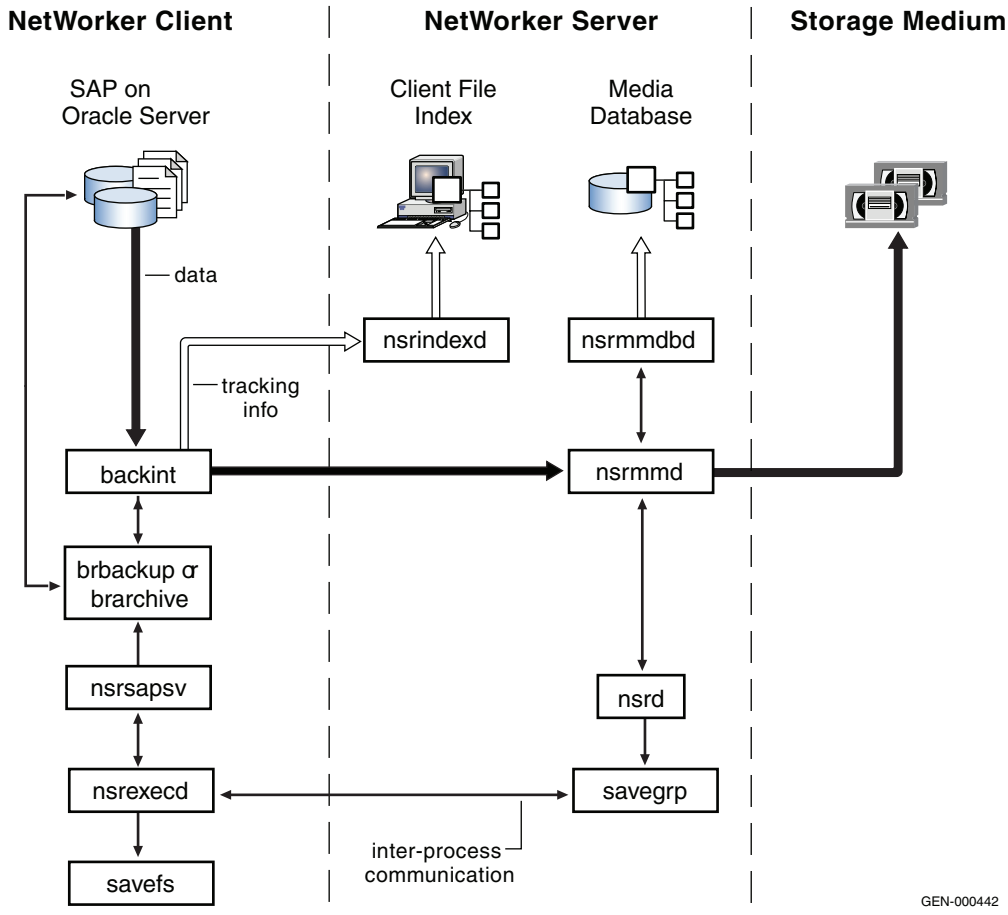

Figure 2 NetWorker and database interaction during a scheduled backup

Restore processes

A data restore is initiated directly by the SAP **brrestore** recovery utility. Chapter 6, "Restoring Data," describes how to restore data that was backed up by the NMSAP software.

Figure 3 on page 27 shows how NetWorker services, processes, and programs interact during a restore. The interactions are described as follows:

1. The **brrestore** program invokes the **backint** program to which it passes a list of files to restore and other parameters.
2. The **backint** program processes the restore parameters, using the settings in the inti<ORACLE_SID>.utl file, and spawns child **backint** processes to restore the data in parallel.
3. Each child **backint** process does the following:
   a. Contacts the **nsrindexd** service to verify that the backup pieces exist in the client file index.
   b. Sends a restore request to the NetWorker server, which proceeds as follows:
      1. The main NetWorker service, **nsrd**, contacts the media service, **nsrmmd**.
      2. The **nsrmmd** service calls the media database service, **nsrmmdbd**, to determine which media contains the requested save set, and issues a mount request.
      3. The **nsrmmd** service reads the appropriate backup volumes and passes the data to the **backint** process.
   c. Writes the data to the mounted disk.
   d. Repeats steps a through c until all the files are restored.

Note: After the data is restored, a database must be recovered by using the SAP **brrecover** utility or the Oracle SQL Plus tool. SAP documentation has more information.

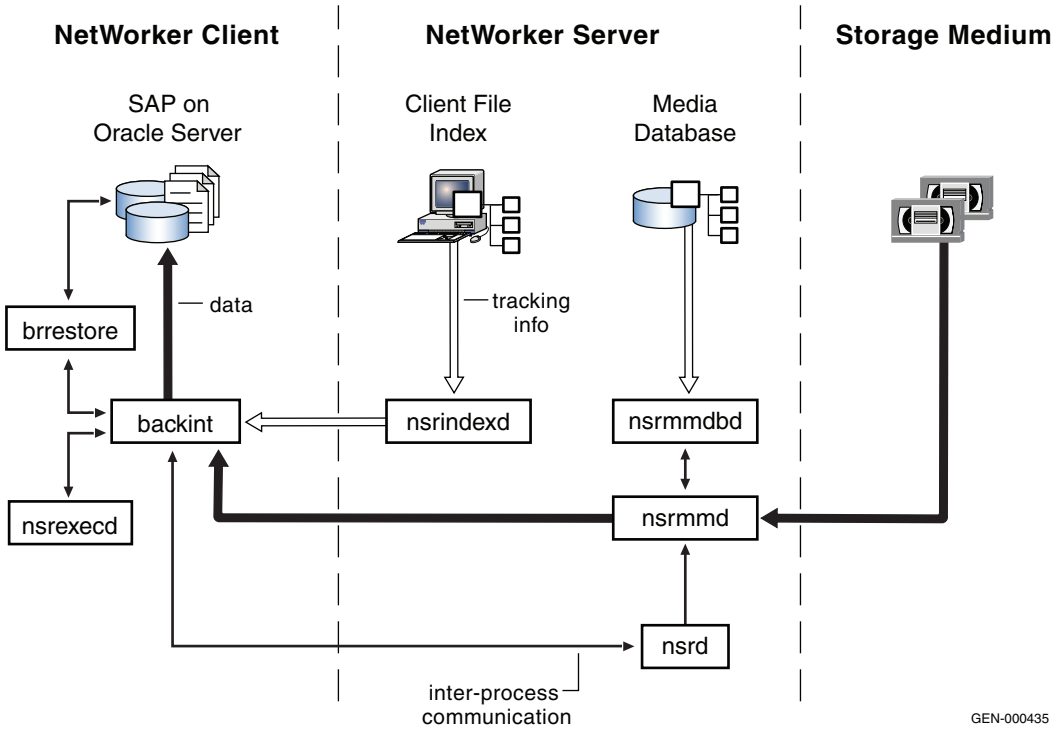

Figure 3 **NetWorker and database interaction during a restore**

Restore with RMAN

If the Oracle RMAN software is used for the restore, the process is similar, except the **brrestore** program first invokes RMAN to restore the Oracle database and then invokes the **backint** program to restore the configuration files, logs, and other flat files that are specific to SAP.

2

Configuring the NMSAP Basics

This chapter provides basic configuration instructions for the NMSAP software and other supporting software required for backup, recovery, and inquiry of SAP with Oracle data and related files.

Unless otherwise noted, the configurations described in this chapter apply to *both* manual and scheduled backups.

This chapter describes the tasks that need to be performed for basic configuration of the NMSAP software:

How to configure the basic NMSAP environment

Configure the basic NMSAP environment as follows:

1. Ensure the SAP software is properly installed and configured before the NMSAP environment is configured. Refer to the appropriate SAP documentation.
2. Install and enable the NMSAP software on each Oracle database server with SAP that requires backup and recovery services. For instructions, refer to the *NetWorker Module for SAP with Oracle, Release 3.5, Installation Guide*.
3. Set the PATH environment variable for the Oracle user to point to the location of the NetWorker client executables, which is typically as follows:
   - On UNIX systems: /usr/bin
   - On Microsoft Windows systems: C:\Program Files\Legato\usr\bin

   The appropriate NetWorker installation guide provides more information.
4. Ensure the **backint** executable binary file is in the same directory as BRTools. On UNIX, set the owner of **backint** to root.
5. If you need to restore to raw device files on UNIX, set the uid bit for the **backint** program by typing the following command:

   ```
   chmod 4755 backint
   ```

   Note: In rare cases, the uid bit must be set in order to restore to file systems on UNIX.
6. Ensure that the SAP backup user is listed in the **User Groups** resource of the NetWorker server, and has the following privileges:
   - Monitor NetWorker processes
   - Back up local data
   - Recover local data

How to configure the NetWorker resources

The NetWorker resources reside on the NetWorker server and are configured by the NetWorker Administrator program.

Table 4 on page 30 provides resource configuration details that are specific to the NMSAP software.

Table 4 NetWorker resources

Resource	Description
Client	Specifies the NetWorker Client resources for each SAP server running Oracle that requires backup, restore, and inquiry operations. For scheduled backups, specify the **Remote User** and **Password** attributes in the Client resource for certain Microsoft Windows configurations. On UNIX, these attributes do not need to be specified in the Client resource. Table 8 on page 47 provides details on setting the **Save Set** and **Backup Command** attributes, which are specific for scheduled backups.
Devices	Ensure that a Device resource is configured for each Oracle storage device used for backup and restore operations. Each device must contain a labeled and mounted volume.
Group	Specifies a set of clients to start backing up data at a specified time.

Table 4 NetWorker resources (continued)

Resource	Description
Media Pool	Sets the volumes in each pool to receive specific or related backup data. When configuring the Media Pool resource, leave the **Save Sets** attribute blank. The NMSAP program sets the **Save Sets** during each backup session.
Schedule	Specifies the days of the week or month when scheduled backups runs.
Server	Defines the NetWorker server to be used for backup, restore, and inquiry operations. When configuring the **Server** resource, check for the following: • Ensure that the **Parallelism** attribute is equal to or greater than the number of save streams being sent to the NetWorker server by the Oracle server or cluster client. The value should match or be greater than the parallelism setting found in the NMSAP parameter file, init<*ORACLE_SID*>.utl. The listing for **parallelism** on page 35 provides more information. • When performing manual backups, ensure the **Manual Saves** attribute is set to **Enabled**. It is not necessary to specify the SAP backup user in the Administrator attribute.

The NetWorker online help and the *EMC NetWorker Administration Guide* provides detailed information on how to configure the NetWorker resources.

How to configure the NMSAP parameters

During backup, restore, or inquire sessions, the NMSAP program uses the default or user-specified parameter settings in the init<*ORACLE_SID*>.utl parameter file. These settings provide client, server, pool, group, expiration, and other values to the **backint** program.

CAUTION

For scheduled backups, the names for the server and group do not need to be specified in the parameter file. However, if they are specified, they must match the corresponding attributes on the NetWorker server or an error occurs. Any other parameters specified in this file, such as pool name, take precedence over the corresponding setting on the NetWorker server.

To set a parameter in the init<*ORACLE_SID*>.utl file, use the following format:

```
parameter=value
```

Refer to the following rules when setting parameters:

- Uncomment and modify as necessary all parameters to be used in backup, restore, or inquire operations.
- Parameter names and values are case-sensitive.

Table 5 on page 32 lists descriptions and default values for NMSAP parameters.

"How to configure the backup of cluster data" on page 38 provides specific instructions on how to configure data clusters.

Table 5 Parameters for the NMSAP init*<ORACLE_SID>*.utl file

Parameter	Description / Default values
arch_backint_log	Specifies the full pathname of the log file to run the **brarchive** command. • Default location on UNIX: `/nsr/applogs/arch_backint<ORACLE_SID>.log.raw` • Default location on Microsoft Windows: `C:\Program Files\Legato\nsr\applogs\arch_backint<ORACLE_SID>.log.raw`
backint_log	Specifies the full pathname of the backint log file for running the **brbackup** and **brrestore** commands. • Default location on UNIX systems: `/nsr/applogs/backint<ORACLE_SID>.log.raw` • Default location on Microsoft Windows systems: `C:\Program Files\Legato\nsr\applogs\backint<ORACLE_SID>.log.raw` **Note:** To specify a separate log file to use specifically for restores, modify this parameter before you run **brrestore**. Alternatively, the **backint_log parameter** can be specified in an init*<ORACLE_SID>*_restore.utl file, which can be referenced from the **util_par_file** parameter in the init*<ORACLE_SID>*_restore.sap file, for example: **`brrestore -p`** `init<ORACLE_SID>_restore.sap`
backint_tmpdir	Specifies the directory name of the **backint** temporary files. • Default location on UNIX systems: `/nsr/applogs/` • Default location on Microsoft Windows systems: `C:\Program Files\Legato\nsr\applogs\`
checksum	Specifies whether to perform cyclic redundancy checking (CRC) on restores. Setting this parameter to **Yes** excludes using the compress, encrypt, and NSR_AES_ENCRYPTION parameters (which should be set to No or False). If more than one of these parameters is set to **Yes** or **True**, the priority order is: compress, checksum, encrypt, and NSR_AES_ENCRYPTION. Default value is **No**.
client	Specifies the NetWorker client hostname to use for the client file index for the current backup or restore operation. If you are using the NMSAP software to back up or restore a virtual cluster client, set this value to the virtual node name. Default value is **Local host**.
compress	Compresses data during a backup before the data is passed over the network or written to tape, which can speed up the backup process. Compression increases CPU usage on the SAP server running Oracle, but reduces the amount of data sent to the NetWorker server. Setting this parameter to **Yes** excludes the use of the checksum, encrypt, and NSR_AES_ENCRYPTION parameters (which should be set to No or False). If more than one of these parameters is set to **Yes** or **True**, the priority order is: compress, checksum, encrypt, and NSR_AES_ENCRYPTION. Default value is **No**.

Table 5 Parameters for the NMSAP init<*ORACLE_SID*>.utl file (continued)

Parameter	Description / Default values
debug_level	Sets the verbosity level of the **backint** diagnostic logs. Possible values are 0 - 9, where 0 means no debugging.
encrypt	Specifies whether to encrypt the backup data by using XLATE ASM. Setting this parameter to **Yes** excludes the use of compress, checksum, and NSR_AES_ENCRYPTION parameters (which should be set to No or False). If more than one of these parameters is set to **Yes** or **True**, the priority order is: compress, checksum, encrypt, and NSR_AES_ENCRYPTION. Default value is **No**.
expiration	Sets the browse and retention periods for all backups. This parameter overrides the NetWorker server-side Client resource settings as well as the NSR_SAVESET_BROWSE and NSR_SAVESET_RETENTION parameters in this file. The value must use **nsr_getdate** format, for example: `expiration = 2 Weeks` **Note:** That this parameters may not be supported in future NMSAP releases. It is replaced by NSR_AES_ENCRYPTION.
level_full	Specifies that a full backup is always performed. For SAP data, do not change this setting from **Yes**. Default value is **Yes** (do not change).
max_logs	Specifies the maximum number of **backint** session logs to be saved in the **backint** log file, specified by the **backint_log** parameter. If the value is set to 0, *all* backup logs will be saved in the log file. Default value is **0**.
notify_done	Alerts when the **backint** program has completed its activity. Uncomment the option and replace *mailx* with the name of the command-line email utility to be used, for example: `notify_done = mailx -s 'backint done' root` No defined default value.
notify_error	Alerts if the **backint** program encounters any errors during its activity. Uncomment the option and replace *mailx* with the name of the command-line email utility to be used, for example: `notify_error = mailx -s 'backint error' root` No defined default value.
notify_start	Alerts when the **backint** program begins its activity. Uncomment the option and replace *mailx* with the name of the command-line email utility to be used, for example: `notify_start = mailx -s 'backint start' root` No defined default value.
notify_success	Alerts when the **backint** program has successfully completed its activity. Uncomment the option and replace *mailx* with the name of the command-line email utility to be used, for example: `notify_success = mailx -s 'backint success' root` No defined default value.

Table 5 Parameters for the NMSAP init<*ORACLE_SID*>.util file (continued)

Parameter	Description / Default values
NRS_AES_ENCRYPTION	Specifies whether to encrypt backup data using 256-bit AES ASM encryption. Not supported for PowerSnap backups. **Note:** If the encryption phrase has changed between the time of the backup and the time the backup is restored, then the **NSR_ENCRYPTION_PHRASES** parameter must include the correct phrase to enable the recovery, for example, **NSR_ENCRYPTION_PHRASES** = *phrase 1*, *phrase 2* Each attempted phrase must be enclosed in double quotes and separated by a comma. There should not be a comma after the last phrase. Setting this parameter to **True** excludes the use of the compress, checksum, and encrypt parameters (which should be set to No). If more than one of these parameters is set to **Yes** or **True**, then the priority order is: compress, checksum, encrypt, and NSR_AES_ENCRYPTION. Default value is **False**.
NSR_DEBUG_DIR	Specifies the directory for the **backint** diagnostic logs, if not using the default location nsr/applogs.
NSR_SAVESET_BROWSE	Specifies the date when the entry for the backup is to be removed from the NetWorker client index and the associated backup files are no longer readily available to desktop users by browsing. **Note:** For a scheduled backup, this parameter overrides the Browse Policy attribute setting in the NetWorker Client resource. The date must be in nsr_getdate(3) format.
NSR_SAVESET_RETENTION	Specifies the date when the save set becomes recyclable and the associated files on the volume can be overwritten. **Note:** For a scheduled backup, this parameter overrides the Retention Policy attribute setting in the NetWorker Client resource. The date must be in nsr_getdate(3) format.
NSR_RAW_DEVICE_SKIP_BYTES	Used to omit unwanted data from recovery on a raw device. Specifies the initial amount of data to skip. This parameter has the following syntax: NSR_RAW_DEVICE_SKIP_BYTES=/raw/dev1=skip[B|K|M|G] The device name is followed by an equal sign and the amount of data to skip, secified in bytes (B or b), kilobytes (K or k), megabytes (M or m), or gigabytes (G or g). The parameter can specify multiple devices by separating the entries with a colon. For example, to skip 8KB for the raw device /dev/rdsk/c2t4d0s5, set: NSR_RAW_DEVICE_SKIP_BYTES=/dev/rdsk/c2t4d0s5=8K **Note:** It is the user's responsibility to determine how much data to skip, based on the operating system or volume manager specifications.

Table 5 Parameters for the NMSAP init<*ORACLE_SID*>.utl file (continued)

Parameter	Description / Default values
parallelism	Specifies the number of save sets or save streams to send simultaneously to the NetWorker server. Typically, this setting should be equal to the sum of the "target sessions" for all of the devices dedicated to the NMSAP software. Ensure that the NetWorker server is configured to support this parallelism value or greater. The listing for **Server** in Table 4 on page 30 provides more information. **Note:** The **Parallelism** value will be reduced if it is greater than the value of the **save sets** parameter, provided the **ss_group_by_fs** parameter is set to No or not set. Default value is **No**.
pool	Specifies the NetWorker **media pool** resource, (defined on the NetWorker server), that receives backup data from the SAP with Oracle server. This parameter should be used for manual backups only. If not specified, the pool is determined by the NetWorker server. If set for scheduled backups, this parameter overrides the NetWorker server setting. To use multiple pools to separate data: 1. Create separate init<*ORACLE_SID*>.utl parameter files. 2. Use the **-r** option to specify the parameter filename to use at the command line when using **brbackup** or **brarchive**. For example, a pool named ARCHData is used specifically for archive logs. You can create a separate parameter file for archive logs, named for example, archiveC11.utl, and set the pool attribute equal to ARCHData. To use this pool to back up the archive logs, you would enter the following command at the command line: `brarchive -u sys/admin -d util_file -r archiveC11.utl -m all -s save`
prev_bk_restore	UNIX only. Specifies whether to restore the previous backup if the required backup cannot be found, when the **query_index** parameter is set to **No**. Default value is **No**.
query_index	UNIX only (Microsoft Windows is always **Yes**). Specifies whether to query the NetWorker server indexes for validation of the requested files and backup IDs before a restore begins. If set to **No**, the query does *not* occur. Default value is No.
raw_dir	Specifies the directory for raw disk partitions. Any files below these directories are considered to be raw disk partitions. Do *not* set the /dev or /devices directories for raw partitions. They are already treated as raw devices. To specify the directory, uncomment this option, and use a semicolon (;) to separate the directory paths, for example: `raw_dir = /oracle/data;/sap/data;/lotus/data` No defined default value.
retry_count	Specifies the number of times that a failed backup is attempted for each save set. Any integer greater than 0 is allowed. Default value is 0.

Table 5 Parameters for the NMSAP init*<ORACLE_SID>*.utl file (continued)

Parameter	Description / Default values
savesets	Specifies the number of save sets to divide the files on a client and distribute the backup load. If the value is equal to or greater than the number of database files, then a separate save set is made for each file. If the value is smaller than the number of database files, then a save set may contain more than one file. This value is ignored if the **ss_group_by_fs** parameter is set to **Yes**. Default value is 20.
sem_timeout	Sets the amount of time, in minutes, that **backint** waits for **brbackup** or **brconnect** to remove the semaphore file. If the semaphore file is *not* deleted, **backint** exits with an error at the end of this time-out period. Default value is 30.
server	Specifies the hostname of the NetWorker server that the NMSAP program uses for backup, restore, and inquiry sessions, for example: `server = prelude` **Note:** This parameter does not need to be set for scheduled backus, but if it is, it must match the server that started the backup, or an error occurs. If the server parameter is *not* specified, then the NMSAP program backs up data to the local host. Default value is Local Host.
ss_group_by_fs	If set to **Yes**, ignores the **savesets** and **ss_size_max** parameters and groups save sets by file system instead of file size. This more efficient grouping of files can improve performance of scheduled backups, index lookups, and restore times. Default value is No.
ss_size_max	Specifies maximum save set size in megabytes. If not set, or set to zero, then size is unrestricted. The value must be equal to or greater than the size of the largest datafile. Default value is 0.
ssNameFormat	Sets the naming convention for save sets. • If set to **Old**, then the name for *all* save sets is backint:*<ORACLE_SID>*. • If set to **New**, then the save set name for each session differs according to the files being backed up. It uses the format backint:*<ORACLE_SID>*:full_path of the first filename in the save set. If you set each save set to store one file, then a value of New simplifies the process of browsing the media database. The media database will show each filename as part of the save set name. **Note:** If set to **New**, the NetWorker **recover -S** command cannot be used to restore the database. However, the **brrestore** command can be used. Default value is Old.
verbose	Provides more detailed information in the log file from save and recover operations. Default value is No.

How to configure the backup and restore utility

Backups, restores, and inquiries of SAP data can be performed by BRTools with either the NMSAP **backint** utility or the Oracle RMAN utility. The following two examples describe a simple configuration of each case.

Note: If RMAN is used to back up Oracle databases, BRTools still uses **backint** to back up the SAP configuration files, logs, and other files.

Example 1 Configure backint as the backup and restore utility

The following example describes a simple configuration of BRTools to use the **backint** program for backup, restore, and inquiry operations. For complete instructions, refer to the appropriate SAP documentation.

1. With a text editor, open the SAP initialization file, init<*ORACLE_SID*>.sap, which is typically located in the following directory:
   - On UNIX systems: *$ORACLE_HOME*/dbs
   - On Microsoft Windows systems: *%ORACLE_HOME%\DATABASE*
2. Set the backup device type parameter to use the **backint** program by specifying one of the following:
   - backup_dev_type = util_file
   - backup_dev_type = util_file_online
3. Set the backup utility parameter file parameter to point to the NMSAP parameter file, init<*ORACLE_SID*>.utl, as follows:
   - On UNIX or Linux systems:

     ```
     util_par_file = ?/dbs/init<ORACLE_SID>.utl
     ```

     where ? = $ORACLE_HOME
   - On Microsoft Windows systems:

     ```
     util_par_file = ?\database\init<ORACLE_SID>.utl
     ```

     where ? = %ORACLE_HOME%

"How to configure the NMSAP parameters" on page 31 describes how to configure the init<ORACLE_SID>.utl parameter file.

Example 2 Configure RMAN as the backup and restore utility

The following example describes a simple configuration of the Oracle RMAN utility, which works with the BRTools utilities, for backup, restore, and inquiry operations. For complete instructions, refer to the appropriate SAP documentation.

1. With a text editor, open the SAP initialization file, init<*ORACLE_SID*>.sap, which is typically located in the following directory:
   - On Microsoft Windows systems: *%ORACLE_HOME%\DATABASE*
   - On UNIX systems: *$ORACLE_HOME*/dbs
2. Set the backup device type parameter to use the RMAN utility by specifying the following:

   ```
   # backup device type
   backup_dev_type = rman_util
   ```

3. Uncommon the line for the **rman_send** parameter and set it to include each NetWorker-specific (NSR_*) environment variable that is appropriate for your backup, restore, and inquiry sessions.

   Table 21 on page 92 lists these environment variables. The environment variable names are case-sensitive and use the following syntax:

   ```
   rman_send="NSR_ENV=(var1=value, var2=value, ...)"
   ```

   For example:

   ```
   rman_send="NSR_ENV=(NSR_SERVER=server_name,
   NSR_DATA_VOLUME_POOL=pool_name)"
   ```

How to configure the backup of cluster data

In cluster configurations, the NMSAP program backs up *all* Oracle data that resides on private disks in a cluster, or only *shared* Oracle data that resides on a virtual client in a cluster.

To configure the backup of cluster data on SAP with Oracle systems:

1. Ensure that the NMSAP program is installed on both physical nodes of the cluster, but only on the private disks of the nodes. For details on installing the NMSAP, refer to the *NetWorker Module for SAP with Oracle Installation Guide*.
2. Ensure that a NetWorker Client resource is created for each physical node and for the virtual node.
3. Configure the NMSAP parameter file (init<*ORACLE_SID*>.utl) with the appropriate client parameter setting for the type of backup you want:
   - To back up Oracle data located on a private disk, use the physical node name as the client name.
   - To back up Oracle data located on a shared disk that belongs to a virtual system, use the network name associated with the virtual system as the client name.

   Table 5 on page 32 provides details on the NMSAP init<ORACLE_SID>.utl parameter settings.

Note: Scheduled or **savegrp** backups of virtual cluster clients may fail (although they may be reported as successful) if the save set name in the NetWorker Client resource is not an actual pathname, for example BACKINT:*ora_sid*. To work around this issue, create an empty file named pathownerignore in the directory where the NetWorker **savefs** command is installed. This file must be created on each NetWorker client host in the cluster. Table 6 on page 38 lists the default installation locations for the **savefs** command.

Table 6 Default installation locations for the savefs command

System	Directory
Solaris and Linux	/usr/sbin
HP-UX	/opt/networker/bin
AIX	/usr/bin
HP Tru64 UNIX	/usr/opt/networker/bin
Microsoft Windows 2000	%SystemDrive%/Program Files/Legato/nsr/bin

3 Configuring Manual Backups

This chapter describes how to configure and perform manual backups of either online or offline Oracle database instances that reside on an SAP server that is running Oracle. It assumes that you have properly configured the basic settings for manual backups, as described in Chapter 2, "Configuring the NMSAP Basics."

This chapter includes the following sections:

About manual backups

Two types of manual backups, also known as "ad hoc" or "unscheduled" backups, can be performed: either offline or online.

- Perform *offline* backups when network traffic is low, typically in the evenings or on weekends. The SAP services and the Oracle database instance are not available to users during the backups.
- An *online* backup allows users to continue to use SAP services and Oracle database instances while the Oracle tablespaces on the SAP server are being backed up.

Unlike scheduled backups, manual backups do *not* automatically save backup records to the *client file index* database and the *bootstrap* save set on the NetWorker server. Regular backups of these components are required to ensure adequate recovery in the event of a disaster, such as a disk failure. "How to back up the client file indexes and bootstrap file" on page 41 provides details.

Note: PowerSnap operations are *not* supported for manual backups, and must be initiated through the **nsrsapsv** scheduled backup program. Chapter 7, "PowerSnap Backup and Data Restore," provides details.

Requirements

Before you begin a manual backup, ensure the following:

- The backup parameters are set in the *NMSAP* init<*ORACLE_SID*>.utl file. "How to configure the NMSAP parameters" on page 31 describes how to configure backup parameters.
- The parameters for the backup device type (backup_dev_type) and backup utility parameter file (util_par_file) are set in the SAP utilities profile, init<*ORACLE_SID*>.sap. "How to configure the backup and restore utility" on page 37 describes how to configure the utilities profile.
- The NetWorker server, the SAP server that runs Oracle, and the NetWorker client services are all running.
- For online backups, ensure the Oracle database instance is in ARCHIVELOG mode. To set an Oracle database instance to ARCHIVELOG mode, refer to the appropriate Oracle documentation.

How to perform a manual backup

The following steps describe how to perform a basic manual backup with the **brbackup** command, with options for either an offline or online backup.

1. Type the appropriate command:
   - Offline backup:

     ```
     brbackup -m all -t offline [-d util_file]
     ```

   - Online backup:

     ```
     brbackup -m backup_objects -t online [-d util_file_online]
     ```

where:

- **-m all** specifies the backup mode is to back up the entire Oracle database instance.
- **-m** *backup_objects* specifies the objects to be backed up, such as tablespace, file ID, file ID range, or object list.
- **-t offline** specifies the backup type is offline.
- **-t online** specifies the backup type is online.
- **-d util_file** specifies the NMSAP program is to be used for the backup.

The Oracle database instance or the selected objects are backed up to the NetWorker server.

Note: Appendix A, "Examples of SAP Command Options," gives further information on **brbackup** command options. For complete instructions on how to perform a manual backups, refer to the appropriate SAP documentation.

2. If backing up online, back up the archive redo logs by the typing the additional command:

   ```
   brarchive
   ```

   Note: Without the redo logs, a database that was backed up online can be recovered only to the time of its last full backup. Appendix A, "Examples of SAP Command Options,"provides further information on **brarchive** command options.

3. Back up the client file indexes and bootstrap. "How to back up the client file indexes and bootstrap file" on page 41 provides instructions.

How to back up the client file indexes and bootstrap file

Unlike scheduled backups, manual backups do *not* automatically back up the client file indexes and the bootstrap file on the NetWorker server. If you do *not* perform regular scheduled backups, protect this vital information after a manual backup by following this procedure.

IMPORTANT

Backups of the *client file index* database and the *bootstrap* save set are required to ensure adequate recovery from a disaster, such as a disk failure.

To back up the client file indexes and bootstrap file, and apply browse and retention policies to the client file indexes:

1. Include the client in a Group resource, which must be defined in *both* the NetWorker Administrator program and the init<*ORACLE_SID*>.utl file. (A Group resource can be created even for a single client.) This ensures that browse and retention policies are applied to the client file indexes when the **savegrp** command is entered in step 2.

   For more information on how to configure a Group resource with the NetWorker Administrator program, refer to the *EMC NetWorker Administration Guide*.

   Note: If the client is *not* included in a Group resource, you must perform step 3 as an additional step to manually run the **nsrim** command.

2. On the NetWorker server, log in as the root user (UNIX) or administrator (Microsoft Windows), and type the following **savegrp** command:

   ```
   savegrp -O -c client_name
   ```

   where:

   - **-O** saves the index files and bootstrap file for the client on the associated NetWorker server *without* backing up the client database files.
   - **-c** *client_name* specifies the hostname of the SAP server that runs Oracle and whose index files are to be backed up.

   For more information on the **savegrp** command, refer to the *EMC NetWorker Command Reference Guide*.

3. If the client is *not* included in a Group resource (see step 1), apply browse and retention policies to the client index files with the **nsrim** command as follows:

   ```
   nsrim -c client_name
   ```

   where **-c** *client_name* specifies the hostname of the SAP server running Oracle whose index is to be backed up.

   Note: It is recommended to apply browse and retention policies to SAP backups. Otherwise the client file indexes use large amounts of hard drive space and index queries are slower.

   The *EMC NetWorker Command Reference Guide* has more information on the **nsrim** command.

How to review backup session reports

During backup or restore sessions, the NMSAP program appends a report to a sessions log file. The default location for the log is:

- On Microsoft Windows systems: C:\Program Files\Legato\applogs
- On UNIX or Linux systems: /nsr/applogs

The default format for the log filename is backint<*ORACLE_SID*>.log.raw.

This backup sessions log can be written to a different location by using a different name, as specified in the **backint_log**, **arch_backint_log**, or **backint_tmpdir** parameters in the init<*ORACLE_SID*>.utl file. "How to configure the NMSAP parameters" on page 31 provides more information.

This sessions log is in I18N format, and must be run through the NetWorker nsr_render_log utility to be readable. If the language pack is installed, the log is translated into the language set by the locale.

Table 5 on page 32 describes the contents of this log. At the end of each session in the report, there is a statement of the number of successfully completed files out of the total number of files.

Table 7 on page 43 lists the types of values recorded in a backup, restore, or inquire session report.

Appendix C, "Troubleshooting," describes NMSAP and NetWorker error messages.

Table 7 Values reported for backup and restore sessions

Recorded log value	Description
BACKUP *backup_id file*	ID and filename from a successful inquiry function.
ERROR *file* or NOTFOUND *file*	An unsuccessful backup, restore, or inquire function and the intended file.
RESTORED *backup_id file*	IID and filename for each successful restore function.
SAVED *backup_id file*	ID and filename for each successful backup function.
Files	Number of files to be backed up or restored in this backup or restore session.
Input File	Name of the input file containing all files that **backint** is requested to back up or restore. Each requested file is listed under the message, "Reading input file."
Local Host	SAP server running Oracle that is associated with the report.
n of *m* files saved *n* of *m* files restored *n* of *m* files reported	Number of files (*n*) successfully saved, restored, or reported by the NetWorker program out of the total number of files (*m*) intended for the backup or restore operation. Backups list two records, one for data and one for profiles.
Number of Symlinks (UNIX only)	Total number of symbolic links found in the files listed in the Input File.
Parallelism	Parallelism setting that **backint** uses when either passing save sets to the NetWorker server for backup or receiving save sets for restore.
Params File	init<*ORACLE_SID*>.utl parameter file that **backint** uses for backup, restore, or inquiry of the SAP with Oracle data.
Processing Parameter File	Parameter that **backint** uses during the backup, restore, or inquire process. "How to configure the NMSAP parameters" on page 31 provides details on the NMSAP parameters.
Savesets/Sessions	Number of save sets that **backint** sends to the NetWorker server.
Starting	Backup or restore command, which is followed by a list of the files that were or were not successfully backed up or recovered in each session.
Symlink (UNIX only)	Location of a symbolic link associated with the file backed up or restored. The most common symbolic link is between the /oracle and /mnt/oracle directories. During backup, this link is backed up so that upon recovery the link is resolved. Only one level of symlinks is supported due to SAP restrictions.
User	Database ID (*ORACLE_SID*) associated with the database instance. BRTools passes this value to **backint**.

4

Configuring Scheduled Backups

This chapter describes how to configure scheduled backups of SAP servers that run Oracle.

This chapter includes the following sections:

Requirements

Before configuring scheduled backups, test the network connections and basic software settings by performing a successful manual NMSAP with Oracle backup.

- Chapter 2, "Configuring the NMSAP Basics," describes the basic settings.
- Chapter 3, "Configuring Manual Backups," describes how to perform a manual backup.

How to configure scheduled backups with the wizard

Scheduled backups can be configured with the NMSAP backup configuration wizard, which is run on NetWorker Management Console (NMC) as an alternative to the NetWorker server Administration program. The wizard does the following:

- Creates a new Client resource for the NMSAP client on the NetWorker server. It cannot modify an existing Client resource.
- Creates a new Group resource, or assigns the client to an existing group, on NetWorker server.
- Creates a scheduled backup configuration file (nsrsapsv.cfg) on the NMSAP client.
- Creates, if needed, the NMSAP generic configuration file, init<ORACLE_SID>.utl.

Note: Manual backup and recovery operations also use the BRTools configuration file, init<ORACLE_SID>.sap, and, depending on preferences, these operations may require different parameters to be set in this file. The wizard does not modify the BRTools configuration file.

Note: The wizard does not support configuration of RMAN or PowerSnap backups.

The *EMC NetWorker Module for SAP with Oracle Release 3.5 Multiplatform Version Installation Guide* provides installation details.

"How to configure scheduled backups with NetWorker" on page 47 describes how to perform these configurations without the assistance of the wizard.

How to run the wizard

The backup configuration wizard is run from the NetWorker Management Console by first selecting the NetWorker server that will perform the backups and then starting the wizard. The wizard offers a choice of either a typical and a custom configuration.

- Typical backup configuration presents a limited number of steps with typical default values.
- Custom backup configuration offers more steps and flexibility in the setting of non-default backup parameters. For example, a custom configuration would be used to perform any of the following:
  - An online backup
  - A backup of only a specific tablespace, data file or archived logs
  - To set some non-default values for SAP and NMSAP parameters

How to configure scheduled backups with NetWorker

As an alternative to using the NMSAP backup configuration wizard, scheduled backups can be configured in detail by running the NetWorker server Administration program, editing the backup configuration file, and encrypting the Oracle username and password. The procedures and attributes for using this method of configuration are described in the following tasks.

Task 1: Configure the client resource

Use the NetWorker Administrator program on the NetWorker server to configure the Client resource for each SAP server with Oracle data that is to be scheduled for backup.

- Table 4 on page 30 provides general Client resource settings for the NMSAP software.
- Table 8 on page 47 provides Client resource settings that are specific to scheduled backups.
- All other settings for scheduled backups must be specified in the NMSAP parameter file and the scheduled backup configuration file. More information can be found in the following sections:
  - "How to configure the NMSAP parameters" on page 31
  - "Task 2: Configure the scheduled backup configuration file" on page 48.

CAUTION

Settings in the NMSAP init<*ORACLE_SID*>.utl parameter file override any corresponding settings (including default settings) in the NetWorker Client resource.

For a complete description of Client resource settings, refer to the *EMC NetWorker Administration Guide*.

Table 8 NetWorker Client resource settings for scheduled backups

Attribute	Description
Backup Command	Enter the **nsrsapsv** command in this attribute, with the **-f** option and the configuration filename: **`nsrsapsv -f`** *filename* where *filename* is the full pathname of the scheduled backup configuration file, nsrsapsv.cfg. The pathmane must contain only ASCII characters. Because the **Backup Command** attribute is limited to 64 characters, following default path is recommended: • On Microsoft Windows systems: C:\Program Files\Legato\nsr\res\nsrsapsv.cfg • On UNIX or Linux systems: /etc/nsrsapsv.cfg "Task 2: Configure the scheduled backup configuration file" on page 48 provides information on the scheduled backup configuration file.
Browse Policy	Specifies the date when the entry for the backup is to be removed from the NetWorker client index and the associated backup files are no longer readily available to desktop users by browsing.
Password	On Microsoft Windows systems only, enter the password for the **Remote User** attribute.

Table 8 NetWorker Client resource settings for scheduled backups (continued)

Attribute	Description
Remote User	On Microsoft Windows systems only, enter the SAP user's operating system username.
Retention Policy	Specifies the date when the save set becomes recyclable and the associated files on the volume can be overwritten.
Save Set	Ensure that the save set name includes the **backint** key word and is defined in the following format: backint:<*ORACLE_SID*>

Task 2: Configure the scheduled backup configuration file

The NMSAP scheduled backup configuration file, named nsrsapsv.cfg, is included with the installation. This is a text file that contains parameters required by the NetWorker **nsrsapsv** scheduled backup program.

Note: Use a copy of the nsrsapsv.cfg file, and preserve the original file.

Among other things, the nsrsapsv.cfg configuration file is used to:

- Identify the SAP Oracle database to be backed up.
- Specify the BRTools command that is used for the scheduled backups.
- Encrypt user credentials for logging in to the SAP server and connecting to Oracle.
- Configure system-specific environment variables.

To use this configuration file, its full pathname must be specified in the Backup Command attribute of the Client resource. Table 8 on page 47 describes the Backup Command attribute.

Uncomment any parameters in the configuration file that you want to use in the backup. To set a parameter, use the following format:

```
parameter = value
```

CAUTION

Use full pathnames for parameters that specify a path or filename. Special Oracle characters, such as ?, are not supported. Also, environment variables, such as $ORACLE_HOME and %ORACLE_HOME%, are not supported.

Table 9 on page 49 lists the parameters and values for the scheduled backup configuration file (nsrsapsv.cfg) or a copy of this file.

Table 9 Parameters for the NMSAP scheduled backup configuration file (nsrsapsv.cfg)

Parameter	Description
Any *name_path*=*value* pair	Appends values to any environment variable named *name_path* (for example, LD_LIBRARY_PATH). • If an environment variable with this name already exists, then the parameter value listed here is appended to the existing value for the environment variable. • If an environment variable with this name does not exist, then it is created. For example: LD_LIBRARY_PATH=/export/home/oracle/product/8.1.5/lib:/usr/openwin/lib **Notes**: • For AIX, add LIBPATH to the path. • For Tru64, add SHLIB_PATH to the path. This parameter is optional.
Any *name*=*value* pair	Adds any environment variable named *name*. If the environment variable specified by *name* already exists, then it is overwritten. For example: BR_TRACE=1 BR_TRACE is set to 1 in the environment, which instructs **brbackup** or **brarchive** to print out additional trace information. This parameter is optional.
BR_EXEC	Specifies the **brbackup** or **brarchive** command, with any options that **nsrsapsv** uses. **Note:** Do *not* use the **-u** option, which identifies the username and password of the Oracle database administrator. Instead, the username and password should be encrypted by using the **nsrsapadm -c** *filename* command. "Task 3: Encrypt the username and password" on page 51 provides details. For example: **BR_EXEC**=brbackup This is a required parameter.
HOMEDRIVE	Microsoft Windows systems only. This parameter specifies the drive name where Windows system files reside. You can verify this setting by entering **set homedrive** in a command window. For example: **HOMEDRIVE**=C:
NLS_LANG	Specifies the language character set. Format the value of this parameter as follows: LANGUAGE_TERRITORY.CHARACTERSET For example: **NLS_LANG**=AMERICAN_AMERICA.US7ASCII For more information about this parameter, refer to the Oracle documentation. This is a required parameter.
NSR_SAP_WAIT_BRTOOLS_DONE_MINS	Specifies how long after a backup is aborted by the user the **nsrsapsv** program waits for the **brbackup** program to do the following: • Perform a cleanup routine • Remove tablespaces from backup status. Default value is **2 minutes**.

Table 9 Parameters for the NMSAP scheduled backup configuration file (nsrsapsv.cfg)

Parameter	Description
ORACLE_BIN	Specifies the location of the Oracle binaries. The specified path is appended to the PATH environment variable so that all Oracle binaries can be found, if needed. This parameter is required only if the Oracle binaries are *not* in the default location, *$ORACLE_HOME*/bin.
ORACLE_HOME	Specifies the installation path for the Oracle server software for *<ORACLE_SID>*. Use the full pathname. For example: **ORACLE_HOME**=/export/home/oracle/product/8.1.5 This is a required parameter.
ORACLE_SID	Identifies the system identification (SID) for the Oracle instance to be backed up. • If this parameter is specified, then its value is used for the Oracle SID. • If the parameter is not specified, then the Oracle SID is derived from the save set name in the NetWorker Administrator's Client resource for this client. For example, if the save set name is backint:SAP and you do not specify <ORACLE_SID> in the scheduled backup configuration file, then SAP is used for the Oracle SID. For example: **ORACLE_SID**=SAP This parameter is optional.
ORACLE_USR_PASSWD	Contains the SAP user's encrypted Oracle username and password. The **nsrsapadm -c** command creates this parameter. Do not manually add or edit this parameter. Use the **nsrsapadm -c** command instead.
OS_USR_PASSWD	Contains the SAP user's operating system username and password. The **nsrsapadm -c** command creates this parameter. Do not manually add or edit this parameter. Use the **nsrsapadm -c** command instead.
PATH	Adds more search paths to the *PATH* environment variable. The specified value is appended to the PATH environment variable. You can specify multiple search paths by either one of the following methods: • PATH=d:\dir1;d:\dir2;d:\dir1\dir2\dir3 • PATH=d:\dir1 PATH=d:\dir2 PATH=d:\dir1\dir2\dir3 This parameter is optional.
SAP_BIN	Specifies the path to the location of the BRTools binary files. This should also be where the **backint** (UNIX) or **backint.exe** (Microsoft Windows) executable resides, after it is manually moved to this location following installation of the NMSAP software. This path is added to the PATH environment variable so that the BRTools binaries and **backint** can be found. For example: **SAP_BIN**=/usr/sap/SAP/SYS/exe/run This is a required parameter.

Table 9 Parameters for the NMSAP scheduled backup configuration file (nsrsapsv.cfg)

Parameter	Description
SAP-specific environment variables: SAPARCH SAPREORG SAPTRACE SAPCHECK	Microsoft Windows systems only. Required for **brbackup** to run properly on Windows. They are normally set in the SAP environment on Windows. For example: SAPARCH=d:\orant\CER\saparch SAPREORG=d:\orant\CER\sapreorg SAPTRACE=d:\orant\CER\saptrace SAPCHECK=d:\orant\CER\sapcheck These parameters are required only if they are not set on the Microsoft Windows system or need to be overwritten.
SAPBACKUP	Indicates the directory to store backup logs. BRTools uses this directory to store temporary or log files. • For Microsoft Windows systems, this is a required parameter. • For UNIX systems, the default value is $*ORACLE_HOME*/sapbackup.
SAPDATA_HOME	Specifies the root directory for SAP datafiles. For details, refer to the SAP documentation.

Task 3: Encrypt the username and password

The SAP user's operating system username and password, and the SAP user's Oracle username and password, must be encrypted in the NMSAP scheduled backup configuration file, nsrsapsv.cfg (or a copy of this file).

To encrypt both the SAP user's operating system username and password and the SAP user's Oracle username and password:

1. Type the following at the command line:

   nsrsapadm -c *filename*

   where *filename* is the full pathname of the scheduled backup configuration file used for the backup.

2. Follow the prompt instructions.

How to review backup session reports

During a backup session, several reports are written to log files on each SAP server that runs Oracle where the NMSAP software resides.

- Each time the **nsrsapsv** program is called, a log file is created with the name nsrsapsv.<process_id><*ORACLE_SID*>, for example, nsrsapsv.359_CER.
- The **backint** program saves a backup report in the **backint** log file. The default log filename is backint<*ORACLE_SID*>.log.raw.

The default location for all logs is:

- On Microsoft Windows systems: C:\Program Files\Legato\applogs
- On UNIX or Linux systems: /nsr/applogs

Logs can be written to a different location by using different names. These names are specified in the **backint_log**, **arch_backint_log**, or **backint_tmpdir** parameters. Table 5 on page 32 gives information on these parameters.

The **backint** log is in I18N format, and must be run through the NetWorker nsr_render_log utility to be readable. If the language pack is installed, the log is translated into the language set by the locale.

Table 7 on page 43 lists backup and restore session report values.

5

Cloning backup data

This chapter includes the following sections:

About cloning backups

Cloning is the NetWorker process used to make an exact copy of saved data (save sets) from a storage volume to a clone volume. You can clone individual save sets or the entire contents of a storage volume. The cloned volumes are indistinguishable from the original, except that the volume labels are different. NetWorker software indexes and tracks clones in both the client file index and the media database. The NetWorker Module for SAP with Oracle (NMSAP) software uses the **sapclone** command to clone save sets.

Sapclone command syntax and options

NMSAP backups of Oracle databases NMSAPcan be cloned by running the **sapclone** command from either the NetWorker server or the SAP server running Oracle. The **sapclone** command works with **nsrclone** to write the cloned data to the default clone pool, or to a specified clone volume whose pool type is "clone."

Use the following syntax for the **sapclone** command:

```
sapclone [-a] [-b pool] [-c client] [-n] [-s server] -u user
```

Command options in brackets ([ ]) are optional. Only the **-u** option is mandatory.

Table 10 on page 54 lists the options to use with the **sapclone** command.

Table 10 The sapclone options

Option	Description	Example
-a	Clones all the save sets of a client. If this option is not specified, the NMSAP program clones only save sets created in the last 24 hours.	`sapclone -a -u mikeERC`
-b *pool*	Specifies the pool to which the cloned save sets are sent. If this option is *not* specified, the save sets are sent to the Default clone pool.	`sapclone -b SAPClone -u mikeERC`
-c *client*	Identifies the name of the client whose backed-up data should be cloned. NetWorker software uses the client file index for the specified client to find and clone the client data. Use this option for cloning data backed up from a cluster. For example, you can set this option to the name of the cluster's virtual node.	`sapclone -c saturn -u mikeERC`
-n	Tests the cloning operation on the save sets for a client. When this option is specified, the cloning operation is not initiated. The example performs a trial cloning process on the save sets created by **backint** in the last 24 hours, with none of the data being stored onto volumes of a clone pool.	`sapclone -n -u mikeERC`
-s *server*	Specifies the destination NetWorker server. You need this option only if one of the following conditions is true: • You clone to a NetWorker server other than the default server. • You enter the **sapclone** command on a SAP server running Oracle.	`sapclone -s mars -u mikeERC`
-u *user*	Required. Identifies the ID of the Oracle database, with the save sets to be cloned.	`sapclone -u mikeERC`

How to monitor the clone process

Messages are displayed in the NetWorker Administrator program for each save set that is cloned. Because the clone process clones only complete save sets, additional volumes are requested if a save set spans multiple volumes.

The messages that appear on the screen during the cloning process are recorded in the NetWorker messages log file, which is located as follows:

- On Microsoft Windows systems: *C:*\Program Files\Legato\nsr\logs
- On UNIX or Linux systems: /nsr/logs

Appendix C, "Troubleshooting," describes NMSAP and NetWorker error messages.

6 Restoring Data

This chapter describes how to restore data that was backed up by the NMSAP software.

This chapter includes the following sections:

How to restore data

Data backed up with the NMSAP software can be restored by using either the BrGui interface or the **brrestore** or **brrecover** commands. If a backup was done with RMAN only, then the data must be restored with RMAN.

- The appropriate Oracle documentation provides details on restoring with RMAN.
- The appropriate SAP documentation provides detailed information on restore and recovery processes.

To restore an entire database or a single database object, such as a tablespace or datafile:

1. Ensure that the NetWorker server, the SAP server with Oracle, and the NetWorker client services are running.
2. Ensure that either **utl_file** or **rman_util** is configured as the backup device type in the SAP initialization file, init<*ORACLE_SID*>.sap. "How to configure the backup and restore utility" on page 37 provides details.
3. Ensure that the appropriate NetWorker **server**, **client**, and **parallelism** settings are configured in the NMSAP init<*ORACLE_SID*>.utl file. "How to configure the NMSAP parameters" on page 31 provides details.
4. Ensure that the backup to be restored exists by using an inquire function, for example:

   ```
   brrestore -verify
   ```

CAUTION

Perform an inquiry of the backup first, before performing a restore. The **brrestore** program, whether invoked directly from the command line or indirectly from the **brrecover** command or the BrGui interface, first deletes all the original files to be restored before calling **backint** to restore the files. If for any reason **brrestore** is unable to invoke the **backint** command, then the original files are lost. An alternative is to restore the files to a different location. Use the **-m** parameter, and specify the restore destination, as follows:

```
brrestore -m tablespace_name=restore_directory
```

5. Do one of the following:
   - For a full restore: Shut down the Oracle database instance.
   - For a restore of a single database object: Take the database objects you are restoring offline.
6. Use one of the following to restore the data:
   - SAP user-interface program, such as BrGui
   - Text-menu program, such as **brrecover**
   - Command-line program, such as **brrestore**

   Appendix A, "Examples of SAP Command Options," contains examples of **brrestore** and **brrecover** commands and options. Details of these and other SAP commands can be found in the appropriate SAP documentation.

Note: ›"""""""""""""""""""""""""""**????**Restore options override any corresponding settings in the SAP initialization file, init<*ORACLE_SID*>.sap. "How to configure the backup and restore utility" on page 37 describes the settings contained in this file.

7. To apply redo logs to recover a database consistent with a given point in time, refer to the appropriate SAP and Oracle documentation.

How to restore cluster data

To restore data backed up from private disks in a cluster node, the process is similar to restoring data on a system that is not part of a cluster.

To restore data from a shared disk of a virtual client, set the NMSAP client parameter in the init<*ORACLE_SID*>.utl parameter file to restore files to the virtual client, where the files originated during the backup. Table 5 on page 32 provides details.

How to review restore session reports

During restore, the NMSAP program appends a restore session report to a log file on each NMSAP server.

The default format for the restore log filename is backint<*ORACLE_SID*>.log.raw.

The default location for all logs is:

- On Microsoft Windows systems: *C:*\Program Files\Legato\nsr\applogs
- On UNIX or Linux systems: /nsr/applogs

Logs can be written to a different location using different names, as specified in the **backint_log**, or **backint_tmpdir** parameters. Table 5 on page 32 gives information on these parameters.

The **backint** log is in I18N format, and must be run through the NetWorker nsr_render_log utility to be readable. If the language pack is installed, the log is translated into the language set by the locale.

Table 7 on page 43 gives a list of restore session report attributes.

7 PowerSnap Backup and Data Restore

This chapter describes how to configure NetWorker PowerSnap software to back up and restore SAP with Oracle data on supported primary storage devices.

This chapter includes the following sections:

Requirements

This section describes the types of environments and software required to use the PowerSnap features of the NMSAP software.

Supported environments

PowerSnap provides continuous point-in-time (PiT), snapshot-based (*immediate live backup*) protection and availability of SAP with Oracle data on supported primary storage platforms.

To use the PowerSnap features, the NMSAP software must be used with the EMC NetWorker Module for PowerSnap software. This module creates the snapshots, and the NMSAP program stores the snapshot data.

PowerSnap backups must use servers, clients, or storage nodes on supported platforms only. The supported types of primary storage platforms include:

- EMC CLARiiON®
- EMC Symmetrix®
- NAS Filers (EMC Celerra®)

EMC Powerlink website (registration required) at http://Powerlink.EMC.com provides a complete list of supported PowerSnap modules.

Note: The snap volume should *not* contain the Oracle control file or any SAP directories, except sapdata<*n*>. This rule is mandatory for some snapshot platforms. Refer to your snapshot vendor and corresponding NetWorker PowerSnap documentation.

Note: PowerSnap modules support scheduled backups only. Manual (client-initiated) backups are *not* supported. The PowerSnap documentation provides more details.

Required software components

PowerSnap backup and restore of SAP with Oracle data and files require the following software components:

- SAP with Oracle server, which contains BRTools
- NetWorker server
- NetWorker client (installed on the SAP with Oracle server and the PowerSnap client host)
- NMSAP software (installed on the SAP with Oracle server)
- NetWorker Module for PowerSnap appropriate for your system (installed on the SAP with Oracle server and PowerSnap client host and any data mover host)

Note: Any PowerSnap client host or Data Mover host that manages the secondary storage should have NetWorker storage node software installed.

For details on the installation requirements, refer to the following:

- *NetWorker Module for SAP with Oracle, Release 3.5, Multiplatform Version, Installation Guide.*
- *NetWorker Module for PowerSnap Installation and Administration Guide* for the primary storage system.

Types of PowerSnap backup

The NMSAP software, with the appropriate PowerSnap module, supports the types of backups summarized in Table 11 on page 63

Table 11 Summary of supported PowerSnap backup types

Backup type	Snapshot retention	Location of stored data
"Instant backup" on page 63	Permanent	Snapshot only
"Immediate live backup" on page 63	Temporary	Secondary storage only
"Deferred live backup" on page 64	Permanent	Both snapshot and secondary storage

The PowerSnap backup type is configured by the Snapshot Policy attribute in the NetWorker Backup Group. "Group resource" on page 70 gives details.

Instant backup

An instant backup creates a permanent PiT copy, or snapshot, of SAP with Oracle data. This copy is then stored on the primary storage system where it is available to the NMSAP program for performing instant restores or rollbacks. Instant backups can be scheduled to occur many times in a single day, with minimal impact to the SAP with Oracle Server or network.

A group of SAP with Oracle datafiles in the snapshot is referred to as a snap set. The snapshot policy must be configured to control the lifecycle of the snap set. This policy specifies the frequency of instant backups and how long snapshots are retained before being recycled. "Snapshot Policy resource" on page 69 gives more information.

CAUTION

Instant backups protect against logical failures only. To protect against physical media failures, the snapshot must be backed up to secondary storage, such as tape.

"Instant backup processes" on page 76 provides functional details of an instant backup.

Live backup

A live backup (also known as snapshot rollover or rollover to tape backup) is a tape backup of a previously created snapshot. The NMSAP program supports two types of live backup: immediate live backup and deferred live backup.

Immediate live backup

Immediate live backup (also known as serverless snapshot backup or snapshot-based backup) is a process by which a temporary snapshot is created, and immediately backed up to secondary storage such as tape. The snapshot is then automatically

deleted from the primary storage (and not available to the NMSAP program for performing instant restores or rollbacks).

"Immediate live backup" on page 78 provides functional details of an immediate live backup.

Deferred live backup

Deferred live backup is a process by which a permanent snapshot, created on the primary storage system by an instant backup, is backed up to secondary (conventional) storage, such as tape. The permanent snapshot is retained on the primary storage (and available to the NMSAP program for performing instant restores or rollbacks) for the period specified by either of the following:

- The snapshot expiration policy
- The Retain Snapshots attribute of the snapshot policy for the **Group resource** of the client

The group snapshot policy must be configured to enable live backups. "Snapshot Policy resource" on page 69 provides more information.

Note: A PowerSnap client host that is separate from the Oracle Server host can be used to move the snapshot to the conventional storage medium, such as tape. The use of a PowerSnap client as a secondary host reduces the demand on the Oracle Server host. The PowerSnap client can be a NetWorker storage node.

"Deferred live backup" on page 80 provides functional details of a deferred live backup.

Types of PowerSnap restore

The NMSAP software, with the appropriate PowerSnap module, supports the types of restore of PowerSnap for SAP with Oracle described in Table 12 on page 64.

Table 12 Supported restore types

Restore type	Data retrieved from:
"Instant restore" on page 64	Mounted snapshot
"Rollback" on page 65	Unmounted snapshot, entirely restored to source location
"Restore from secondary storage" on page 65	Secondary storage (no snapshot available)

The restore type is specified in the RESTORE_TYPE_ORDER variable in the user-defined PowerSnap configuration file. "How to configure the PowerSnap configuration file" on page 73 provides details.

Instant restore

An instant restore is the process by which a snapshot that was created by an instant backup is mounted. This enables its saved data to be retrieved. A minimal amount of time is required for this type of restore.

"Instant restore and rollback processes" on page 82 provides functional details of instant restores.

Rollback

A rollback restores the entire snapshot to the source location by using the hardware's particular capabilities. Relocation during rollbacks is not currently supported by PowerSnap software. To determine if a rollback is supported on a specific type of hardware, refer to the appropriate *NetWorker PowerSnap Module Installation and Administration Guide*.

CAUTION

Rollbacks are potentially destructive because they overwrite the entire contents of a snapshot unit, such as a volume or disk.

"Instant restore and rollback processes" on page 82 gives functional details of rollbacks.

Restore from secondary storage

A restore from secondary storage is the process by which a snapshot that was saved to the secondary storage system is restored from the secondary storage. The PowerSnap module software essentially uses the NetWorker **recover** program to retrieve the data.

"Restore from secondary storage processes" on page 83 gives functional details on restores from secondary storage.

Basic PowerSnap backup and restore data flows

The backup and restore strategy requires knowledge of how the Oracle and NetWorker software components all work together. "Required software components" on page 62 provides a description.

During a PowerSnap backup of SAP with Oracle data, the SAP with Oracle Server processes interact indirectly with the NetWorker server through the NMSAP and PowerSnap module software.

1. The SAP **brbackup** program invokes the NMSAP software, which then communicates with the PowerSnap module.
2. On the SAP with Oracle server host, the PowerSnap module takes a point-in-time snapshot of the Oracle data on the primary storage.
3. If a live backup is performed, the PowerSnap module moves the SAP with Oracle data from the snapshot on the primary storage to the NetWorker server or storage node.
4. The NetWorker server or storage node stores the Oracle data on the secondary storage, such as a tape.
5. At the end of the PowerSnap backup, the NetWorker server updates the online client and media indexes with information about the backup.

For more information about NetWorker server and NetWorker client programs and services, refer to the *NetWorker Administration Guide*.

Figure 4 on page 66 illustrates the architecture of the SAP with Oracle backup and recovery system, and shows the functional relationship between SAP and NetWorker software components.

The following sections provide functional details on backup and restore processes:

- "Functional details of the PowerSnap backup processes" on page 76
- "Functional details of the PowerSnap restore processes" on page 81

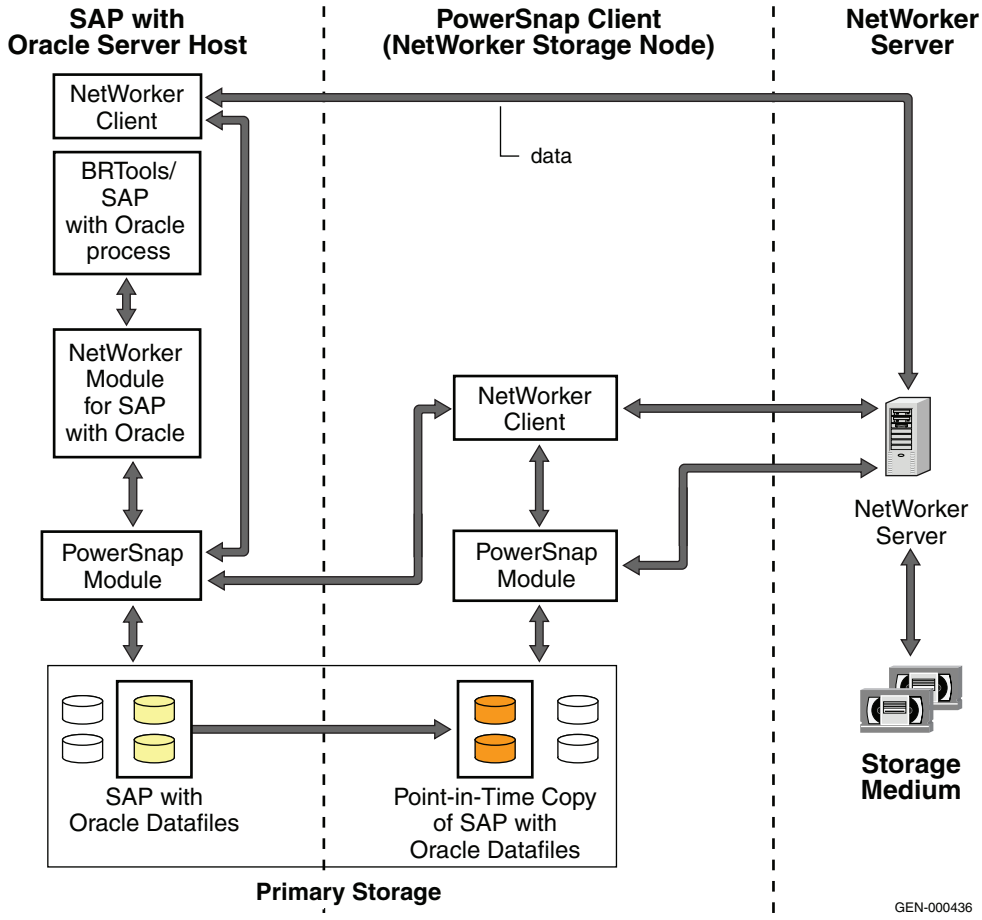

Figure 4 PowerSnap backup and restore data flow with NMSAP

How to test PowerSnap with typical settings

The following steps describe how to enable and use PowerSnap features for a simple snapshot backup and restore. "How to configure PowerSnap" on page 69 describes how to customize these instructions for specific needs.

Note: Before running this test, back up the test database. Test on a nonproduction database.

To configure and test the PowerSnap features with a typical configuration:

1. Ensure that the NetWorker Group resource to which the NMSAP program belongs has the proper PowerSnap attribute settings, as listed in Table 13 on page 67.

Table 13 Backup Group resource attributes for PowerSnap

Attribute	Setting
Snapshot	True
Snapshot Policy	Serverless is recommended for testing. Daily or other customized policies can be set later.
Snapshot Pool	A Pool resource dedicated to the storage of snapshot operation metadata is recommended. File-type volume devices are strongly recommended over tape.
Start Time	Must be set in relation to the Number of Snapshots attribute for the snapshot policy: (Interval *x* Number of Snapshots) must be less than or equal to (24:00 h - Start Time).
Interval	Must be set in relation to the Number of Snapshots attribute for the snapshot policy.

2. Modify the NMSAP init<*ORACLE_SID*>.utl file to enable the PowerSnap parameters and variables.

   A typical and recommended configuration is as follows:

```
ps_backup_mode = yes
ps_archive_mode = no
ps_restore_mode = yes
ps_inquire_mode = yes
ps_exclude_backup_bi_run_nums = 2
ps_exclude_archive_bi_run_nums = 1;2
ps_exclude_backup_paths = (leave blank)
ps_exclude_archive_paths = (leave blank)
ps_ps_before_nonps = yes
ps_group_objs = yes
ps_opaque_pfilename = /nsr/res/nmsapps.cfg
```

   Descriptions of these parameters are listed in Table 15 on page 71.

3. Create and edit the PowerSnap configuration file by using an appropriate filepath and name, for example:

   - On UNIX systems:

     `/nsr/res/nmsapps.cfg`

   - On Microsoft Windows systems:

     `C:\Program Files\Legato\nsr\res\nmsapps.cfg`

   Include any parameters required or intended for use with the installed PowerSnap module, for example:

```
NSR_SNAP_TYPE = sunii
NSR_PS_DEBUG_LEVEL = 9
NSR_VERBOSE = true
```

Debug level is intended for customer support diagnostics only. The *NetWorker Module for PowerSnap Installation and Administration Guide* gives more information on the nmsapps.cfg file's contents.

4. Test the group snapshot settings of the client by invoking the **savegrp** command either from the NetWorker server GUI program or from the command line as follows:

   savegrp -c *clientname grpname*

   The backup test is successful if the **backint** log reports the following message:

   n of *n* PS files reported

   where *n* is the number of files requested that reside on a PowerSnap disk.

   If you encounter a problem, check the NMSAP **backint** log file for PowerSnap related messages. Common problems include:

   - The target file is not managed by the PowerSnap module.
   - The PowerSnap module daemon or service, **nsrpsd**, is not running.
   - The PowerSnap powersnap.res configuration file needs to be modified.
   - The **ps_*xxx*_mode** or **ps_exclude_*xxx*** parameter, where *xxx* is specified as described in Table 15 on page 71, is set to exclude a file from PowerSnap processing.
   - The ps_opaque_pfilename file needs to be modified.

   For further troubleshooting, enable the following parameters in the init<*ORACLE_SID*>.utl file to generate diagnostic logs for EMC Customer Support:

   ```
   debug_level = 9
   nsr_debug_msg = yes
   verbose = yes
   ```

   - To obtain PowerSnap logs, also specify the following in the ps_opaque_pfilename file:

     NSR_PS_DEBUG_LEVEL=**9**.

   - To obtain more detailed SAP_PS_ERROR error and related messages, rerun your test.

5. Run a prerestore inquiry with the following command:

   brrestore -verify

6. Test a restore with the following command:

   brrestore

   The restore test is successful if a **backint** log reports the following message:

   n of *n* PS files reported

   where *n* is the number of files requested that reside on a PowerSnap disk.

How to configure PowerSnap

To configure PowerSnap backups use the following roadmap and referenced topics:

1. Ensure that both the NMSAP software and the required PowerSnap module software are installed according to the instructions in the following documentation:
   - NetWorker Module for SAP with Oracle Installation Guide
   - *NetWorker Module for PowerSnap Installation and Administration Guide* (Refer to the PowerSnap module version for the primary storage system.)
2. Follow the instructions in Chapter 2, "Configuring the NMSAP Basics," to configure the NetWorker server, client, device, and other resources.
3. For live SAP with Oracle backups, configure a Device resource for each secondary storage device to be used during backups. The devices must be mounted.
4. Configure the SAP with Oracle database layout to position the datafiles on the primary storage that is supported by the specific PowerSnap module.
5. Follow the instructions in Chapter 4, "Configuring Scheduled Backups," to configure the basic scheduled backup.
6. Complete the procedure: "How to configure the NetWorker resources for PowerSnap backups" on page 69.
7. Complete the procedure: "How to configure the NMSAP parameter file for PowerSnap" on page 71.
8. Complete the procedure: "How to configure the PowerSnap configuration file" on page 73.

How to configure the NetWorker resources for PowerSnap backups

Configure the NetWorker resources for PowerSnap backups as described in the following sections:

Snapshot Pool resource

Configure a separate NetWorker snapshot Pool resource to support PowerSnap for SAP with Oracle backups. The PowerSnap module stores the metadata from the snapshot in this pool.

- Use the same configuration method as for a regular NMSAP backup, except the specified backup device should be a file, advanced file type, or NAS device.
- Specify this pool name in the Snapshot Pool attribute of the NetWorker Group resource as described in "Group resource" on page 70.

For more information on configuring this extra pool, refer to the appropriate *NetWorker Module for PowerSnap Installation and Administration Guide*.

Snapshot Policy resource

A NetWorker snapshot policy must be configured to perform either instant or live PowerSnap for SAP with Oracle backups. Specify either a preconfigured policy, or create a new one.

Configure a NetWorker Snapshot Policy resource by using the instructions in the appropriate *NetWorker Module for PowerSnap Installation and Administration Guide*.

Group resource

For PowerSnap for SAP with Oracle backups, configure a NetWorker Group resource by following the instructions in the appropriate *NetWorker Module for PowerSnap Installation and Administration Guide*. Table 14 on page 70 gives typical settings.

Table 14 Backup Group resource attributes for PowerSnap backups

Attribute	Setting
Snapshot	True
Snapshot Policy	Set daily or other customized policies.
Snapshot Pool	A Pool resource dedicated to the storage of snapshot operation metadata is recommended. File-type volume devices are strongly recommended over tape.
Start Time	Must be set in relation to the Number of Snapshots attribute for the snapshot policy: (Interval *x* Number of Snapshots) must be less than or equal to (24:00 h - Start Time).
Interval	Must be set in relation to the Number of Snapshots attribute for the snapshot policy.

Client resource

The basic NetWorker Client resource for the NMSAP PowerSnap operations should be configured as described in "Task 1: Configure the client resource" on page 47.

Note: Only members of a NetWorker user group with the Change Security Settings privilege can set the Remote Access attribute in the Client resource.

The lifecycle of a snapshot is defined by the snapshot browse and retention policies of the Group resource that is specified for the NetWorker Client resource.

- The Browse Policy attribute in the Client resource applies only to the NetWorker client file index entries for PowerSnap backups that reside on secondary storage (live backups). This attribute is superseded by the init<*ORACLE_SID*>.utl expiration parameter.
- The Retention Policy attribute in the Client resource applies only to the NetWorker media database entries for live backups performed by PowerSnap. This attribute is superseded by the init<*ORACLE_SID*>.utl expiration parameter.

Client resources for NAS devices

For PowerSnap operations with a network-attached storage (NAS) device, specify two NetWorker Client resources as follows.

NetWorker Client resource for the NAS device

NAS devices are not defined as part of any Group resource.

- Set the Save Set to none.
- Enable NDMP.
- Set the remote username and password to the root username and password of the NAS device.

NetWorker Client resource for the NMSAP host

- Set the Save Set according to NMSAP requirements, for example, backint:<*ORACLE_SID*>:PS.
- Select the Snapshot group.
- Define the Backup Command as: nsrsapsv -f <nsrsapsv.cfg path>.

- The Application Info attribute must contain the following variable:

  NSR_SNAP_NAS_CLIENT = NASFilerHostName

  where NASFilerHostName is the name of the NAS device.

How to configure the NMSAP parameter file for PowerSnap

The NMSAP parameters for PowerSnap backup, restore, and inquiry operations are set in the NMSAP parameter file, init<*ORACLE_SID*>.utl. These settings assume that the PowerSnap module is installed and licensed.

Example 3 Typical PowerSnap settings in the init<*ORACLE_SID*>.utl file

```
ps_backup_mode = yes
ps_archive_mode = no
ps_restore_mode = yes
ps_inquire_mode = yes
ps_exclude_backup_bi_run_nums = 2
ps_exclude_archive_bi_run_nums = 1;2
ps_exclude_backup_paths = (leave blank)
ps_exclude_archive_paths = (leave blank)
ps_ps_before_nonps = yes
ps_group_objs = yes
ps_opaque_pfilename = /nsr/res/nmsapps.cfg
```

Detailed descriptions of the PowerSnap parameters in the init<*ORACLE_SID*>.utl file are listed in Table 15 on page 71.

Table 15 PowerSnap parameters in init<*ORACLE_SID*>.utl file

PowerSnap parameter	Description / Default value
ps_backup_mode **ps_archive_mode** **ps_restore_mode** **ps_inquire_mode**	Each of these PowerSnap functional modes is enabled if set to Yes. Normally, all the modes are set together to either all Yes or all No, *except* ps_archive_mode=no and all others =yes. Do not use any other settings *except* for diagnostic purposes. PowerSnap save sets are named by using the following format: backint:*SID*:PS:. The default value is No.
ps_opaque_pfilename	Absolute pathname of a configuration file that contains PowerSnap specific parameters. The appropriate PowerSnap module documentation describes this path. This setting is mandatory if the PowerSnap functional mode parameters are enabled. "How to configure the PowerSnap configuration file" on page 73 describes how to set the parameters. The default value is Null.

Table 15 PowerSnap parameters in init*<ORACLE_SID>*.utl file (continued)

PowerSnap parameter	Description / Default value

ps_exclude_backup_bi_run_nums
ps_exclude_archive_bi_run_nums
	Specifies which **backint** runs are to be excluded from PowerSnap processing (typically run number 2). Parameter files and SAP backup catalog files do not require PowerSnap processing and can be backed up by conventional processing *without* PowerSnap, thereby saving valuable snapshot disk resources.
	Specify a value of one or more valid **backint** run numbers to exclude, each separated by a semicolon (;).
	Note: The following starting values are *strongly* recommended:
	`ps_exclude_backup_bi_run_nums=2`
	`ps_exclude_archive_bi_run_nums=1;2`
	Each **brbackup** or **brarchive** session invokes multiple **backint** processes sequentially. Run number 1 is followed by run number 2. If run 2 is excluded then the following occurs:
	• Run 1 uses PowerSnap to back up the database files.
	• Run 2 uses conventional processing (without PowerSnap) to back up the database files.
	The default value is Null.

ps_exclude_backup_paths **ps_exclude_archive_paths**	Specifies individual PowerSnap files to exclude from PowerSnap processing and back up with conventional non-snapshot processing instead. PowerSnap files are those on a snapshot-capable file system that NetWorker is aware of. Use values that are based on the actual filenames that BRTools passes to **backint**. **Note:** • On Microsoft Windows systems, support of wildcard characters is limited, and a single trailing * denotes simple case-insensitive prefix matching. Thus X:\DB01\FOO.DBF will be excluded from PowerSnap backups if the parameter is set to a value of: X:*, or X:\db*, or X:\DB01* • On UNIX systems, wildcard support follows standard shell support for full file pathnames. For example the file /db01/foo.dbf is excluded if the parameter is set to a value of: /db01/foo.*, or /db??/*.dbf, but *not* excluded if set to /db*. Specify one or more valid, full pathnames, each separated by a semicolon (;). Standard wildcard characters are valid. Whenever possible, preference should be given to setting the **ps_exclude_xxx_bi_run_nums** parameters instead of using these parameters. The default value is Null.
ps_ps_before_nonps	Specifies whether to perform all PowerSnap processing before conventional processing *without* PowerSnap. This helps prevent potential resource conflicts. Setting this value to **No** enables concurrent processing of all files set for backup, archive, or restore. **Note:** The **No** value is *not* recommended and is used at the user's own discretion. The default value is Yes.

Table 15 PowerSnap parameters in init<*ORACLE_SID*>.utl file (continued)

PowerSnap parameter	Description / Default value
ps_group_objs	Specifies whether to group all session files for each PowerSnap operation, such as prepare or sync, snapshot or split, save or restore, or cleanup. Setting this value to **Yes** improves NMSAP performance for certain database disk or file system configurations, particularly if large numbers of files are processed by BRTools and PowerSnap with **util_file_online**. However, grouping files also reduces the potential parallelism for certain backup and restore suboperations, which in turn can reduce performance. The default value is Yes.

How to configure the PowerSnap configuration file

PowerSnap parameters that cannot be inherited the NMSAP configuration file, init<*ORACLE_SID*>.utl, must be set as variables in a user-defined PowerSnap configuration file, for example, /nsr/res/nmsapps.cfg.

"PowerSnap configurations inherited from the NMSAP parameter file" on page 74 has more information on inherited parameters.

The PowerSnap configuration file must be specified by its complete file pathname in the **ps_opaque_pfilename** parameter in the NMSAP init<*ORACLE_SID*>.utl configuration file.

Each variable in the PowerSnap configuration file must be listed on a separate line, in the following format:

var_name=var_value

where:

- *var_name* is the variable name, such as RESTORE_TYPE_ORDER.
- *var_value* is the variable value, such as pit.

Example 4 Example PowerSnap configuration file settings for NAS devices

```
NSR_SNAP_TYPE=nas
NSR_DATA_MOVER=mover_computer
NSR_PS_DEBUG_LEVEL=9
NSR_VERBOSE=true
SAP_PS_ERROR=true
```

Table 16 on page 74 lists common PowerSnap variables that can be defined in a user-defined PowerSnap configuration file, for example, nmsapps.cfg.

For a complete list of PowerSnap variables, refer to the appropriate *NetWorker Module for PowerSnap Installation and Administration Guide*.

Table 16 Common PowerSnap module variables in the nmsapps.cfg file

PowerSnap variables	Description	Default and valid values
NSR_DATA_MOVER	Mandatory. if the PowerSnap backup uses a live backup host different from the PowerSnap client host (NSR_CLIENT). Specifies the hostname of the PowerSnap backup host.	• Local host (default). • The valid hostname of the secondary live backup host. **Note:** The NSR_CLIENT PowerSnap variable must always be set to the original **brbackup** or **brarchive** host, init<*ORACLE_SID*>.utl client value.
NSR_MAX_STREAMS	Optional. Specifies the maximum number of restore streams.	• Defaults to the parallelism value set in the init<*ORACLE_SID*>.utl file, or its default value of 8. • An integer value.
NSR_PS_DEBUG_LEVEL	Optional. PowerSnap debug level.	Valid values are 0 to 9. Default value is 1.
NSR_PS_SAVE_PARALLELISM	Optional. Specifies the maximum number of concurrent save streams on the PowerSnap client host.	• Defaults to the parallelism value set in the init<*ORACLE_SID*>.utl file, or its default value of 8. • An integer value.
NSR_SNAP_TYPE	Mandatory for NAS devices. Optional for other platforms. Specifies snapshot platforms and releases, when multiple snapshot platforms are used.	Value should be a concatenated string, delimited by a colon (:), for example: `Emctimefinder 4.5.6:EmcClarion 1.2.3:LSIMetaStor 3.4.5`
RESTORE_TYPE_ORDER	Optional. Specifies the type of restore to be performed. **Note:** If multiple values are specified, each type of restore is attempted, in the order specified, until a restore operation is successful.	One or more of the following values, with each value delimited from the others by a colon(:): • pit - Specifies an instant (point-in-time) restore. • conventional - Specifies a restore from secondary storage media. • rollback - Specifies a rollback restore from a PiT copy. The default value is `pit:conventional` **Note:** For NMSAP, a rollback operation aborts if one of the following occurs: • If **brrestore** file relocation is specified. • If nonrequested files exist in the **brrestore**-requested file systems. (These files could become corrupted after a rollback.)

PowerSnap configurations inherited from the NMSAP parameter file

Some parameters used by the PowerSnap module are the same as those used in conventional backup and restore operations, and are inherited from the NMSAP

init<*ORACLE_SID*>.utl file. Normally, these equivalent parameters should *not* be specified as variables in the PowerSnap configuration file.

Table 17 on page 75 lists typical equivalent parameters. If a variable is set in the PowerSnap configuration file, it overrides the equivalent parameter in the NMSAP configuration file.

Table 5 on page 32 describes the parameters in the init<*ORACLE_SID*>.utl file.

Table 17 PowerSnap use of equivalent NMSAP init<*ORACLE_SID*>.utl file parameters

Variable in the PowerSnap configuration file (nmsapps.cfg)	Equivalent parameter in the NMSAP configuraiton file, init<*ORACLE_SID*>.utl
NSR_CLIENT	client (must match if NSR_CLIENT is used)
NSR_SERVER	server (must match if NSR_SERVER is used)
NSR_GROUP	group (must match if NSR_GROUP is used)
NSR_SAVESET_BROWSE	NSR_SAVESET_BROWSE
NSR_SAVESET_RETENTION	NSR_SAVESET_RETENTION
NSR_SAVESET_EXPIRATION	expiration
NSR_COMPRESSION	compress
NSR_ENCRYPTION	encrypt
NSR_CHECKSUM	checksum
NSR_PS_SAVE_PARALLELISM	parallelism (for backup)
NSR_MAX_STREAMS	parallelism (for restore)
NSR_DATA_VOLUME_POOL	pool

How to query PowerSnap backup records

The NetWorker server records information about each PowerSnap backup in its online indexes. Thse index entries are stored in the NetWorker client file index for the SAP with Oracle host, under the "saporacle" namespace. The “backup” namespace is used for regular NMSAP backups.

Use the **nsrinfo** and **mminfo** commands to query the online NetWorker indexes.

- To query the NetWorker client file index, enter the **nsrinfo** command. This displays BRTools file backup IDs (BIDs), for example:

  nsrinfo [**-v**] **-n saporacle -s** *NetWorker_server client*

  where *client* is your SAP with Oracle server hostname.

- To query the NetWorker media database, enter the **mminfo** command. For example:

  mminfo [**-v**] [**-N backint:***ORACLE_SID***:PS:**] **-s** *NetWorker_server* **-c** *client*

  where *client* is your SAP with Oracle server hostname.

NMSAP PowerSnap save sets all have the following save set format:

backint:<*ORACLE_SID*>:*PS*:

Note: The **mminfo** command does *not* display BRTools BIDs or save times for files that were backed up with the PowerSnap module.

The *NetWorker Command Reference Guide* and the UNIX man pages provide more information on these NetWorker commands.

Functional details of the PowerSnap backup processes

A PowerSnap for SAP with Oracle backup is started by automatically or manually invoking the scheduled NetWorker backup group on the NetWorker server. For information on how to invoke a scheduled backup, refer to the *NetWorker Administration Guide*.

Note: A PowerSnap backup should *not* be started by directly invoking the client-side BRTools commands.

There are three types of scheduled PowerSnap backup processes, which are summarized in the following sections:

- "Instant backup processes" on page 76
- "Immediate live backup" on page 78
- "Deferred live backup" on page 80

Instant backup processes

An instant backup creates a *permanent* snapshot copy of SAP with Oracle data that is retained on the primary storage system, where it is available to the NMSAP program for performing instant restores or rollbacks. An instant backup is performed as follows:

1. At the backup start time, the main NetWorker service, **nsrd**, invokes the **savegrp** program to start the group's backup.
2. The **savegrp** program requests that the NetWorker client-side service, **nsrexecd**, on the SAP with Oracle Server host run the **savefs** program to validate the client.
3. If the **savefs** program succeeds, the **savegrp** program starts the PowerSnap program, **nsrsnap**, on the SAP with Oracle Server host. Otherwise, the backup *fails*.
4. If an existing snapshot needs to be removed (for example, it is due to be recycled according to the snapshot policy), the **nsrsnap** program invokes the **nsrsnapck** program, which removes both the snapshot from the storage system and the corresponding NetWorker file and media index entries. File and media index entries are removed only if the snapshot was *not* backed up to tape.

   Note: If the existing snapshot was *not* backed up to tape, there will be invalid records in the BRTools **sapbackup** catalog that do not correspond to any file index entries for the snapshots, because they were deleted by **nsrsnapck** processing. A subsequent attempt at **brrestore** without prior verification results in an expected "#NOT FOUND" message for all requested files. Run the **brrestore -verify** command *before* running snapshot policies that do *not* back up to tape.

5. The **nsrsnap** program contacts the **nsrexecd** service, which starts the **nsrsapsv** program for the scheduled backup.

6. The **nsrsapsv** program sets the required environment variables and invokes the **brbackup** or **brarchive** program.
7. The **brbackup** or **brarchive** program starts the NMSAP **backint** program for the SAP with Oracle backup.
8. The **backint** program contacts the PowerSnap master program, **nsrpsd**, to perform the instant backup.
   - PowerSnap processes create the snapshot that comprises the backup.
   - The **nsrmmd** service stores metadata (used only by the PowerSnap module) about the snapshot on the media configured for the snapshot pool, typically on a file or disk type device.
   - The **nsrmmd** service records tracking information about the point-in-time metadata in the NetWorker media database by using the **nsrmmdbd** service.
   - The **nsrindexd** service records tracking information about each filename in the NetWorker client file index. The client index contains one entry per datafile.
   - BRTools records the backup entry in its **sapbackup** catalog.
9. The **brbackup** or **brarchive** program ***calls the NMSAP program a second time to invoke backup processes for nondata files***, for example init<*ORACLE_SID*>.sap, that do not require PowerSnap processing. This *extra* backup is configured to be a conventional backup without PowerSnap by the following setting in the init<*ORACLE_SID*>.utl parameter file:

   ```
   ps_exclude_xxx_bi_run_nums = 2
   ```

   where *xxx* is backup or archive. Table 15 on page 71 gives configuration details.
10. If the Snapshot Policy resource specifies that the snapshot must be copied to secondary storage, the **nsrsnap** program performs the steps in "Deferred live backup" on page 80.

    Note: The snapshot is *not* deleted from the primary storage.

11. The **savegrp** program backs up the NetWorker server bootstrap and SAP with Oracle client file indexes.

Figure 5 on page 78 shows how the Oracle Server and NetWorker processes interact during a scheduled instant backup.

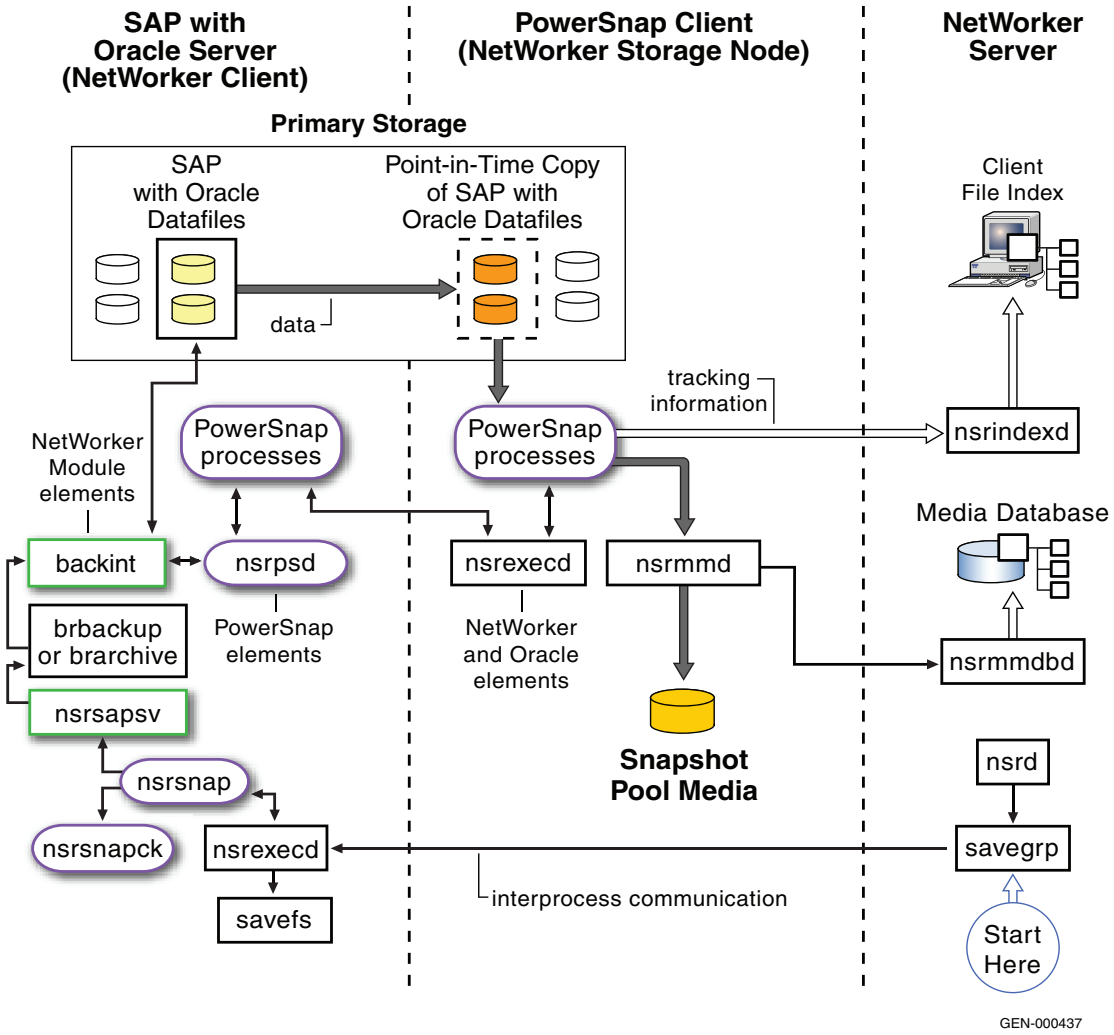

Figure 5 **Scheduled instant backup**

Immediate live backup

An immediate live backup creates a *temporary* snapshot copy of the SAP with Oracle data on the primary storage. This is then immediately backed up to secondary storage, such as tape. The snapshot is then automatically *deleted* from the primary storage, and is *not* available for instant restores or rollbacks. This process involves the following sequence:

Note: The first seven steps are the same as those in "Instant backup processes" on page 76.

1. At the backup start time, the main NetWorker service, **nsrd**, invokes the **savegrp** program to start the group's backup.
2. The **savegrp** program requests that the NetWorker client-side service, **nsrexecd**, on the SAP with Oracle Server host run the **savefs** program to validate the client.
3. If the **savefs** program succeeds, the **savegrp** program starts the PowerSnap program, **nsrsnap**, on the SAP with Oracle Server host. Otherwise, the backup fails.

4. If an existing snapshot needs to be removed (for example, the snapshot is due to be recycled according to its policy), the **nsrsnap** program invokes the **nsrsnapck** program, which removes both the snapshot from the storage system and the corresponding NetWorker file and media index entries. File and media index entries are removed only if the snapshot was *not* backed up to tape, and this removal can result in error messages during restore attempts, as described in “"Not found" error if snapshots not backed up” on page 79.
5. The **nsrsnap** program contacts the **nsrexecd** service, which starts the **nsrsapsv** program for the scheduled backup.
6. The **nsrsapsv** program sets the required environment variables and invokes the **brbackup** or **brarchive** program.
7. The **brbackup** or **brarchive** program starts the NMSAP **backint** program for the SAP with Oracle backup.
8. The **backint** program contacts the PowerSnap master program, **nsrpsd**, to perform the immediate live backup.
   - PowerSnap processes create the snapshot, move the data to secondary storage, and then *delete* the snapshot from the primary storage.
   - The **nsrmmd** service records tracking information about the secondary storage save sets in the NetWorker media database by using the **nsrmmdbd** service.
   - The **nsrindexd** service records tracking information for each backup piece name and for each stored operating system datafile in the NetWorker client file index. The client index contains two entries per datafile.
   - BRTools records the backup entry in its sapbackup catalog.
9. The **brbackup** or **brarchive** program calls the NMSAP a second time to back up nondatafiles, for example init<*ORACLE_SID*>.sap, that do not require PowerSnap processing. This *extra* backup is configured to be a conventional backup without PowerSnap by the following setting in the init<*ORACLE_SID*>.utl parameter file:

   ```
   ps_exclude_xxx_bi_run_nums = 2
   ```

   where *xxx* is backup or archive. Table 15 on page 71 gives configuration details.
10. The **savegrp** program backs up the NetWorker server bootstrap and Oracle client file indexes.

"Not found" error if snapshots not backed up

If the existing snapshot was *not* backed up to tape, there will be invalid records in the BRTools sapbackup catalog that have no corresponding NetWorker file and media index entries. The **nsrsnapck** process deletes these NetWorker entries if the snapshot is not backed up. A subsequent attempt at **brrestore** without prior verification results in an expected "#NOT FOUND" message for all requested files. Run the **brrestore -verify** command *before* running Snapshot Policies that do *not* back up to tape.

This message does not appear if **brrestore** is run for either of the following:

- The most recent backup
- An earlier backup that had its snapshot backed up to the tape

Figure 6 on page 80 shows how the Oracle server and NetWorker processes interact during a scheduled immediate live backup.

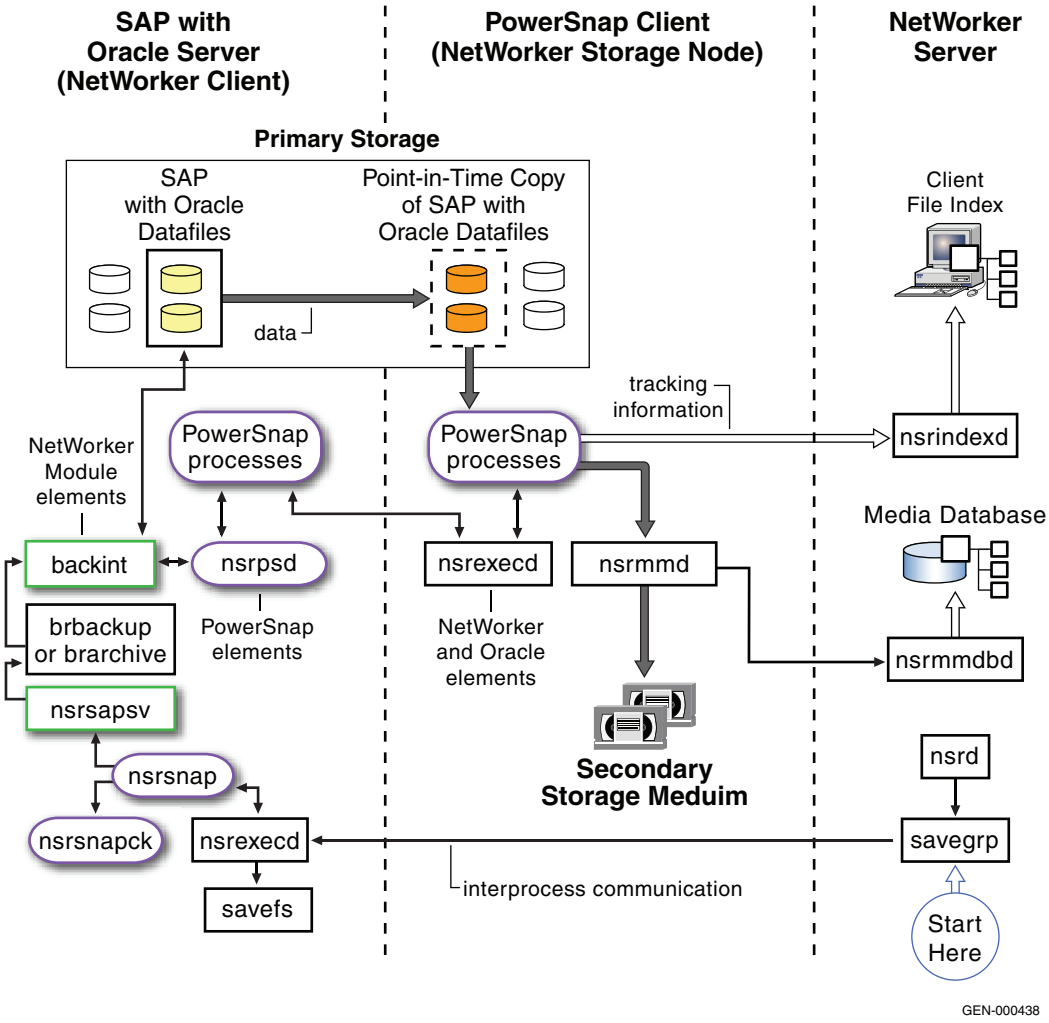

Figure 6 **Scheduled immediate live backup**

Deferred live backup

A deferred live backup creates a *permanent* snapshot copy of the SAP with Oracle data on the primary storage system, which is then backed up to secondary storage system, such as tape. The snapshot is *retained* on the primary storage for the period specified by either of these attributes for the Group resource for the client:

- Snapshot Expiration Policy
- Retain Snapshots

A scheduled, deferred live backup can be run in one of the following ways:

- Automatically as part of a scheduled NMSAP backup
- Manually by using the **nsrsnapadmin** command

The Backup Snapshots attribute of the Snapshot Policy resource specifies the preferred method. For more information, refer to the appropriate *NetWorker Module for PowerSnap Installation and Administration Guide*.

A scheduled deferred live backup uses the following process:

1. The **nsrsnap** or **nsrsnapadmin** program invokes the PowerSnap processes to copy the snapshot to secondary storage.

   Note: The snapshot is *not* deleted from the primary storage.

2. The **nsrmmd** service records tracking information about the deferred live backup in the NetWorker media database by using the **nsrmmdbd** service.
3. The **nsrindexd** service records tracking information for each stored operating system datafile in the NetWorker client file index.

Figure 7 on page 81 shows how the Oracle Server and NetWorker processes interact during a scheduled deferred live backup.

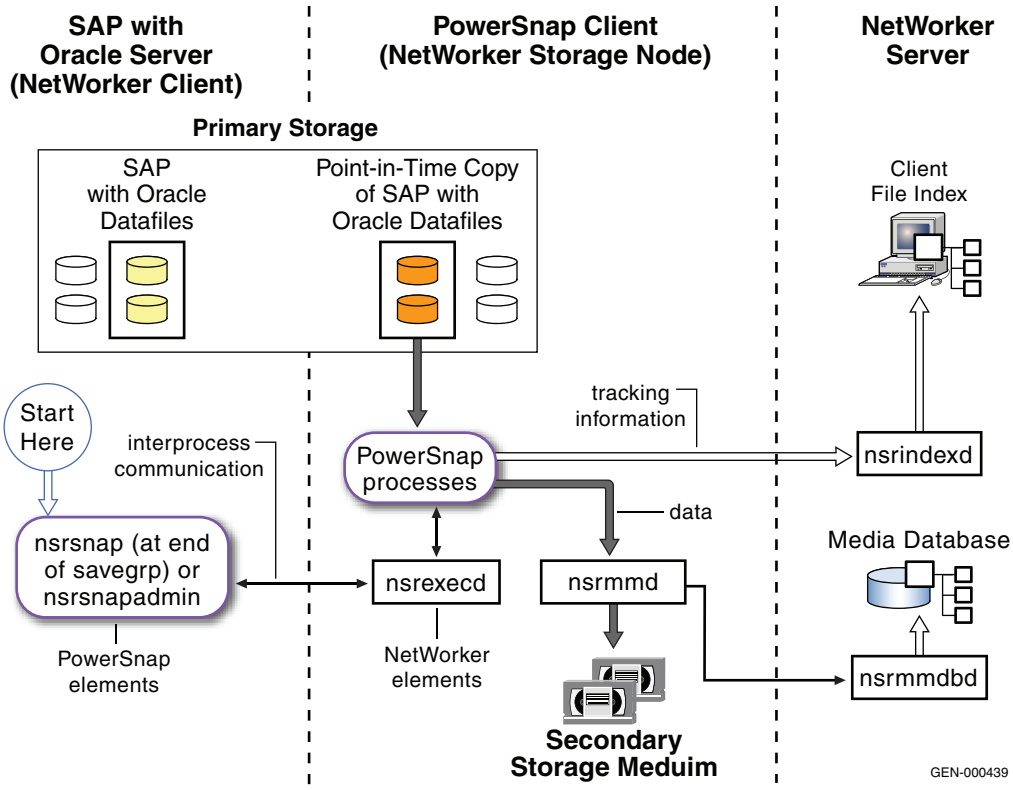

Figure 7 Scheduled deferred live backup

Functional details of the PowerSnap restore processes

NMSAP restores are performed with one of the following:

- The **brrestore** command
- The **brrecover** command
- The BrGui interface

Each of these calls the NMSAP **backint** program. For PowerSnap restores, the **backint** program interacts with both the PowerSnap and NetWorker servers.

The following topics provide descriptions of the processes involved:

- "Instant restore and rollback processes" on page 82
- "Restore from secondary storage processes" on page 83

Instant restore and rollback processes

Both instant restores and rollbacks use the permanent snapshot created by an instant backup or as part of a deferred live backup.

- For an instant restore, the snapshot copy is mounted and the files are copied as needed.
- For a rollback, the entire snapshot is moved to the source destination by using the appropriate commands for the specific platform.

Instant restores and rollbacks use the following process:

1. The NMSAP **backint** program verifies the versions of the requested files through the **nsrindexd** service.
2. The **backint** program contacts the PowerSnap master program, **nsrpsd**, on the Oracle Server host.
3. The **nsrpsd** program works with other PowerSnap and NetWorker programs to access the instant backup copy on the primary storage or retrieve the data from secondary storage, and perform the restore operation.
   - PowerSnap processes retrieve the snapshot metadata stored on the device associated with the snapshot pool by using the **nsrmmd** and **nsrmmdbd** processes.
   - PowerSnap processes do *one* of the following, depending on the RESTORE_TYPE_ORDER setting, which is described inTable 16 on page 74:
     - For an instant restore, mount the snapshot and copy the files into a destination requested by the NMSAP program.
     - For a rollback, execute the command (specific to the primary storage system) to move the entire snapshot unit into the source destination.

Once the required SAP with Oracle files are restored, a database administrator can complete the standard SAP with Oracle database recovery.

Figure 8 on page 83 shows how the Oracle server and NetWorker processes interact during an instant restore or rollback.

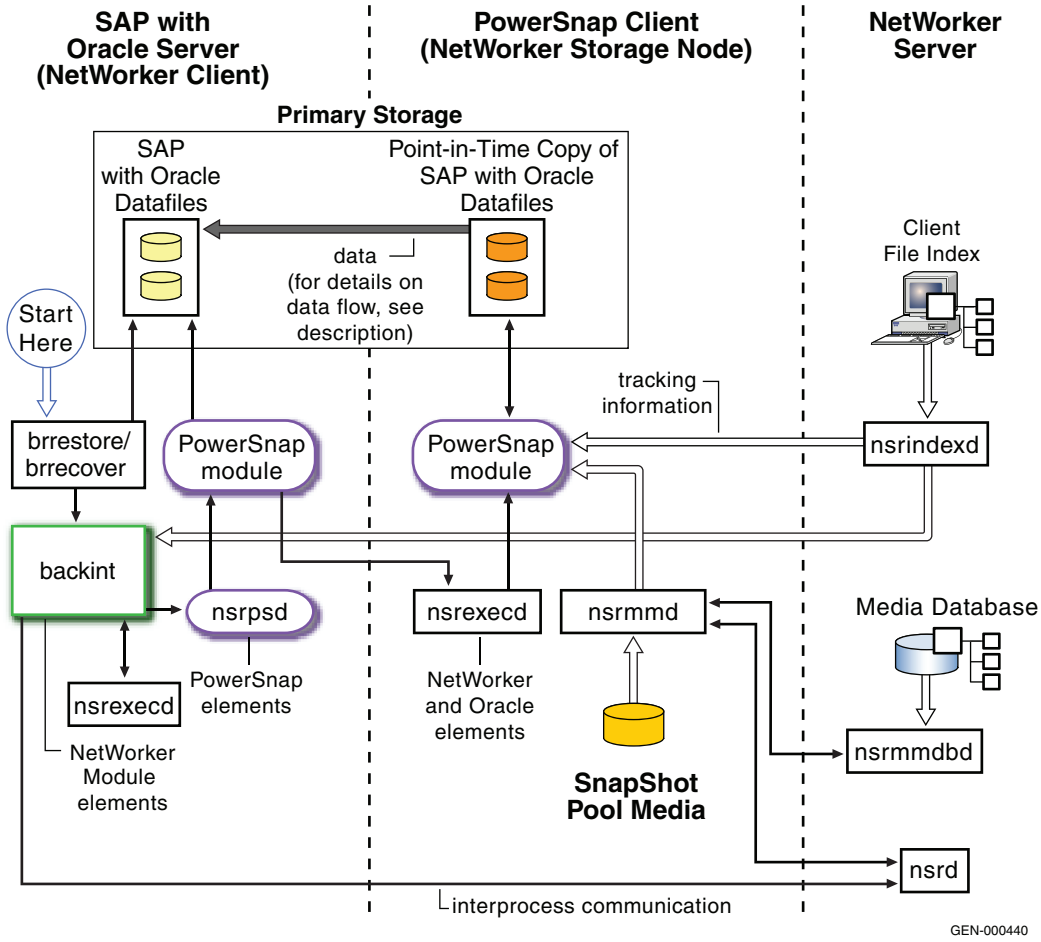

Figure 8 **Instant restore or rollback**

Restore from secondary storage processes

A restore of a PowerSnap backup from secondary storage uses the following process:

1. The NMSAP **backint** program verifies the versions of the requested files through the **nsrindexd** service.
2. The **backint** program contacts the PowerSnap master program, **nsrpsd**, on the Oracle Server host.
3. The **nsrpsd** program works with other PowerSnap and NetWorker programs to retrieve the data from secondary storage, and perform the restore operation.

   PowerSnap processes restore the files (save sets) into a destination requested by the NMSAP program. The processes use the **nsrmmd** and **nsrmmdbd** programs to do the following:

   - Determine which media contain the requested save sets.
   - Read the backup volumes.
4. Once the required SAP with Oracle files are restored from the backup volumes, a database administrator can complete the standard SAP with Oracle database recovery.

Figure 9 on page 84 shows how the Oracle Server and NetWorker processes interact during a restore from secondary storage.

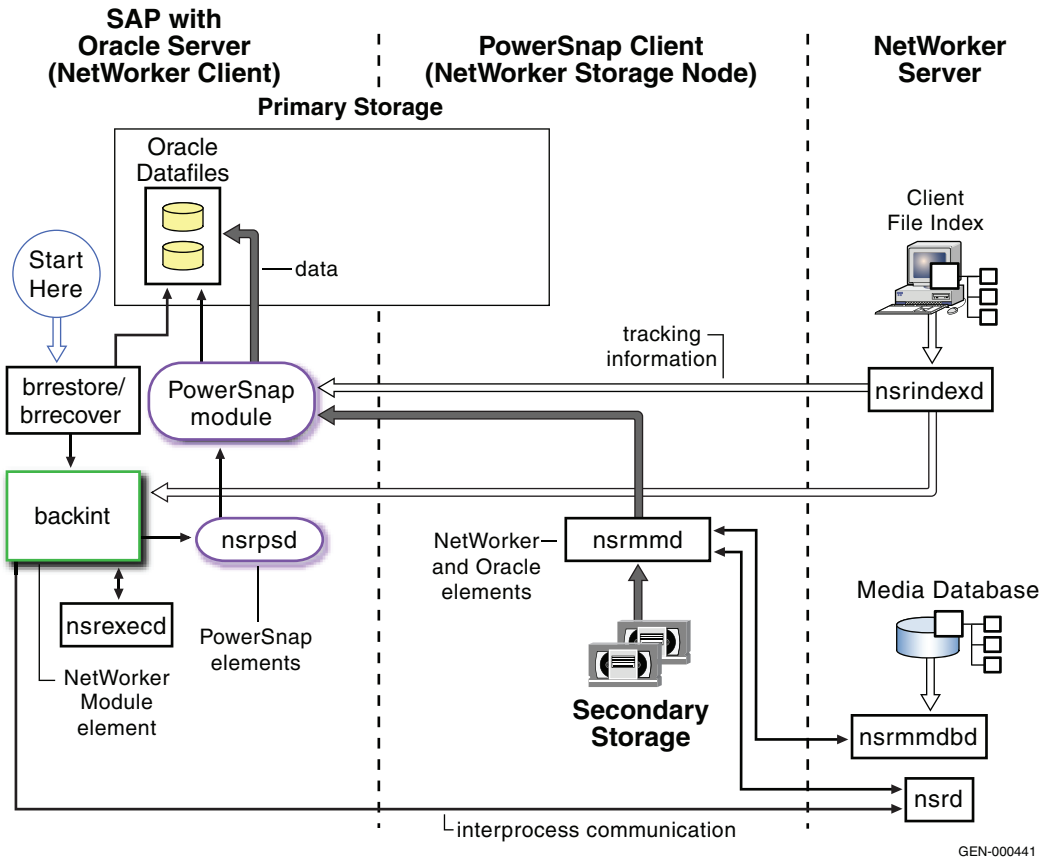

Figure 9 Restore from secondary storage

A

Examples of SAP Command Options

This appendix provides some examples of the syntax and options for the SAP **brbackup, brarchive**, **brrestore**, and **brrecover** commands, which can be used for NMSAP backup and restore operations.

This appendix includes the following sections:

Examples of brbackup and brarchive command syntax and options

The SAP **brbackup** and **brarchive** commands can be used with the NMSAP program from any command prompt. Examples of the syntax and options for these commands are as follows:

```
brbackup [-c force][-d {util_file|util_file_online}]
[-m {all|tablespace_name|file_ID|file_ID_range}][-p profile]
[-q check] [-r parameter_file]
[-t {online|offline|offline_force|offline_standby}]
[-u user/password][-w [use_dbv|only_config]]

brarchive [-c force][-d {util_file|util_file_online}][-f stop]
[-m delay_time][-p profile][-q check][-r parameter_file][-s save]
[-u user/password]
```

Options enclosed in brackets ([ ]) are optional. Options enclosed in braces ({ }) must use at least one of the enclosed options. Table 18 on page 86 lists example options for these commands. The SAP documentation provides complete details of these commands.

Table 18 Options for brbackup and brarchive command

Option	Description
-c force	Suppresses most of the confirmation messages that interrupt the backup process.
-d *util_file* | *util_file_online*	Specifies that NMSAP is used for the backup or archive process. This option is not required because it is set during configuration. "How to configure the backup and restore utility" on page 37 has more information.
-f stop	Instructs **brarchive** to wait for the next offline redo log file written by Oracle, and then send it to **backint** for archiving.
-m all	Sends the entire database to **backint** for backup.
-m *tablespace_name*	Sends a single tablespace to **backint** for backup.
-m *file_ID*	Sends a datafile with an associated Oracle file ID to **backint** for backup. The following file ID formats are acceptable: • Specify control files as ID 0. • Specify online redo log files as the following ID: 0 *group_number* where *group_number* is the group number associated with the redo log files. • Specify all online redo log files as ID 00.
-m *file_ID_range*	Sends datafiles within a specified Oracle file ID range to **backint** for backup.
-m *delay_time*	Specifies the delay time between Oracle creating the offline redo log file and sending datafiles to the database in standby mode.
-p *profile*	Specifies a profile other than the default, init<*ORACLE_SID*>.sap. The nondefault profile used for BRTools must specify the settings outlined in "How to configure the backup and restore utility" on page 37.
-r *parameter_file*	Specifies the parameter file that NMSAP uses during the backup or archive process. This option is required only if you have created additional parameter files. Otherwise, this option is not required, because init<*ORACLE_SID*>.utl is set as the default parameter file during configuration. "How to configure the NMSAP parameters" on page 31 provides details on setting the default parameters.
-s *saveset*	Specifies the number of members in save sets (1, 2, 3, 4, tablespace, or all).

Table 18 Options for brbackup and brarchive command (continued)

Option	Description
-t online	Instructs **brbackup** and NMSAP to perform an online backup of the Oracle database. To reduce the number of redo logs that Oracle generates, use this option with the **-d util_file_online** option.
-t offline	Specifies to **brbackup** and NMSAP that the Oracle database is shut down.
-t offline_force	Instructs the SAP system to shut down the Oracle database immediately and tell **brbackup** to send data to **backint** for backup.
-t offline_standby	Instructs the SAP system that the database in standby mode is ready for backup.
-u *user/password*	Specifies the Oracle database administrator's username and password.
-w use_dbv | only_config	Verifies the backup after the files have been backed up. Helps detect possible hardware problems. The *use_dbv* option performs the backup followed by a restore of the backup to a temporary location. This option approximately doubles backup time.

Examples of brrestore command syntax and options

The SAP **brrestore** command can be used with the NMSAP program from any command prompt. An example of the syntax and options for this command is as follows:

```
brrestore [-c force][-d {util_file|util_file_online}]
[-m
{all|full|table_space_name|file_ID|file_ID_range|generic_path}]
[-p profile][-q check][-r parameter_file]
```

Options enclosed in brackets ([ ]) are optional. Options enclosed in braces ({ }) must use at least one of the enclosed options. Table 19 on page 87 lists example options for this command.

The SAP documentation provides complete details of this command..

Table 19 Options for brrestore command

Option	Description
-c force	Suppresses most of the confirmation messages that interrupt the restore process.
-d *util_file* | *util_file_online*	Specifies that NMSAP is used for the restore process. This option is not required because it is set during configuration. "How to configure the backup and restore utility" on page 37 provides more information.
-m all	Requests the **backint** program to restore all tablespaces and associated files.
-m full	Requests the **backint** program to restore the entire database instance.
-m *table_space_name*	Requests the **backint** program to restore a single tablespace.
-m *file_ID*	Requests the **backint** program to restore a datafile with an associated Oracle file ID. The following file ID formats are acceptable: • Specify control files as ID 0. • Specify online redo log files as the following ID: 0 *group_number* where *group_number* is the group number associated with the redo log files. • Specify all online redo log files as ID 00.

Table 19 Options for brrestore command (continued)

Option	Description
-m *file_ID_range*	Requests the **backint** program to restore datafiles within a specified Oracle file ID range.
-m *generic_path*	Requests the **backint** program to restore all the datafiles whose names start with that full path. The path must contain at least the SAPDATA_HOME directory and an additional generic specification (for example, sapdata<*n*>). If the generic path is a directory, you can also restore one or more files from this directory by additionally specifying one or more filenames.
-p *profile*	Specifies a profile other than the default init<*ORACLE_SID*>.sap profile. A nondefault profile must specify the settings outlined in "How to configure the backup and restore utility" on page 37.
-r *parameter_file*	Specifies the parameter file that NMSAP uses during the restore process. This option is required only if you have created additional parameter files. Otherwise, this option is not required, because init<*ORACLE_SID*>.utl is set as the default parameter file during configuration. "How to configure the NMSAP parameters" on page 31 provides details on setting the default parameters.

Examples of brrecover command syntax and options

The SAP **brrecover** command can be used with the NMSAP program from any command prompt. An example of the syntax and options for this command is as follows:

```
brrecover [options]
```

For example:

```
brrecover -t complete -p initGC2.sap
```

Table 20 on page 88 lists examples of options for this command.

The SAP documentation provides complete details of these commands.

Table 20 Options for brrecover command

Option	Description
-c force	Suppresses most of the confirmation messages that interrupt the recovery process.
-d *util* | *util_file* | *rman_util* | *rman_disk* | *rman_stage* | *rman*	Recovers with the specified device type. • *util* or *util_file*: Restores backups created by an external backup program. • *rman_util*, *rman_disk*, *rman_stage*, or *rman*: Restores a backup created with the RMAN program.
-p *profile*	Defines the profile name. The default value is init<*ORACLE_SID*>.sap.
-pit *yyyy-mo-dd hh.mi.ss*	Recovers the database or tablespaces for a specific point in time.
-r *parameter_file*	Defines the **backint** parameter file.
-scn *scn*	Recovers the database to the specified Oracle system change number.

Table 20 Options for brrecover command (continued)

Option	Description
-t complete **|** dbpit	tspit	reset	restore	apply	disaster	Specifies the type of recovery. • complete: complete database recovery • dbpit: database point-in-time recovery • tspit: tablespace point-in-time recovery • reset: whole database reset • restore: restore of individual backup files • apply: apply offline redo log files (that is, archivelogs) • disaster: disaster recovery
-tsp *tablespace_name*	*tablespace_name_list*	Recovers a single specified tablespace or the tablespaces listed in the specified file.
-u *user/password*	Specifies the Oracle database administrator's username and password.

B

Special Parameters for RMAN

This appendix contains the following sections:

How to configure the NSR* parameters for RMAN

To configure the RMAN utility for backup and restore, NetWorker software uses specific parameters that have the prefix NSR_*. These parameters are set with the **rman_send** parameter in the SAP initialization file (also called the utilities profile), init<*ORACLE_SID*>.sap. This file is typically located in the following directory:

- On Microsoft Windows systems: *%ORACLE_HOME%\DATABASE*
- On UNIX or Linux systems: *$ORACLE_HOME*/dbs

"Configure RMAN as the backup and restore utility" on page 37 describes how to configure the RMAN utility for the NetWorker Module.

NSR* parameter definitions

Table 21 on page 92 lists the NSR_* parameters available to the NMSAP program to configure the RMAN utility.

Table 21 NSR_* environment variables

Parameter	Description	Default and Valid Values
NSR_AES_ENCRYPTION	Optional. Specifies whether the data is encrypted by using 256-bit AES encryption before being sent over the network. NSR_AES_ENCRYPTION must be set only by the **rman_send** parameter in the init<ORACLE_SID>.sap parameter file. AES encryption uses the key that is set in the Datazone Pass Phrase attribute of the NetWorker Server resource. **Note:** Keep safe a record of all keys (pass phrases) used for AES encryption. If the pass phrase on the NetWorker server is changed and the applicable pass phrase is lost, then the encrypted data *cannot* be recovered. The NetWorker Administration Guide provides more information on pass phrases.	• FALSE (default) = The backup data is *not* encrypted through AES encryption. • TRUE = The backup data is encrypted through 256-bit AES encryption.
NSR_CHECKSUM	Optional. Specifies whether or not the NetWorker software performs checksumming on the backup data.	• FALSE (default) = The NetWorker software performs *no* checksumming. • TRUE = The NetWorker software performs checksumming.
NSR_CLIENT	Recommended for a backup of Oracle running on a cluster, OPS, or RAC system. *Recommended* for all restores. Specifies the NetWorker Client resource to use for a backup or restore session. Might be needed for disaster recovery.	• The physical host on which the session runs (default). • A valid NetWorker client hostname.

Table 21 NSR_* environment variables (continued)

Parameter	Description	Default and Valid Values
NSR_COMPRESSION	Optional. Specifies whether the NetWorker software performs compression on the backup data.	• FALSE (default) = The NetWorker software performs *no* compression. • TRUE = The NetWorker software performs compression.
NSR_DATA_VOLUME_POOL	Mandatory if using the **set duplex** command (with **duplex** set to 1, 2, 3, or 4), or other RMAN commands to generate backup copies during a manual backup. Specifies the name of the volume pool to use for the Oracle backup, including a duplexed Oracle backup. **Note:** For a scheduled backup, the NSR_DATA_VOLUME_POOL setting takes precedence over any pool associated with the scheduled backup group.	• The most appropriate pool, selected by the NetWorker server (default). • A valid NetWorker pool name. • The name must be different from the name used by any one of these parameters: NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2, NSR_DATA_VOLUME_POOL3.
NSR_DATA_VOLUME_POOL1	Mandatory if using the **set duplex** command (with **duplex** set to 2, 3, or 4). Specifies the name of the volume pool to use for a duplexed Oracle backup.	• Undefined (default). • A valid NetWorker pool name. • The name must be different from the name used by any one of these parameters: NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL2, NSR_DATA_VOLUME_POOL3.
NSR_DATA_VOLUME_POOL2	Mandatory if using the **set duplex** command (with **duplex** set to 3 or 4). Specifies the name of the volume pool to use for a duplexed Oracle backup.	• Undefined (default). • A valid NetWorker pool name. • The name must be different from the name used by any one of these parameters: NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL3.
NSR_DATA_VOLUME_POOL3	Mandatory if using the **set duplex** command (with **duplex** set to 4). Specifies the name of the volume pool to use for a duplexed Oracle backup.	• Undefined (default). • A valid NetWorker pool name. • The name must be different from the name used by any one of these parameters: NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2.
NSR_DEBUG_FILE	Optional. Enables debugging by specifying the complete pathname of the log file on the Oracle Server that receives debug information during a proxy or non-proxy backup or restore. Only used for debugging of the NMO media management library (MML). **Note:** This parameter must be set with the **parms** option. Do *not* set it with the **send** option or command.	• Undefined (default). • The valid pathname of the debug file to use on the Oracle Server. **Note:** If undefined, no debug information is generated. If a file with the specified pathname *cannot* be created, debug information is either directed to the default location or not generated.

Table 21 NSR_* environment variables (continued)

Parameter	Description	Default and Valid Values
NSR_DEBUG_LEVEL	Optional. Controls the amount of debug information that NMO writes to the debug log file, which is specified by NSR_DEBUG_FILE. The debug level limits only the amount of debug information generated by the three functions—sbtread(), sbtwrite(), and sbtpcstatus()—that are called most often during backups and restores. All the debug messages for other functions are always written to the log file, regardless of the debug level. **Note:** This parameter must be set with the **parms** option. Do *not* set it with the **send** option or command.	• 0 (default) = Only operational messages are written for the sbtread(), sbtwrite(), and sbtpcstatus() functions. No entry or exit messages are written for the functions. • 1 = Only entry and exit messages are written for the sbtread(), sbtwrite(), and sbtpcstatus() functions. No operational messages are written for the functions. • 2 = All debug messages for all the functions are written to the log file.
NSR_DPRINTF_FILE	Optional. Enables debugging by specifying the complete pathname of a log file on the Oracle Server that receives messages from the NetWorker dprintf() function during NMO operations. If this parameter is set: • NSR_DEBUG_FILE must be set. • NSR_DEBUG_LEVEL must be set to a value of 1 or greater. The level of messages printed is determined by the NSR_DEBUG_LEVEL value. **Note:** This parameter must be set with the **parms** option. Do *not* set it with the **send** option or command.	• Undefined (default). • The valid pathname of a log file to which the NetWorker dprintf() messages are printed for debugging purposes.
NSR_GROUP	Optional. Use for a manual backup *only.* Specifies the NetWorker group to use for a backup session. Used by the NetWorker server to select the volume pool for the manual backup.	• The predefined NetWorker group named Default (default). • A valid NetWorker backup group name. **Note:** A NetWorker Group resource must be configured for the specified backup group.
NSR_NO_BUSY_ERRORS	Optional. Specifies whether a scheduled backup fails immediately when the NetWorker server is busy or waits for the NetWorker server to accept the connection. **Note:** For proxy Oracle backups, this parameter is always set to FALSE.	• FALSE (default) = The scheduled backup waits for the NetWorker server to accept the connection. • TRUE = The scheduled backup fails immediately when the NetWorker server is busy.

Table 21 NSR_* environment variables (continued)

Parameter	Description	Default and Valid Values
NSR_NO_MULTIPLEX	Optional. When set for a specific RMAN channel, specifies whether multiplexing is disabled during a backup on the NetWorker device that the RMAN channel is using. If multiplexing is disabled, no other save sets can be written to the device. To optimize restore operations, RMAN requires NMSAP backups to *not* be multiplexed. Setting the parameter to TRUE may affect the backup performance. For example, the device may sit idle during part of the backup. If the performance is adversely affected, reset the parameter to FALSE.	• FALSE (default) = Multiplexing is *enabled* on the device that the RMAN channel is using. • TRUE = Multiplexing is *disabled* on the device that the RMAN channel is using. **Note:** If a random access NetWorker device such as an advanced file device is used, do *not* set the parameter to TRUE.
NSR_NWPATH	Mandatory when the NetWorker client is not installed in the default location. Specifies the complete pathname of the directory that contains the NetWorker client binaries.	• The platform-specific default location of the NetWorker client binaries (default). • A valid pathname of the directory containing the NetWorker client binaries, for example, */usr/local/bin*.
NSR_RETENTION_DISABLED	Optional. Specifies whether the NetWorker browse and retention policies are disabled. Set to TRUE to use Oracle policies only (*not* NetWorker policies) to manage the backup data lifecycle. Then the RMAN catalog and NetWorker indexes cannot become unsynchronized, for example, when a NetWorker index entry is expired but the corresponding RMAN catalog entry is *not* expired.	• FALSE (default) = NetWorker browse and retention policies are enabled, and used to manage the lifecycle of the NMO backup data. • TRUE = NetWorker browse and retention policies are disabled. Only Oracle policies are used to manage the lifecycle of the NMO backup data.
NSR_SAVESET_BROWSE	Mandatory if setting a nondefault browse policy for a *manual* Oracle backup. Specifies the date when the entry for the backup is to be removed from the NetWorker client index. **Note:** For a *scheduled* Oracle backup, this parameter overrides the Browse Policy attribute setting in the NetWorker Client resource.	• The most appropriate policy for the client, as selected by the NetWorker server (default). • A valid date in **nsr_getdate(3)** format.
NSR_SAVESET_RETENTION	Mandatory if setting a nondefault retention policy for a *manual* Oracle backup. Specifies the date when the save set becomes recyclable. **Note:** For a *scheduled* Oracle backup, this parameter overrides the Retention Policy attribute setting in the NetWorker Client resource.	• The most appropriate policy for the client, as selected by the NetWorker server (default). • A valid date in **nsr_getdate(3)** format.

C

Troubleshooting

This appendix contains troubleshooting tips and NMSAP error messages. It also provides suggestions to help diagnose and fix problems with the NMSAP program during backup and restore sessions.

This appendix includes the following sections:

Verifying the release information

When making queries or requests to an EMC Customer Support Representative, provide specific information about the NMSAP software you are using.

To verify the release information for your installation, use the appropriate command or procedure:

- On UNIX systems, type the following command as the root user:

  what *filenm* | **more**

  where *filenm* is the name of a NMSAP binary file, for example, **backint** or **nsrsapsv**.

- On Linux systems, type the following command as the root user:

  strings *filenm* | **grep "@(#)"**

  where *filenm* is the name of a NMSAP binary file, for example, **backint** or **nsrsapsv**.

- On Microsoft Windows systems:

  1. Locate the NMSAP binary file, for example, **backint.exe** or **nsrsapsv.exe**.
  2. Right-click the file, and select **Properties**.
  3. In the **Properties** window, click the **Version** tab to display the release information.

Generating diagnostic logs

To generate **backint** diagnostic logs, set the following values in the init<*ORACLE_SID*>.utl file:

```
NSR_DEBUG_DIR (if not using the default location nsr/applogs)
debug_level = 9
```

Note: Debug level is intended for testing and EMC Customer Support diagnostics only.

Backup and restore problems

Table 22 on page 99 provides guidelines for solving problems that may occur during an NMSAP backup or restore process.

Table 22 NMSAP backup or restore problems

Problem	Possible reason or solution
Data is not being backed up to the NetWorker server.	Ensure that the SAP initialization file, init<*ORACLE_SID*>.sap, is configured to use NMSAP. "How to configure the backup and restore utility" on page 37 provides more information.
Data is not being backed up using the settings in the Client resource on the NetWorker server.	During a backup, NMSAP does not use most of the settings in the Client resource, except for the save set name and backup schedule. The client settings must be specified in the init<*ORACLE_SID*>.utl file on the SAP server running Oracle. "How to configure the NMSAP parameters" on page 31 provides more information.
The bootstrap notification report was not printed to the printer specified in the Group resource on the NMSAP server.	Bootstrap notification reports are not generated after a manual NMSAP backup. "How to back up the client file indexes and bootstrap file" on page 41 provides information on the generation of a bootstrap notification report.
Online backup of an Oracle tablespace is taking a long time.	Oracle creates more online redo logs during an online backup than during an offline backup. This might prolong the online backup.
Following a backup, the parallelism setting in the backint<*ORACLE_SID*>.log.raw is different from the setting in the parameter file init<*ORACLE_SID*>.utl.	The parallelism setting is adjusted by **backint** during the backup session depending on other parameters, for example, when the number of files within the backup session is lower than the server parallelism setting.
A specified backup of an Oracle directory failed.	NMSAP does not support the backup of directories. Specify each database object within the directory to back up and then perform the backup.
You are unable to view the files backed up to the NetWorker server from the BrGui program on the SAP server that is running Oracle.	Ensure that the SAP user's operating system authorization has the appropriate permission to access the NetWorker server.
You are unable to restore the most recent version of the file that was backed up.	When a restore is initiated within a certain time frame that expired or otherwise is not available, **brrestore** restores files from previous backups, depending on whether the **prev_bk_restore** parameter is set to Yes. The **prev_bk_restore** in Table 5 on page 32 provides more information. Ensure that the SAP user's operating system authorization has the appropriate permission to access the NetWorker server.

Regular session error messages

This section discusses error messages that might occur during a backup, restore, or inquire session, but that do *not* stop the session.

Table 23 on page 100 indicates possible error messages that might appear in the backint<*ORACLE_SID*>.log.raw file.

Note: If NMSAP has been localized, the localized version of the **backint** log can be read and interpreted to any of the supported locales by the NetWorker Management Console log viewer.

Table 23 NMSAP regular session error messages

Error message	Description	Solution
Error when sending email	NMSAP could not write a notification to the command-line mail utility specified in the error message.	Notification is supported only on UNIX. Check the usage of the notify parameters in the init<*ORACLE_SID*>.utl file. "How to configure the NMSAP parameters" on page 31 has more information.
Error: *filename* is not a regular file, raw partition, or directory.	The **backint** program does not support the file type (such as a symbolic link or a named pipe).	Check the filename to see what type of file is being backed up. If **brbackup** requests a backup of special files, contact SAP support.
Error: save symlinks had errors	During the process of saving symbolic links, **backint** ran out of memory and could no longer add symbolic links to its list.	This situation is unlikely. The computer may be low on memory, or the program may contain a logic error. If this situation recurs, go to http://softwaresupport.EMC.com.
Error: unexpected inquire case.	The files requested in the input file do not match the SAP **backint** specification. Valid file specifications include: • #NULL is specified for a backup ID, with or without a filename • A filename is specified with a backup ID. • A backup ID is specified without a filename	Check the backup input file generated by **brbackup**. If the input file generated appears to be the wrong format, contact SAP support.
Ignoring, use format *param=value*	Uncommented text in the init<*ORACLE_SID*>.utl parameter file does not conform to "param = value" and is ignored.	"How to configure the NMSAP parameters" on page 31 provides information on setting the parameters in the init<*ORACLE_SID*>.utl file.
Lookup failed on *filename (backup_ID)*	The **backint** program was trying to look up a filename and/or backup ID in the client file index, but the attempt to query the index failed. The next message should explain why the index query failed.	Check the error message to determine why the attempt to query the index failed. If this message does not explain the problem, and future inquire or restore requests fail, go to http://softwaresupport.EMC.com.
Pathname not found in index	The specified file was not found in the NetWorker client file index.	Ensure that the file was actually backed up in a previous run of **backint**. If **brbackup** specifies filenames that were never backed up, check the SAP installation.

Table 23 NMSAP regular session error messages (continued)

Error message	Description	Solution
Process_ID File *filename* not found in index, no attempt to recover will be made	The NetWorker software did not save the filename specified for recovery and the filename does not appear in the client file index.	Check the specified filename to see if the name is correct. Check previous backups to determine whether the file was actually saved in a previous backup.
Unable to build command line.	The **backint** command was unable to build a command line for a subprocess because the program ran out of memory.	This situation is unlikely to occur. The computer might be low on memory, or the program might contain a logic error. If this situation recurs, go to http://softwaresupport.EMC.com.
Unable to find pid *process ID* in list of files	The **backint** program is checking the status of a subprocess that was created to save individual files. However, the subprocess ID does not match any of the expected process IDs.	Check the rest of the messages from the backup process to ensure that everything was saved. In particular, check for the message "*x* of *y* files saved at *time*." If all of the files were not saved, retry the backup.
Unable to query with savetime and filename both absent	The **backint** program was trying to find a file in the client file index, but neither the save time nor the filename were provided.	Check the input file to see if any file information is specified incorrectly. If this situation persists, go to http://softwaresupport.EMC.com.
Warning: Unknown parameter, *parameter_name*	The parameter indicated is not a valid NMSAP parameter.	"How to configure the NMSAP parameters" on page 31 lists valid parameters.

Fatal error messages

This section discusses fatal error messages. It also explains why a particular backup, restore, or inquire session fails.

Table 24 on page 102 indicates any fatal error messages that begin with the following line:

```
Backint exiting at time_stamp with fatal error
```

Table 24 NMSAP fatal error messages

Error message	Description	Solution
BACKUP: Bad input line: *line*	One of the lines in the input file had a bad format. There should be only one or two specifications on each input line (filename and size, if it is a special file).	Check the input file **brbackup** generated to make sure it has the correct format. If not, and this error recurs, contact SAP customer support.
Bad function on input line, *function*	The function indicated cannot be performed as it is either an invalid function or you are attempting to use unsupported options.	NMSAP can be invoked only through the BrGui program or associated commands. For information on supported functions, refer to Oracle documentation.
Cannot reopen *filename* as stderr	The **backint** program was unable to open a log file for writing.	Check the permissions on the file listed in the message, as well as the permissions on the directory.
Cannot connect to server: *error*	The **backint** program was unable to connect to the NetWorker server to start reading the media database.	Ensure that the correct NetWorker server is specified. Check the log file to see if any other messages refer to this problem.
Cannot start session with server: *error*	The **backint** program was unable to start reading the media database on the NetWorker server.	Ensure that the correct NetWorker server is specified. Check the log file to see if any other messages refer to this problem.
Checking for deletion of semaphore file: *error*	The existence of the semaphore file could not be confirmed because of a system error.	Check to see if the .switch.sem file is still in the SAPBACKUP directory. If so, delete it before running the SAP backup again.
Creating directive file: *error*	The directive file for NetWorker software to use cannot be created. This directive file is created so the NetWorker software can process files with the correct attributes.	Check the directory where the directive file is being created, specified by the backint_tmpdir parameter in the NMSAP parameter file, to ensure files can write to it.
Error: Too many symlinks	There are too many symbolic links to save (more than 100).	If the list of database files to be backed up contains more than 100 symbolic links, consider restructuring the directories to eliminate the extra symbolic links.
File was *filename*, lstat error	NMSAP tried to get information for a symbolic link that does not exist or NMSAP cannot access because permission is denied.	Check the file to see that it exists and is a valid symbolic link.

Table 24 NMSAP fatal error messages (continued)

Error message	Description	Solution
Improperly formatted backup id: *backup ID*	The backup ID is incorrect. It should specify either a number or the word #NULL.	Check the input file **brrestore** generated to ensure that it has the correct format. If not, and this error keeps occurring, contact SAP customer support.
INQUIRE: Bad input line: *line*	One of the lines in the input file had a bad format. There should be only one or two specifications on each input line (backup ID or #NULL an optional filename).	Check the input file **brrestore** generated to ensure that it has the correct format. If not, and this error keeps occurring, contact SAP customer support.
Interrupted... backint exiting	The NMSAP **backint** program was interrupted during a backup, restore, or inquire session.	This error usually occurs due to a keyboard error.
Nonrecursive directory backup is not supported at this time	You have attempted to back up a directory. The backup of directories is not supported.	Select specific database objects to back up from the BrGui program and restart the backup process.
Not enough save sets, please increase savesets setting in .utl file	The number or size of the save sets to be backed up exceeds the current settings for the number of save sets allowed or the maximum save set size allowed.	Increase the number of save sets or the maximum save set size. • The **savesets** parameter in Table 5 on page 32 describes how to set the number of save sets. • The **ss_size_max** paremeter in Table 5 on page 32 describes how to set the maximun save set size.
Opening input file: *error*	The input file, which lists all files to be backed up or restored, could not be opened. It may not exist, or it may not have read permissions.	Ensure that the input file exists and is readable.
Opening output file: *error*	The output file could not be opened for the reason specified.	Check the permissions on the output file and directory, and check for sufficient disk space to create a new file.
Opening parameter file	Unable to open the **backint** parameter file, init<*ORACLE_SID*>.utl.	Attempt to open the parameter file for **backint** in any text editor. If you are unable to open the parameter file, replace it with the original file from the NMSAP CD.
Opening switch list file for online backup: *error*	When performing an online backup, **backint** tries to open a file to communicate with **brbackup**. This file could not be opened for the reason given.	Check to see if the .switch.lis file exists in the SAPBACKUP directory. If so, check the permissions on this file. Normally, NMSAP deletes and re-creates this file for every tablespace to be switched into backup mode.
Opening switch log file for online backup: *error*	When performing an online backup, **backint** expects **brbackup** to provide a log file of the tablespaces that were switched into or out of backup mode.	Check to see if the .switch.log file is still in the SAPBACKUP directory. If so, delete it before running the SAP backup again.
Opening switch semaphore file for online backup: *error*	When performing an online backup, **backint** tries to open a file to communicate with **brbackup**. This file could not be opened for the reason given.	Check to see if the .switch.sem file exists in the SAPBACKUP directory. If so, check this file's permissions. Normally, NMSAP deletes and re-creates this file for every tablespace to be switched into backup mode.

Table 24 NMSAP fatal error messages (continued)

Error message	Description	Solution
ORACLE_HOME not set.	The ORACLE_HOME environment variable must be set.	Set the ORACLE_HOME environment variable to the correct directory.
recover_start: cannot connect to server *server_name*	The **backint** program was unable to connect to the NetWorker server to start the recovery process.	Ensure that the correct NetWorker server is specified. Check the log file to see if any other messages refer to this problem.
RESTORE: Bad input line: *line*	One of the lines in the input file had a bad format. There should be only two or three specifications on each input line (backup ID or #NULL, a filename, and an optional destination directory).	Check the input file **brrestore** generated to make sure it has the correct format. If not, and this error keeps occurring, contact SAP customer support.
SAPBACKUP must be set for online backups.	The SAPBACKUP environment variable must be set to a valid directory for an online backup. This directory is used to hold the switch log and switch list files on Microsoft Windows.	Set the SAPBACKUP environment variable to a valid directory (such as: *%ORACLE_HOME%*\<*ORACLE_SID*>\sapbackup on Microsoft Windows).
Semaphore file not deleted in *time* seconds.	When performing an online backup, the SAP module was waiting for the switch semaphore file to be deleted. After waiting some number of seconds, the switch semaphore file still was not deleted.	If **brbackup** appears to be running properly but just slowly, you can increase the **sem_timeout** setting in init<*ORACLE_SID*>.utl.
stat'ing file: *error*	The filename given in the input file does not exist, or it may be inaccessible.	Check the file to see if it exists and has read permissions.
Switch log file indicates an error.	The **brconnect** program indicated in the switch log file that there was an error switching one of the tablespaces into or out of backup status. This is considered a fatal error in the **backint** specification.	Investigate the error messages in the switch log file to determine the problem. Check the SAP installation or the SAP documentation to determine the problem.
This eval copy has expired.	The evaluation version of the NMSAP software has expired.	Go to http://softwaresupport.EMC.com to obtain a permanent enabler. For instructions on entering the enabler code, refer to the *NetWorker Module for SAP with Oracle Installation Guide*.
Unable to allocate memory for struct fileinfo	The **backint** program ran out of space when it tried to allocate memory for a block of file information.	Check the memory usage on the computer. You may need to reboot the computer if it is running low on memory. If the input file is excessively large, ensure BrGui is providing a valid list of files.
Unable to allocate memory: *error*	The **backint** program was unable to allocate memory.	Check the memory usage on the computer. You may need to reboot the computer if it is running low on memory.
Unable to change to root: *error*	In a cluster environment on UNIX, the program was unable to change its real and effective user IDs to root.	Ensure the user has proper permission to log on as root.

Table 24 NMSAP fatal error messages (continued)

Error message	Description	Solution
Unable to execute child backint process.	The **backint** process could not execute a subprocess to back up an individual save set.	Ensure that the **backint** binary is installed in the directory from which BrGui, **brbackup**, or **brrestore** is run. Check the log file for any other messages which may help pinpoint the problem.
Unable to open output file: *error*	The output file could not be opened because of the *error* specified.	Check the permissions on the output file and directory, and check for sufficient disk space to create a new file.
Usage error.	An unsupported option was included in the **backint** command.	For parameters accepted by **backint**, refer to SAP's BC-BRI BACKINT Interface for Oracle documentation.
Use absolute path name for: *filename*	The filename given in the input file was not an absolute pathname. The file cannot be restored or inquired without having the full pathname.	Check the input file **brrestore** generated to ensure that it has the correct format. If not, and this error recurs, contact SAP customer support.
waitchild *name* failed: *error*	The program could not properly receive the exit code from a subprocess. It is possible that the subprocess did not start correctly.	Check any prior error messages to determine whether a subprocess failed, and if so, why.
Warning, empty input file	The input file that contains the list of files to be backed up or restored is empty.	Ensure that you have selected database objects for backup or restore.

Glossary

This glossary contains terms and definitions found in this manual. Most of the terms are specific to NetWorker Module for SAP with Oracle (NMSAP) software.

A

ad hoc backup See *manual backup*.

administrator The person who normally installs, configures, and maintains software on network computers, and who adds users and defines user privileges.

Administrator group A Microsoft Windows user group whose members have the rights and privileges of users in other groups, plus the ability to create, modify, and manage the users and groups in the domain.

archive The process by which NetWorker software backs up directories or files to an archive volume to free disk space. Archived data can be deleted but is not recyclable.

archived redo log See *redo log*.

authentication A security method that enables high confidence in the identity of users, clients, and servers in distributed environments.

autochanger See *library*.

B

backup An operation that saves data to a volume.

backup cycle The period of time from one level full backup to the next level full backup.

backup volume A volume used to store backup data. Backup data cannot be stored on an archive volume or a clone volume.

bootstrap A save set that is essential for the NetWorker disaster recovery procedures. The bootstrap consists of three components that reside on the NetWorker server: the *media database*, the *resource database*, and the *server index*.

browse policy A NetWorker policy that specifies the time period during which backup entries are stored in a *client file index* and the associated backup files are readily accessible to desktop users.

C

carousel See *library*.

client A computer, workstation, or fileserver whose data can be backed up and recovered. See also

client file index A database maintained by the NetWorker server that tracks every database object, file, or *file system* backed up. The NetWorker server maintains a single index file for each client computer. The tracking information is purged from the index after the browse time of each backup expires.

client-initiated backup See *manual backup*.

clone A reliable copy of backed up data, which is indexed and tracked. Unlike volumes created with a simple copy command, clone volumes can be used in exactly the same way as the original backup volume. Single save sets or entire volumes can be cloned.

clone volume An exact duplicate of a backup volume. One of four types of volumes that NetWorker software can track (backup, archive, backup clone, and archive clone). Save sets of these different types may not be intermixed on one volume.

cluster 1. Two or more independent network servers that operate and appear to clients as if they were a single unit. The cluster configuration enables work to be shifted from one server to another, thereby providing "high availability," which allows application services to continue despite most hardware or software failures. Also known as an agent (Sun), logical server (HP TruCluster), package (HP-UX), and virtual server (Microsoft). 2. A group of disk sectors. The operating system assigns a unique number to each cluster and keeps track of files according to which clusters they use.

command line The line on a display screen, also known as a command prompt or shell prompt, where you enter software commands.

Console server The software program that is used to manage NetWorker servers and clients. The Console server also provides reporting and monitoring capabilities for all NetWorker processes.

D

datawheel See *library*.

datazone A group of computers administered by a NetWorker server.

device 1. A storage unit that reads from and writes to backup volumes. A storage unit can be a tape device, optical drive, autochanger, or file connected to the server or storage node. 2. When dynamic drive sharing (DDS) is enabled, refers to the access path to the physical drive.

directed recovery A method of recovery that recovers data that originated on one client computer and recreates it on another client computer.

directive An instruction that directs NetWorker software to take special actions on a given set of files for a specified client during a backup or recover operation. Directives are ignored in manual (unscheduled) backups.

drive A hardware device through which media can be read or written to.

Dynamic Drive Sharing (DDS) A feature that allows NetWorker software to recognize shared drives and when they are available.

E

enabler code A special code that activates the software. The enabler code that unlocks the base features for software is called a base enabler. Enabler codes for additional features or products (for example, library support) are called add-on enablers.

F

file index See *client file index*.

file system 1. The software interface used to save, retrieve, and manage files on storage media by providing directory structures, data transfer methods, and file association. 2. The entire set of all files.

full backup See *level*.

G

group A client or group of client computers that are configured to back up files at a designated time of day.

H

high availability system A system of multiple computers configured as cluster nodes on a network that ensures that application services continue despite a hardware or software failure. Each cluster node has its own IP address with private resources or disks that are available only to that computer.

host A computer on a network.

host ID A serial number that uniquely identifies a host computer.

I

instant backup The process of creating a point-in-time copy (snapshot) of data from a single client and saving it on a primary storage volume, which can be immediately recovered as a backup copy.

instant restore The process of copying data created during an instant backup to its original location, or to an alternate location, during a recover operation.

L

label An electronic header on a volume used for identification by NetWorker or other data move application.

level A backup configuration option that specifies how much data is saved during a scheduled or manual backup. A full (f) backup backs up all files, regardless of whether they have changed. Levels one through nine [1-9] backup files that have

changed since the last lower numbered backup level. An incremental (incr) backup backs up only files that have changed since the last backup.

library A hardware device containing one or more removable media drives, as well as slots for pieces of media, media access ports, and a robotic mechanism for moving pieces of media between these components. Libraries automate media loading and mounting functions during backup and recovery. The term library is synonymous with autochanger, autoloader, carousel, datawheel, jukebox, and near-line storage.

live backup Also known as a "PiT rollover" or "rollover to tape" backup. A backup to media of a previously created snapshot. The two types of live backup are immediate live backup and deferred live backup.

M

manual backup A backup that a user performs from the client, also known as an unscheduled backup or an *ad hoc* backup. The user specifies the files, file systems, and directories to back up. A manual backup does not generate a bootstrap save set.

media The physical storage, such as magnetic tape, optical disk, or file system, to which backup data is written.

media database A database that contains indexed entries of storage volume location and the life cycle status of all data and volumes managed by the NetWorker server.

media index See *media database*.

Media Manager The NetWorker database that tracks save sets stored on backup volumes.

media pool See *pool*.

mount To make a database available for use or to place a removable tape or disk volume into a drive for reading or writing.

N

NAS See *Network attached storage (NAS)*.

NDMP data server An NDMP service that either reads from or writes to disk.

NDMP host The host computer that executes the NDMP server application.

NDMP save set A save set of an NDMP client that is backed up to an NDMP device.

NDMP server An instance of one or more NDMP services controlled by a single NDMP control connection. Thus a data/tape/SCSI server is an NDMP server providing data, tape, and SCSI services.

NDMP service The virtual state machine on an NDMP host that is controlled by the DMA. Examples of NDMP services include: a general server with direct attached storage (storage appliance), a system with one or more tape drives, or a software process that reads two data streams and multiplexes them into one stream.

NDMP storage node A host having NDMP services or any open system having NDMP services installed. For instance, Netapp Filer and EMC Filer.

near-line storage See *library*.

Network attached storage (NAS) A disk array or storage device (NAS filer) with multiple file systems that connects directly to the messaging network or LAN interfaces and uses common communication protocols (TCP/IP or NDMP).

Network Data Management Protocol (NDMP) A TCP/IP-based protocol that specifies how heterogeneous network components communicate for the purpose of backup and recovery.

Network File System (NFS) A client/server application that allows users to access shared files stored on networked computers of different types.

NetWorker A network-based EMC software product that backs up and recovers file systems.

NetWorker Management Console See *Console server*.

NetWorker resource See *resource*.

NetWorker server The computer on a network that runs the NetWorker server software, which contains the online indexes and provides backup and recovery services to the clients on the same network.

NFS See *Network File System (NFS)*.

NFS server A computer that contains exported file systems that NFS clients can access.

nsrd The master NetWorker server process.

nsrhost The logical hostname of the computer that is the NetWorker server.

O

override A different backup level that is used in place of the regularly scheduled backup.

P

parallelism A method that backs up or recovers data for several clients, or several save sets for one client, at the same time.

pathname A set of instructions to the operating system for accessing a file. An absolute pathname indicates how to find a file starting from the root directory and working down the directory tree. A relative pathname indicates how to find a file starting from the current location.

physical cluster host A NetWorker client that is bound to a physical host in the cluster and can have its own resources (private or local).

physical host A node or host that forms part of a cluster.

point-in-time (PiT) copy A fully usable copy of a defined collection of data, such as a consistent filesystem, database, or volume, which contains an image of the data as it appeared at a single point in time. A PiT copy is also called a shadow copy or a snapshot.

policy A set of constraints that specify how long the save sets for a client are available for recovery. Each client has a browse policy and a retention policy. When the retention policy expires, the save sets associated with that policy are marked recyclable.

pool A feature to sort backup data to selected storage volumes.

proxy-client A surrogate client that performs the NetWorker save operation for the client that requested the backup. A proxy client is required to perform a serverless backup.

purge Removing file data from the extended drive (after the file has been moved to media), while leaving a file tag behind. The file appears as if it is still on the drive.

purge list A list of files that have qualified for purge rules but have not yet been purged from the extended drive. Files on the purge list are purged either when a background scan occurs or when extended drive used space reaches a certain level, depending on the configuration.

R

recover To apply transactional logs to a database to make it consistent with a given point in time.

recyclable save set A save set whose browse and retention policies have expired. Recyclable save sets are removed from the media database.

recyclable volume A volume whose data has exceeded both its browse and retention policies and is now available to be relabeled and reused.

redo log The online log (also known as archived redo log) of an Oracle database, consisting of at least two redo log files (separate from the datafiles) that records all changes made in the database instance.

remote device A storage device that is attached to a storage node.

Remote Procedure Call (RPC) The protocol that the NetWorker server uses to perform client requests over a network.

resource A component that describes the NetWorker server or its clients. Clients, devices, schedules, groups, and policies are all NetWorker resources. Each resource has attributes that define its properties.

resource database A database of information about each resource.

restore The process of retrieving individual files from backup storage and copying the files to disk.

retention policy A setting that determines the length of time that backup data is retained on a volume available for recovery, though not necessarily immediate recovery.

retrieve To locate and recover archived files and directories.

rollback restore The process by which a specific point-in-time copy (snapshot) of data is restored to the source location by using the hardware's particular capabilities. A rollback restore is a destructive save set restore.

rollover save set A save set that is backed up to tape from a snapshot. Whether this snapshot is retained or not depends on a snapshot policy. When a snapshot is rolled over to tape,

entries are made in the client file index and media database, which enable the save set to be browsed for recovery.

root 1. (UNIX only) The UNIX superuser account. 2. (Microsoft Windows and UNIX) The highest level of the system directory structure.

RPC See *Remote Procedure Call (RPC)*.

S

save The NetWorker command that backs up client files to backup volumes and makes data entries in the online index.

save set A group of files or a file system from a single client computer, which is backed up on storage media.

save set consolidation A process that performs a level 1 backup and merges it with the last full backup of a save set to create a new full backup.

save set ID A internal identification number assigned to a save set.

save set recover To recover data by specifying save sets rather than by browsing and selecting files or directories.

save set status A NetWorker attribute that indicates whether a save set is browsable, recoverable, or recyclable. The save set status also indicates whether the save set was successfully backed up.

save stream The data and save set information that is written to a storage volume during a backup. A save stream originates from a single save set.

scanner The NetWorker command used to read a backup volume when the online indexes are not available.

scheduled backup A type of backup that is configured to start automatically at a specified time for a group of one or more NetWorker clients. A scheduled backup generates a bootstrap save set.

secondary storage A storage library attached to the NetWorker server or storage node, used to store traditional or snapshot backups. A NetWorker server Device resource must be configured for each secondary storage device.

server index See *client file index*.

shared disk The storage disk that is connected to multiple nodes in the cluster.

SID System identifier for an Oracle database instance.

silo See *library*.

SmartMedia An EMC software application that manages media resources within a distributed environment.

snap set The group of files, volumes, or file systems from a single client that describes the collection of data for which a point-in-time copy is created on an external disk subsystem, such as a storage array.

snapshot A point-in-time, read-only copy of data created during an instant backup.

snapshot policy A set of rules that control the lifecycle of a snap set. The snapshot policy specifies the frequency of snapshots, and how long snapshots are retained before recycling.

SNMP (Simple Network Management Protocol) A protocol used to send messages to the administrator about NetWorker events.

ssid See *save set ID*.

staging Moving data from one storage medium to a less-costly medium, and later removing the data from its original location.

stand-alone device A storage device that contains a single drive for backing up data. Stand-alone devices cannot store or automatically load backup volumes.

storage node A storage device physically attached to a computer other than the NetWorker server, whose backup operations are administered from the controlling NetWorker server.

system administrator The person normally responsible for installing, configuring, and maintaining NetWorker software.

T

tablespace An Oracle database structure that consists of one or more datafiles.

tape service An NDMP DSP service that controls access to tape storage. A system can simultaneously host multiple tape services corresponding to multiple backup streams.

target sessions The number of backup sessions accepted by a backup device.

temporary enabler A code that allows operation of the software for an additional 45 days beyond the evaluation period.

trap Unsolicited notification sent from the SNMP agent to the network manager's SNMP event manager.

U

unscheduled backup See *manual backup*.

update enabler A code that updates software from a previous release. Like other temporary enabler codes, it expires after 45 days.

V

versions The date-stamped collection of available backups for any single file.

virtual cluster client A NetWorker client that is not permanently bound to one physical host but is managed by a cluster manager. It can have its own data disks. It is also referred to as a logical cluster client or a virtual client.

volume 1. A unit of physical storage medium, such as a magnetic tape, optical disk, or file system to which backup data is written. 2. An identifiable unit of data storage that may reside on one or more computer disks.

volume ID An internal identification that NetWorker software assigns to a backup volume.

volume mount point A disk volume that is grafted into the namespace of a host disk volume. This allows multiple disk volumes to be linked into a single directory tree, and a single disk or partition to be linked to more than one directory tree.

volume name The name assigned to a backup volume when it is labeled.

Index

O

P

Q

R

S

T

U

V

W