

**Legato NetWorker[®]
Module for Oracle[®]**

Administrator's Guide

Releases 3.0 and 3.1



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Legato NetWorker Module for Oracle Administrator's Guide, Releases 3.0 and 3.1

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Preface

About This Guide

This *Legato NetWorker® Module for Oracle® Administrator's Guide* provides information on how to configure and use the Legato NetWorker Module for Oracle software in conjunction with Legato NetWorker server software for Oracle data storage management. You must install the latest NetWorker Module for Oracle software on a Windows® 2000, Windows NT® (Intel®), or UNIX® operating system running Oracle8 or Oracle8i.



Important: In this guide, “Windows” refers to *both* the Windows 2000 and Windows NT operating systems, unless specified otherwise.

This guide describes the initial configuration procedure for NetWorker Module for Oracle. It also explains how to use NetWorker Module for Oracle with the NetWorker server for managing Oracle backup devices and volumes, performing and monitoring Oracle backup and restore operations, and managing Oracle backup data.

Audience

The information in this guide is intended for system administrators and Oracle database administrators (DBAs) who are responsible for maintaining Oracle Server backup and recovery systems. This guide includes information on configuring an Oracle data storage management system for both UNIX and Windows systems.

About This Guide

To use this guide effectively, you need a working knowledge of Oracle concepts and terminology, especially those related to Oracle database backup and recovery.

About This Guide

The information presented in this guide assumes that you have already installed the following software:

- NetWorker for UNIX release 5.1 or later *or* NetWorker for Windows release 5.1 or later *server* software on the storage management system. The storage management system can be either the Oracle Server system or a separate system.
- NetWorker for UNIX release 5.1 or later *or* NetWorker for Windows release 5.1 or later *client* software on the Oracle Server system
- Oracle Server release 8.0.3 or later on a supported UNIX or Windows system
- NetWorker Module for Oracle software on the Oracle Server system

The requisite Oracle, Legato NetWorker, and NetWorker Module for Oracle software outlined above *must* be installed before you can use the information presented in this guide.

For instructions on installing the Legato NetWorker software, refer to the appropriate *Legato NetWorker Installation Guide* for your particular platform. For NetWorker Module for Oracle installation instructions, refer to the current release of the *Legato NetWorker Module for Oracle Installation Guide*. For details on installing and configuring the Oracle Server software, refer to your Oracle documentation.

How This Guide Is Organized

This *NetWorker Module for Oracle Administrator's Guide* has seven chapters and four appendixes, followed by a glossary and an index.

Chapter 1: Introduction

This chapter surveys the main features of Legato NetWorker and the NetWorker Module for Oracle as used for Oracle data storage management. It also contains guidelines for disaster preparation and outlines other related documentation.

Chapter 2: Overview of Operations

This chapter explains how NetWorker Module for Oracle and the NetWorker server function with other major components of an Oracle8 or Oracle8i backup and recovery system on UNIX or Windows. It provides details on the internal

NetWorker server resources and attributes used during Oracle backup and restore operations. It also contains information about using the NetWorker Administrator Graphical User Interface (GUI).

Chapter 3: Basic Configuration

This chapter describes how to configure the required resources on a UNIX or Windows NetWorker server to enable Oracle backup and restore operations using the NetWorker server and NetWorker Module for Oracle.

Chapter 4: Manual Oracle Backups

This chapter provides information about how to perform manual Oracle backups as well as the NetWorker server bootstrap backups that are essential for disaster recovery. This chapter also outlines the procedures for monitoring manual Oracle backups using the NetWorker Administrator GUI and specific log files.

Chapter 5: Scheduled Oracle Backups

This chapter describes how to set up your Oracle Server as a client of the NetWorker server for scheduled Oracle backups using NetWorker Module for Oracle. It also outlines the procedures for testing and stopping scheduled Oracle backups, and monitoring scheduled Oracle backups using the NetWorker Administrator GUI and specific log files.

Chapter 6: Restoring Oracle Data

This chapter provides details on how to restore Oracle database files backed up by NetWorker and NetWorker Module for Oracle. It describes the basic procedures for recovering an Oracle database to a consistent state after the relevant files have been restored. Information on preparing for disaster recovery is also included.

Chapter 7: Cluster and OPS Systems

This chapter describes the support provided for different cluster and Oracle Parallel Server (OPS) systems and includes specific procedures for enabling NetWorker Module for Oracle operations on the supported cluster and OPS systems.

Appendix A: NetWorker Functionality

This appendix describes the services and programs that the Legato NetWorker server uses to perform scheduled backups and restores of *regular* filesystem data. It also describes the basic NetWorker operations with storage nodes.

Appendix B: Environment Variables

This appendix describes NetWorker-specific environment variables that must be set in the RMAN script as well as other variables that must be set in the scheduled Oracle backup script.

Appendix C: RMAN Commands

This appendix describes support for RMAN commands in Oracle8i that are dependent on the Media Management implementation, including **proxy copy**, **send**, and **set duplex**. Specific features of the **pool** and **trace** options of the **backup** command are also described.

Appendix D: Troubleshooting

This appendix provides information to assist in troubleshooting problems with running Oracle backups and restores using NetWorker Module for Oracle. A check list is included for the proper installation and configuration of the backup and restore system. The check list highlights the steps for setting up manual and scheduled Oracle backups.


Product Documentation

Legato offers an extensive archive of product documentation at its web site at www.legato.com. Most of the documents are in Adobe® Acrobat® Portable Document Format (PDF), and can be viewed by downloading and installing the Adobe Acrobat Reader. The Reader is available in the *acroread* directory on the Legato Documentation Suite CD-ROM, or directly from the Adobe web site at www.adobe.com. To install and use the Reader on the platform of your choice, refer to the instructions in the CD-ROM's *acroread/readme.txt* file or at the Adobe web site.

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This manual uses the following typographic conventions and symbols to make information easier to access and understand.

Table 1. Document Conventions

Convention	Indicates	Example
boldface	Names of DOS or UNIX line commands, daemons, options, programs, or scripts	The nsradmin command starts the command line version of the administration program.
<i>italic in text</i>	Pathnames, filenames, computer names, new terms defined in the Glossary or within the chapter, or emphasized words	Displayed messages are also written to <i>/nsr/logs/daemon.log</i> .
<i>italic in command line</i>	A variable that you need to provide in the command line	nwadmin -s <i>server-name</i>
fixed-width	Examples and information displayed on the screen	media waiting: recover waiting for 8mm 5GB tape volume name
fixed-width, boldface	Commands and options that you must type exactly as shown	nsr_shutdown -a
Menu_Name> Command> Command	A path or an order to follow for making selections in the GUI	Volume>Change Mode>Appendable
Important:	Information that you must read and follow to ensure successful backup and recovery of your data	 <hr/> Important: You must install the NetWorker Module software in the same directory where you installed the NetWorker client binaries.

Year 2000 Compliance

NetWorker Module for Oracle and NetWorker support dates in the year 2000 and beyond. For additional information and details about related test cases, see the Year 2000 Compliance (Y2K) section on the Legato web site at www.legato.com.

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Customer Feedback

The Legato NetWorker Module for Oracle team welcomes your comments and suggestions about software features, the installation procedure, and documentation. Please send any suggestions and comments to *feedback@legato.com*. You will receive a notice confirming receipt of your e-mail. Although we cannot respond personally to every request, we consider all your comments and suggestions during product design.

Help us improve our documentation and be eligible to win a prize by completing a brief survey. Visit the Legato web site at *www.legato.com*, go to the Manuals page, and then look for the link to the Legato Documentation Survey.

NetWorker Application and Database Modules Mailing List

As a user of NetWorker Module for Oracle, be sure to join the NetWorker Application and Database Modules Mailing List for the latest news and important information on NetWorker Module for Oracle software upgrades, patches, release notes, and new product offerings.

To join the mailing list, visit the Legato web site at www.legato.com/mail_list/mail_list.html and select *NetWorker Application and Database Modules Mailing List*. In the fields provided, enter your name and e-mail address and then click the button at the bottom of the page.

Chapter 1: Introduction

This chapter provides an overview of the important features and functionality of the Oracle Recovery Manager (RMAN), Legato NetWorker server, and Legato NetWorker Module for Oracle. It includes guidelines for disaster recovery preparation and lists other documentation to be used in conjunction with this guide.

This chapter contains the following sections:

- [“Importance of Backing Up Mission-Critical Data”](#)
- [“Recovery Manager \(RMAN\)”](#)
- [“Legato NetWorker”](#)
- [“Legato NetWorker Module for Oracle”](#)
- [“Preparing for Disaster”](#)
- [“Related Documentation”](#)

NetWorker Module for Oracle acts in conjunction with NetWorker to provide a comprehensive Oracle data storage management system. NetWorker Module for Oracle acts as an intermediary between NetWorker and RMAN during Oracle backup and restore operations. It integrates backup and restore procedures for Oracle databases into the network-wide data protection system that NetWorker provides.

Importance of Backing Up Mission-Critical Data

The reliability of computer equipment has improved greatly in recent years, but system and hardware failures still occur, sometimes with catastrophic results.

In a client-server environment, data can be lost, not only due to hardware failures, but also as a result of user errors. Software bugs, procedural flaws, and simple user errors are common culprits that necessitate database media restores. A viable backup strategy can help in recovering from these potentially disastrous situations.

Many database administrators do not recognize the importance of performing regular backups of database files and frequent backups of archived redo logs. If all archived redo logs are lost, a database can only be recovered to the time of its last full backup. Without backups and archived redo logs, the database cannot be recovered.

Recovery Manager (RMAN)

The Oracle backup/restore utility, RMAN, acts as an integral component of an Oracle8 or Oracle8i database backup and recovery system. During the Oracle backup and restore operations on an Oracle8 or Oracle8i Server, NetWorker Module for Oracle acts as an intermediary between Legato NetWorker and RMAN. For more information on the interactions of these components, see [“Oracle Backup and Recovery System” on page 25](#).

RMAN provides the following features:

- Online/offline Oracle database backup
- High performance through parallel backups and restores
- Intelligent interface to Oracle databases
- Parallel processing
- Well-defined backup strategies
- Error checking
- Block level incremental

Legato NetWorker

Legato NetWorker is a high-capacity, easy-to-use solution for network data storage management that provides data backup and restore capabilities for heterogeneous networks of servers and clients. NetWorker simplifies the storage management process and reduces the administrative burden by automating and centralizing your data storage operations.

With NetWorker, you can perform the following tasks:

- Run automated “lights-out” backups during off-peak hours.
- Use centralized administration to configure, monitor, and control backups from anywhere on a network.

- Automate tape handling tasks using SmartMedia™, the intelligent media manager provided with NetWorker that supports a wide variety of 4 mm DAT, 8 mm, and high-end devices, as well as barcode label recognition and cleaning cartridge support.
- Increase backup performance by simultaneously sending data from multiple datafiles to the backup server.
- Use concurrent device support to direct data streams to multiple backup devices for even greater speed.

Legato NetWorker Module for Oracle

Legato NetWorker NetWorker Module for Oracle is an add-on module for NetWorker. Together, NetWorker Module for Oracle and the NetWorker server augment the basic backup and recovery subsystem provided by the Oracle Server. NetWorker Module for Oracle is an important active component in Oracle backup and restore operations, and provides Oracle backup data management and automated media management functionality.

NetWorker Module for Oracle provides:

- True “lights-out” database storage management through automated scheduling, autochanger support, and electronic tape labeling and tracking.
- Support for local backup and distributed backup to a centralized backup server.
- High performance through support for multiple, concurrent high-speed devices such as DLT drives.

NetWorker Module for Oracle acts as an intermediary between the Legato NetWorker server and RMAN. You can initiate an Oracle backup or restore on an Oracle8 or Oracle8i Server by running RMAN.

The storage devices and volumes used during Oracle backups and restores are connected to the NetWorker server or an associated storage node. During an Oracle data backup, NetWorker Module for Oracle receives the data from RMAN and passes the data to NetWorker server processes that store it on the backup volumes. The NetWorker server maintains information records about the Oracle backups in its online index files, using this information to track the backed-up data.

During an Oracle data restore, NetWorker server processes retrieve the required data from the backup volumes and pass it to NetWorker Module for Oracle, which in turn passes the data to RMAN.

Preparing for Disaster

Follow these guidelines to ease the burden of disaster recovery:

- Determine the frequency of your backups, considering that the frequency is a trade-off of time spent now against time spent recovering your database later—after a crash.
- Run in ARCHIVELOG mode if you want to perform online backups.
- Institute mirrored control files.
- Refer to your Oracle documentation for recommendations on whether to institute mirrored online redo logs.
- Ensure that your RMAN Recovery Catalog is being backed up regularly.
- Back up your archived redo logs frequently between database backups.
- In conjunction with manual Oracle backups, be sure to perform regular backups of the NetWorker server bootstrap and Oracle client index using the procedure described in [“NetWorker Server Bootstrap Backup” on page 82](#).

Related Documentation

To make the best use of the information in this *NetWorker Module for Oracle Administrator’s Guide*, use it in conjunction with the information available in the following documentation.

The complete set of the latest Legato documentation is provided in PDF form on the Legato Documentation Suite CD-ROM shipped with your Legato software. The *most* up-to-date releases of the Legato documentation are available on the Legato web site at www.legato.com. For information on how to access Legato documentation from the company web site, see [“Product Documentation” on page 14](#).

Legato NetWorker Module for Oracle Installation Guide

The *Legato NetWorker Module for Oracle Installation Guide* explains how to upgrade to, install, or remove the latest release of NetWorker Module for Oracle. The requisite Legato NetWorker and NetWorker Module for Oracle software must be installed before you can use the information presented in this *NetWorker Module for Oracle Administrator’s Guide*.

Legato NetWorker Administrator’s Guide

The *Legato NetWorker Administrator’s Guide* describes the complete set of Legato NetWorker server features. This *Legato NetWorker Module for Oracle Administrator’s Guide* contains a number of references to the *Legato NetWorker*

Administrator's Guide for more information about specific aspects of NetWorker server functionality. The *Legato NetWorker Administrator's Guide* is available in separate versions for UNIX and Windows.

Release Supplements

The *Release Supplements* for the latest releases of Legato NetWorker and NetWorker Module for Oracle provide late-breaking information about software bugs, workarounds, new and improved features, and other items regarding the products that could not be included in the *Administrator's Guides*.

Before you install the NetWorker or NetWorker Module for Oracle software, review the corresponding *Release Supplement* for any last-minute notes on the installation procedures. After installation, review the *Release Supplement* for notes on how to configure the software.

Online Help

Both the UNIX and Windows versions of the Administrator GUI for the Legato NetWorker server include online help. The online help includes specific information about the GUI, including context-sensitive help in each window that describes the purpose of the window and the information to enter in each field in the window. Other help topics describe NetWorker features and provide step-by-step instructions for carrying out NetWorker functions using the GUI.

For more information about the online help available with the NetWorker Administrator GUI, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker platform. See [“Related Documentation” on page 22](#) for details on how to access the *Administrator's Guide*.

UNIX Manual Pages

The manual (man) pages provided with the UNIX version of Legato NetWorker are a reference for the syntax and function of the NetWorker commands you issue from the command line. For more information on how to use the man pages, refer to the *Legato NetWorker Administrator's Guide* for UNIX, as described in [“Legato NetWorker Administrator's Guide” on page 22](#).

The NetWorker Module for Oracle software also provides the **nsrnmno** man page, which includes information on how to set up and run scheduled Oracle backups using NetWorker Module for Oracle. For more details on scheduled Oracle backups, see [“Chapter 5: Scheduled Oracle Backups”](#).

Windows Command Line Utilities Help

Designed for use with the Windows NT version of the Legato NetWorker server, the Command Line Utilities Help files contain technical information about NetWorker commands.

The Command Line Utilities Help files are provided on the Legato Documentation Suite CD-ROM prior to November 1999. After that time, the Command Line Utilities Help files are no longer available, but the new *Legato Command Reference Guide* is included on the CD-ROM. For more information, see "[Legato Command Reference Guide](#)" immediately after this section.

The Command Line Utilities Help files are HTML files in the directory *docs\windows\cluhelp* on the Legato Documentation Suite CD-ROM. You must access the files directly from the CD-ROM using a web browser.

For more information on how to access and use the Command Line Utilities Help files, refer to the *Legato NetWorker Administrator's Guide, Windows NT Version*.

Legato Command Reference Guide

The *Legato Command Reference Guide* provides technical information describing each of the NetWorker commands.

The *Legato Command Reference Guide* is available in PDF form in the directory *docs/cmndref* on the Legato Documentation Suite CD-ROM, starting in November 1999. The guide uses the advanced search feature available in the Adobe Acrobat Reader release 4.0, included on the CD-ROM.

For more information about the *Legato Command Reference Guide* and how to use the advanced search feature of Acrobat Reader with the guide, refer to the file *docs/cmndref/readme.txt* on the Legato Documentation CD-ROM.

Chapter 2: Overview of Operations

This chapter provides an overview of how NetWorker Module for Oracle and the Legato NetWorker server function with Oracle components to create a complete Oracle backup and recovery system. It describes the internal organization of NetWorker server components as a set of resources and attributes, and how the NetWorker server uses these components for Oracle backup and restore operations. This chapter also outlines general procedures for using the Legato NetWorker Administrator GUI.

This chapter contains the following sections:

- [“Oracle Backup and Recovery System”](#) immediately below
- [“NetWorker Components”](#) on page 30
- [“NetWorker and NetWorker Module for Oracle Operations”](#) on page 34
- [“Using the NetWorker Administrator GUI”](#) on page 38

[“Appendix A: NetWorker Functionality”](#) includes more information about how the NetWorker server performs scheduled backups and restores of *regular* filesystem data.

Oracle Backup and Recovery System

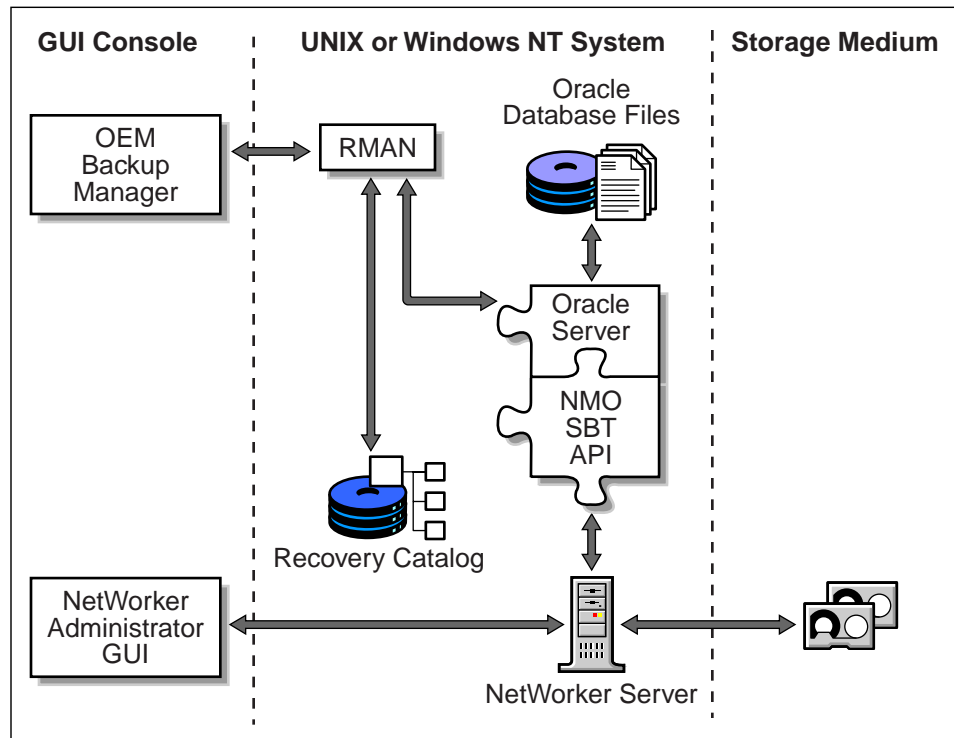
NetWorker Module for Oracle and NetWorker function with the components of the standard Oracle backup and recovery subsystem to produce a comprehensive Oracle data storage management system. To implement a well-defined Oracle backup and recovery strategy, you need to understand how NetWorker Module for Oracle and NetWorker work together with the Oracle components.

NetWorker Module for Oracle and the Legato NetWorker server interact with the Oracle8 or Oracle8i backup and recovery subsystem during Oracle backup and restore operations. The Oracle backup and recovery subsystem comprises the following major components:

- Oracle8 or Oracle8i Server
- Recovery Manager (RMAN)
- Recovery Catalog (optional)
- Oracle Enterprise Manager (OEM) Backup Management Tools (optional)

Figure 1 illustrates the architecture of the overall Oracle backup and recovery system and shows the functional relationship between NetWorker Module for Oracle (NMO), the NetWorker server, RMAN, and the Oracle Server.

Figure 1. Oracle8 or Oracle8i Backup and Recovery System



Recovery Manager (RMAN)

RMAN is the main Oracle8 or Oracle8i backup/restore utility for backing up, restoring, and recovering Oracle databases. It uses information from an Oracle database's control file or Recovery Catalog to locate, back up, restore, and recover datafiles, control files, and archived logs.

RMAN simplifies Oracle backup and recovery procedures by providing a way to:

- Configure frequently executed backup operations
- Generate a printable log of all backup and recovery actions
- Use the Recovery Catalog to automate restore and recovery operations
- Perform automatic parallelization of backups and restores
- Find datafiles requiring a backup based on user-specified limits on the amount of redo that must be applied
- Back up an entire database, selected tablespaces, or selected datafiles

For more information about RMAN, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Recovery Catalog

The Recovery Catalog is a repository of information maintained by RMAN. RMAN uses the information in the Recovery Catalog or database control file to determine how to execute requested backup and restore actions.

The Recovery Catalog includes information about the following types of objects:

- Datafile and archive log backup sets and backup pieces
- Archived redo logs and copies
- Tablespaces and datafiles at the target database
- Stored scripts (for example, user-created sequences of RMAN commands)

Although a Recovery Catalog is not mandatory, Oracle *recommends* using a Recovery Catalog, especially if you have 20 or more datafiles. If you do *not* use a Recovery Catalog, the following functions are *not* supported:

- Point-in-time recovery
- Stored scripts
- Restore and recovery when the control file is lost or damaged

For more information about the Recovery Catalog, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Software Installation and Configuration Requirements

Before you can run an Oracle backup or recovery, the following requisite Oracle, Legato NetWorker, and NetWorker Module for Oracle software must be properly installed and configured:

- NetWorker for UNIX release 5.1 or later *or* NetWorker for Windows release 5.1 or later *server* software on the storage management system. The storage management system can be either the Oracle Server system or a separate system.
- NetWorker for UNIX release 5.1 or later *or* NetWorker for Windows release 5.1 or later *client* software on the Oracle Server system
- Oracle Server release 8.0.3 or later on a supported UNIX or Windows system
- NetWorker Module for Oracle software on the Oracle Server system

You can install the Legato NetWorker server software on either the Oracle Server or a separate UNIX or Windows system. For details on installing the Legato NetWorker software, refer to the *Legato NetWorker Installation Guide* for your particular platform.

You must install the NetWorker Module for Oracle software on the Oracle Server system. For more information, refer to the current release of the *Legato NetWorker Module for Oracle Installation Guide*.

For details on installing and configuring the Oracle Server software, refer to the appropriate Oracle documentation for your particular platform.

After the software installation, you must configure the Oracle Server as a client of the NetWorker server. You must also configure the necessary backup devices and label backup volumes. For more information about the required configuration tasks, see [“Chapter 3: Basic Configuration”](#).

Oracle Backup and Restore Operations

In providing storage management services for Oracle Server data, NetWorker Module for Oracle uses the System Backup to Tape (SBT) Application Programming Interface (API). NetWorker Module for Oracle interacts with an Oracle Server process through the SBT API.

You can start an Oracle8 or Oracle8i backup or recovery by issuing the appropriate commands to RMAN through its command line interface. Alternatively, you can start the backup or recovery using the OEM Backup Management Tools, with the optional graphical user interface to RMAN.

The OEM Backup Management Tools generate RMAN commands that are sent to the Oracle Server, providing a much simpler interface than using RMAN scripts. The OEM Backup Management Tools enable users to perform backup and recovery using the point-and-click method. For information about performing backup and recovery operations using the OEM Backup Management Tools, refer to the *Oracle Enterprise Manager Administrator's Guide*.

The RMAN command line interface starts Oracle Server processes on the database to be backed up or restored (the *target database*). These Oracle Server processes perform the backup or restore. For example, during an Oracle backup, the Server process reads the datafile, control file, or archived redo log being backed up and writes it to the NetWorker server through the SBT API used by NetWorker Module for Oracle. The NetWorker server, in turn, stores the Oracle data to the appropriate backup device.

NetWorker Module for Oracle includes a Media Management Library (MML). It is integrated with Oracle during the NetWorker Module for Oracle installation on the Oracle Server. The NetWorker Module for Oracle installation links the media management software routines of the library with the Oracle kernel software. This allows the Oracle Server processes to call the SBT API routines to back up and restore Oracle datafiles to and from the media controlled by the NetWorker server.

At the end of the Oracle backup, the NetWorker server updates the online client and media indexes with information about the backup media used and the Oracle data it contains. NetWorker takes care of the storage management tasks, while RMAN passes the data from the Oracle Server to NetWorker using the NetWorker Module for Oracle.

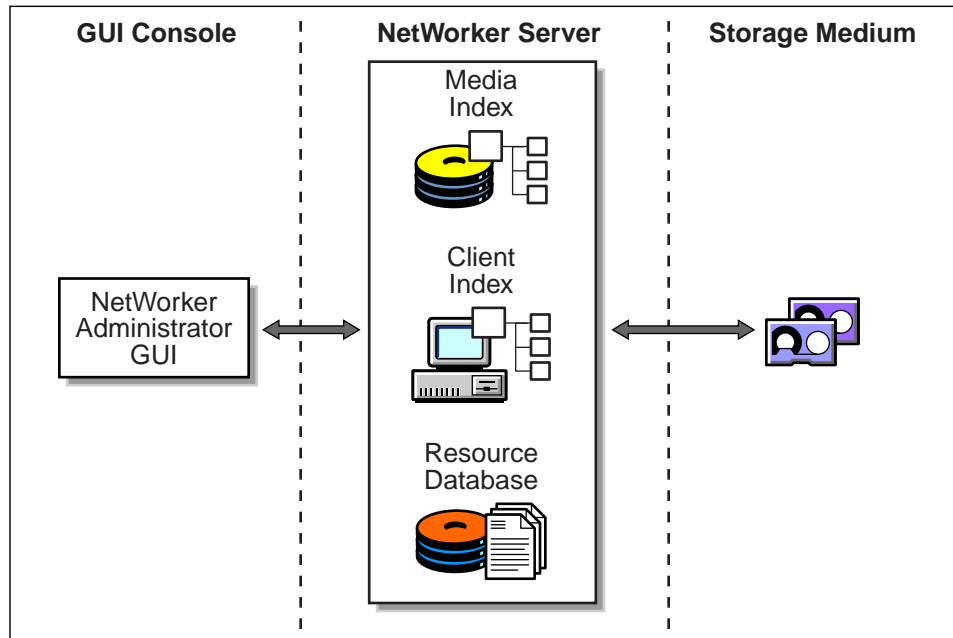
In conjunction with manual Oracle backups, it is important to run regular backups of the NetWorker server *bootstrap*, as required for proper disaster recovery on the NetWorker server. For more information about how to run the bootstrap backup, see [“NetWorker Server Bootstrap Backup” on page 82](#).

When you initiate an RMAN restore request, the NetWorker Module for Oracle SBT API translates the object names requested by RMAN into a format understood by NetWorker and forwards it to the NetWorker server. The NetWorker server searches its online indexes for the media containing the requested data objects. It reads the media and passes the data back to the Oracle Server process, which writes the Oracle data to the disk.

NetWorker Components

Figure 2 illustrates the general organization of the NetWorker server’s major components and the relationship of the NetWorker server and NetWorker Administrator GUI.

Figure 2. NetWorker Components



The NetWorker server uses the two online index files—the *client index* and *media index*—to store information about the Oracle backups. It uses this information to manage the life cycle of the Oracle backup data and enables users to browse this index information. For more information about how NetWorker uses the online index files, see [“NetWorker and NetWorker Module for Oracle Operations” on page 34](#). The NetWorker server also maintains an online *resource database* file containing all the information about its configured resources.

NetWorker Resources

The process of installing the Legato NetWorker server preconfigures NetWorker resources to default settings. These settings enable you to start using the NetWorker server with NetWorker Module for Oracle to perform Oracle data storage operations with a minimum of additional configuration.

NetWorker server programs can operate in conjunction with NetWorker Module for Oracle only if all the required NetWorker configurations are in place. A number of the required configurations are already in place after installation of the NetWorker server and NetWorker Module for Oracle.

The NetWorker client-server technology uses a resource allocation protocol (RAP), whereby the NetWorker server maintains its configurations as a set of internal *resources*. There are several different types of internal NetWorker resources (for example, client, server, device, and pool types of resources).

Resources are the building blocks NetWorker uses to license, configure, and manage NetWorker clients and servers to back up and restore data. Each NetWorker resource also has its own components, known as *attributes*, to which you assign values. For example, the Name attribute of a NetWorker resource defines the name of that particular resource. When you create a new NetWorker resource, you often need to assign a unique value to its Name attribute.

- On UNIX, a NetWorker resource is represented by a window in the NetWorker Administrator GUI; the resource attributes are represented by fields, radio buttons, or check boxes in the window.
- On Windows, a NetWorker resource is represented by a dialog box in the NetWorker Administrator GUI; the resource attributes are represented by text boxes, drop-down lists, and similar components in the dialog box.

Resources for Oracle Data Storage

Table 2 lists the main types of internal resources that NetWorker uses for Oracle data storage management.

Table 2. NetWorker Resource Types

Resource Type	Function
Autochanger	Describes a storage device that can mount and write to multiple backup volumes automatically. See <i>Device</i> below.
Client	Identifies the Oracle Server as the NetWorker backup client and specifies the policies that the NetWorker server uses for backup data management.
Device	Describes a storage device either locally connected to the NetWorker server or connected to a NetWorker storage node managed by the NetWorker server. The NetWorker server uses a device for backup and restore operations.

Table 2. NetWorker Resource Types (Continued)

Resource Type	Function
Group	Names and defines a collection of client resources that participate in a group backup. Clients can follow different backup schedules within the group operation, but all clients in the group start the backup at the same time.
Label Template	Provides instructions for the NetWorker server to use in creating a label for a storage volume. Each storage volume belongs to a volume pool (represented by a pool type of resource), and each pool has a specific label template associated with it.
Notification	Names and defines a trigger-and-action pair of events. A specific NetWorker event is associated with a specific NetWorker- or user-defined server response.
Policy	Names and defines a time period for the NetWorker server to use for managing the life cycle of backed-up data.
Pool	Names a collection of backup volumes and specifies the criteria the backup data must meet to be written to this named collection.
Registration	Defines the NetWorker product features enabled for a particular NetWorker server.
Schedule	Names and defines a backup schedule that can be assigned to a client or group resource. The schedule configured for use by a scheduled Oracle backup dictates the days when the Oracle data will be backed up.
Server	Identifies the NetWorker server characteristics. (Only one server resource can exist for each NetWorker server.)

Configuring the NetWorker server for Oracle data storage management is a process of creating, modifying, or removing NetWorker resources, using the NetWorker Administrator GUI or appropriate NetWorker commands. The resource types listed in [Table 2](#) are the only ones you need to configure to enable full NetWorker server functionality for Oracle data storage.

The NetWorker server automatically configures a registration resource during the NetWorker Module for Oracle installation when you follow the instructions for enabling and registering the software in the latest release of the *Legato NetWorker Module for Oracle Installation Guide*.

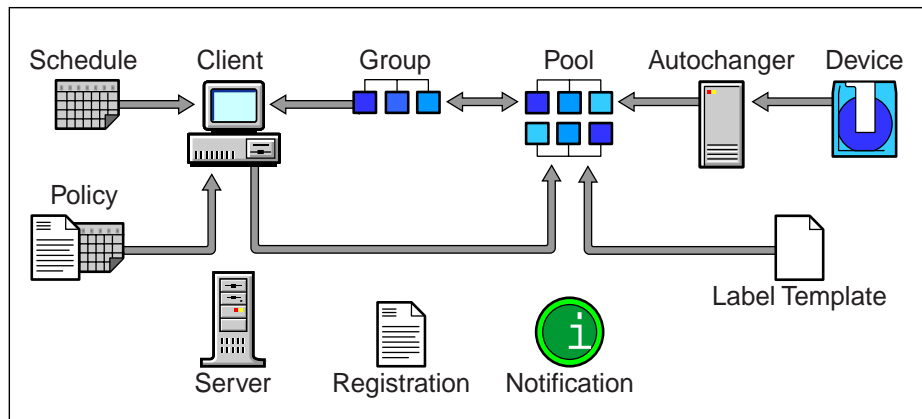
You only need to configure an autochanger resource if you plan to use an autochanger for Oracle backups. For more information on how to configure the other NetWorker resources required for Oracle data storage, see [“Chapter 3: Basic Configuration”](#).

The NetWorker server has other types of resources not shown in [Table 2](#). The *Legato NetWorker Administrator’s Guide* for UNIX or Windows contains information on the complete set of resources available with the NetWorker server.

Some of the resources described in [Table 2](#) exist as attributes of the other resources. These interdependent relationships affect the order in which you configure the different NetWorker resources, because NetWorker requires component resources to be defined before they can be listed as attributes of other resources.

[Figure 3](#) shows the dependencies between the NetWorker resources that can be configured for Oracle data storage operations. The resources with outgoing arrows are both independent resources themselves and attributes of the resources where the arrows end.

Figure 3. Resource Configuration Dependencies



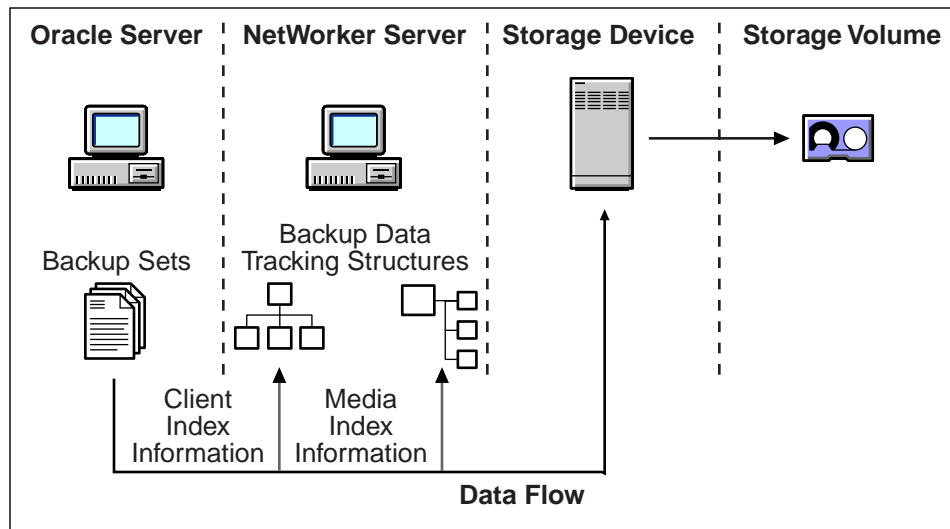
You must first define resources that are attributes of other resources. For example, you must define a policy type of resource before you can assign it as an attribute in a client type of resource. Also, you cannot assign a custom label template to a pool resource until you have created that custom label template.

For complete information about the NetWorker resource configurations that must be in place before you can use the NetWorker server with NetWorker Module for Oracle to perform Oracle backups and restores, see [“Basic Configuration Roadmap”](#) on page 50.

NetWorker and NetWorker Module for Oracle Operations

Figure 4 illustrates a simplified model for an Oracle backup operation using the NetWorker server and NetWorker Module for Oracle. As explained in “Oracle Backup and Restore Operations” on page 28, Oracle Server processes create the Oracle backup data sets during the backup operation. The NetWorker Module for Oracle passes these backup sets to the NetWorker server, which writes the Oracle data to volumes in the storage devices.

Figure 4. Backup Data Flow



The NetWorker server tracks the location and status of the backed-up Oracle data using two special online index files: the client index and media index.

- The *client index* file contains a database of information with entries for each Oracle data object backed up. The NetWorker server maintains one client index file for each client computer, regardless of the number of client resources configured for it.
- The *media index* file contains a database of indexed entries tracking the location and content of each storage volume, including the life cycle status of all the data on each volume. The NetWorker server maintains a single media index file, tracking the data from *all* clients.

At the end of an Oracle backup, the NetWorker server adds entries for the backup to the client index and media index files.

- To the client index, it adds information about the specific Oracle data backed up for the client.
- To the media index, it adds information about the location of each backup volume and the Oracle data written to the volume.

NetWorker Server Bootstrap



Important: The section [“NetWorker Server Bootstrap Backup” on page 82](#) describes a special type of NetWorker backup—the NetWorker server *bootstrap* backup. The bootstrap is a special save set essentially for disaster recovery procedures on the NetWorker server. To properly prepare for future disaster recovery, it is important to perform regular manual backups of the bootstrap in conjunction with any *manual* Oracle backups.

The bootstrap save set contains the information needed to restore the following three components to the point just before the bootstrap was created:

- NetWorker server index
- Media index
- Resource database

From these three components, the complete NetWorker server environment can be recreated.

Browse and Retention Policies

The NetWorker server can only perform Oracle backup operations after you have properly configured the required NetWorker resources. For more information on configuring the NetWorker resources, see [“Chapter 3: Basic Configuration”](#).

For example, you must configure a *client* resource to identify the Oracle Server as the NetWorker backup client. Two important attributes of that client resource are the *browse policy* and *retention policy*. The NetWorker server uses the browse and retention policies to manage the life cycle of the backed-up Oracle data. These policies specify how long the Oracle data is available for recovery.

When you create a client resource, you can accept default values that NetWorker provides for the browse and retention policies. By default, NetWorker sets the browse policy to one month and the retention policy to one year. You can modify the policy periods as required, *with the restriction that the browse policy period cannot exceed the retention policy period.*

Browse Policy

The *browse policy* determines how long the *client index* file on the NetWorker server maintains the information about an Oracle backup. As long as the browse policy period for a particular backup set has not expired, the entry for that backup set remains in the client index. And, as long as there is an entry for the backup set in the client index (and in the Oracle Recovery Catalog or control file), you can use RMAN to restore the backup set from the volumes managed by NetWorker.

After the browse policy period for an Oracle backup set has been exceeded, NetWorker automatically *removes* the entry for that backup set from the client index. When the entry has been removed from the client index, you *cannot* restore the backup set using RMAN. However, you can use the **scanner** program to recreate the backup's entries in the client index and media index to enable recovery using RMAN.

Retention Policy

The *retention policy* determines the *minimum* period of time that the *media index* file on the NetWorker server maintains information about Oracle backup data. The retention policy is different from the browse policy in that its expiration does *not* trigger the automatic removal of entries from the media index.

After the retention policy period for an Oracle backup set has been exceeded, NetWorker marks the status of the backup set "recyclable," but retains its entry in the media index. When *all* the backup sets on a volume are marked "recyclable," NetWorker changes the volume's mode to "recyclable." The volume is then eligible for automatic relabeling by NetWorker. NetWorker removes the entries for a volume from the media index *only* when either the volume is relabeled or you manually remove the volume's entries using the Volumes window of the NetWorker Administrator GUI.

Using the Browse and Retention Policies

For example, using the default browse policy of one month, the NetWorker server retains an entry for a backup set (or "save set") in the client index for one month. During that month, you can restore the save set using RMAN.

After the browse policy expires, the NetWorker server removes the save set's entry from the client index, but retains an entry for the save set in the media index. Using the default retention policy of one year, the storage volumes do not become "recyclable" for at least one year.

If a backup set has passed its browse and retention policies and has become "recyclable", you can still use the **scanner** program to rebuild the client index and media index entries for the backup set and then use RMAN to recover the backup set.

If you mount a "recyclable" volume in a tape device, for example, and enable the "auto media management" attribute in the device resource, NetWorker can automatically relabel the volume to satisfy a volume mount request. When NetWorker relabels a volume, all entries for the volume's backup sets are removed from the media index. *When a volume is relabeled, you can no longer recover the data on the volume.* For more information about the auto media management feature, see "[Auto Media Management](#)" in Chapter 3.



Important: When NetWorker relabels a volume for reuse within the *same volume pool*, the volume identification (the volume name as it appears in the volume label) remains unchanged. Even so, after relabeling, the information that NetWorker needs to locate and access all existing data on the volume is destroyed, and the **scanner** program is no longer an option. At this point, the volume is ready for new data. All existing data is inaccessible and is overwritten.

All entries for a volume's backup sets are also removed from the media index when you *manually* remove the volume from the NetWorker volume inventory. You can perform this type of manual removal within the Volumes window of the NetWorker Administrator GUI. For more information about using the Volumes window, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.

Additional Information

For details on the **scanner** program, refer to the **scanner** man page on UNIX. On Windows, refer to **scanner** in the Command Line Utilities Help or *Legato Command Reference Guide*. For more information on how to access these sources, see the appropriate section:

- "[UNIX Manual Pages](#)" on page 23
- "[Windows Command Line Utilities Help](#)" on page 24
- "[Legato Command Reference Guide](#)" on page 24

The *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform contains more information on the **scanner** program. The *Legato NetWorker Administrator's Guide* also contains details about the NetWorker server's system of tracking the status of Oracle storage volumes and the backup save sets on them. NetWorker assigns a "status" value to each backup save set and a "mode" value to each storage volume.

When you run the NetWorker Administrator GUI and select the Volumes window, you can see the list of all the Oracle backup volumes and their modes, as well as the save sets on each volume and their status. For details about how to run the NetWorker Administrator GUI, see the next section, "[Using the NetWorker Administrator GUI](#)". For more information about using the Volumes window, see "[Using the Volumes Window](#)" on page 75.

Using the NetWorker Administrator GUI

The NetWorker Administrator GUI is the graphical user interface for connecting to and configuring the NetWorker server and the Oracle storage devices and volumes. You can also use the NetWorker Administrator GUI to monitor the status of Oracle backup and restore operations as well as the status of Oracle backup volumes and the backup sets stored on the volumes.

The NetWorker Administrator GUI is installed at the same time as the NetWorker server. For information on how to use the NetWorker Administrator GUI, see the appropriate section:

- "[NetWorker Administrator GUI on UNIX](#)" immediately following this section
- "[NetWorker Administrator GUI on Windows](#)" on page 40

Note: The NetWorker Administrator GUI details presented in this manual are specifically for the *latest* release of the NetWorker for UNIX or Windows.

NetWorker Administrator GUI on UNIX

To run the NetWorker Administrator GUI on a UNIX system:

1. Become *root* user on the UNIX system containing the NetWorker server.
2. Enter the **nwadmin** command at the shell prompt.

The **nwadmin** man page contains detailed information about running the **nwadmin** program on UNIX. Use the **man nwadmin** command to access the information.

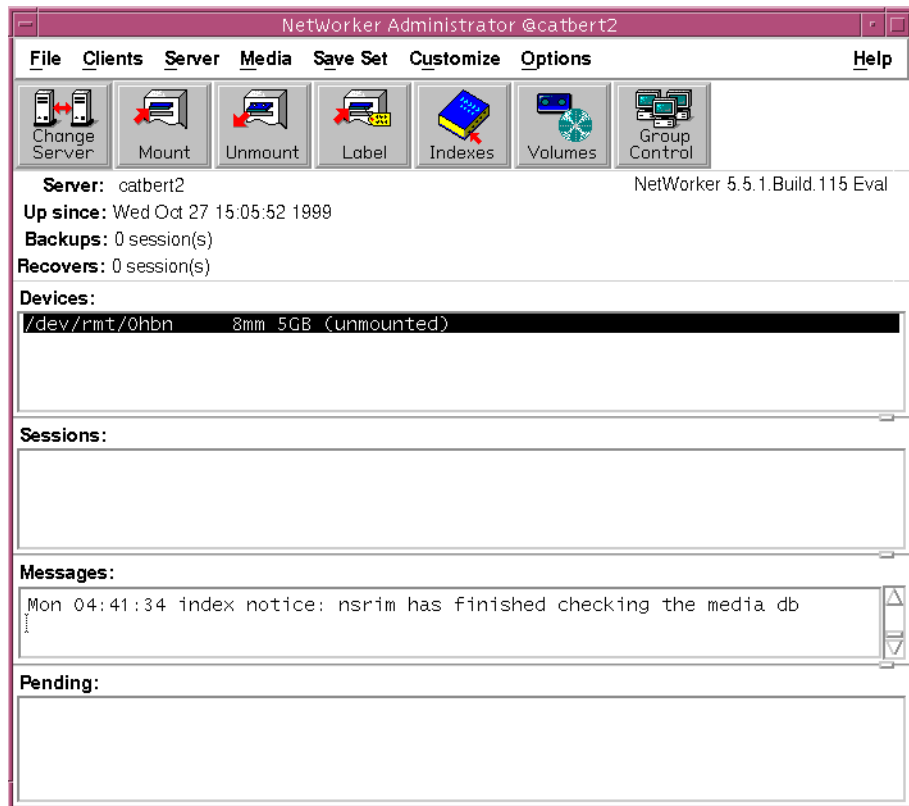
For more information about **nwadmin**, refer to the *Legato NetWorker Administrator's Guide* for UNIX. See "[Related Documentation](#)" on page 22 for details on how to access the *Legato NetWorker Administrator's Guide*.

If you have trouble running the NetWorker Administrator GUI on UNIX, it could be due to a network problem involving your system. For more information about testing network communications from the UNIX side, refer to the troubleshooting section in the *Legato NetWorker Administrator's Guide for UNIX*.

For more information about the UNIX version of the NetWorker Administrator GUI, you can also access its online help component, as described in [“Online Help” on page 23](#) of this guide.

The main UNIX NetWorker Administrator window is displayed in [Figure 5](#).

Figure 5. NetWorker Administrator GUI on UNIX



Now, proceed to [“Chapter 3: Basic Configuration”](#).

NetWorker Administrator GUI on Windows

To ensure that you can successfully start the NetWorker Administrator GUI on a Windows system, fulfill the following TCP/IP network requirements:

- Add the NetWorker server name to the local HOSTS file in `%SystemDrive%\system32\drivers\etc` or the domain name system (DNS) file that contains the names and aliases of the servers (hosts) on your network. If you are using DNS, you must correctly configure reverse lookup.
- If the NetWorker server is a dynamic host configuration protocol (DHCP) client, it must use a reserved address.
- If you are using DHCP with dynamic addresses, you must synchronize DHCP with DNS.
- If possible, use the same name for the NetWorker server's TCP/IP hostname and the Windows computer name.

To run the NetWorker Administrator GUI on the Windows system, perform *one* of the following steps:

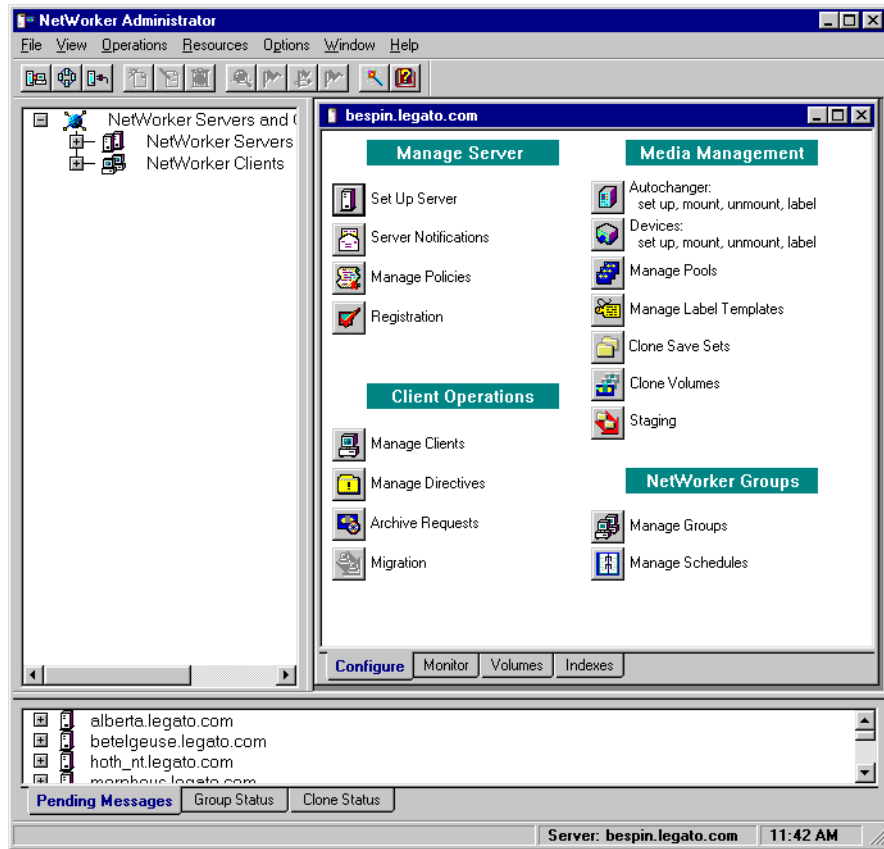
- From the taskbar, choose Start > Programs > NetWorker Group > NetWorker Administrator.
—or—
- With the NetWorker installation directory in your system path, run the **nwadmin** command at the command line prompt. The default NetWorker installation directory is:
 - `%SystemDrive%\win32app\nsr\bin` for NetWorker release 5.5.x and earlier
 - `%SystemDrive%\Program Files\nsr\bin` for NetWorker release 5.7 and later

For more information on how to use the Windows version of the NetWorker Administrator GUI, you can access its extensive online help component, as described in [“Online Help” on page 23](#).

The *Legato NetWorker Administrator's Guide* for Windows also includes information about the Administrator program interface or GUI. See [“Related Documentation” on page 22](#) for details on how to access the *Legato NetWorker Administrator's Guide*.

The main Windows NetWorker Administrator window is displayed in [Figure 6](#).

Figure 6. NetWorker Administrator GUI on Windows



Now, proceed to [“Chapter 3: Basic Configuration”](#).

Chapter 3: Basic Configuration

Before beginning this chapter, be sure you have installed NetWorker Module for Oracle on the Oracle Server system according to the instructions in the latest *Legato NetWorker Module for Oracle Installation Guide*.

This chapter describes how to configure the required NetWorker resources to enable Oracle backup and restore operations using NetWorker Module for Oracle.

This chapter contains the following sections:

- [“NetWorker Module for Oracle Configuration Options” on page 44](#)
- [“Oracle Recovery Catalog” on page 50](#)
- [“Basic Configuration Roadmap” on page 50](#)
- [“Step 1: Verifying the Oracle Server Configuration” on page 52](#)
- [“Step 2: Enabling Regular Filesystem Backups” on page 52](#)
- [“Step 3: Server Resource” on page 53](#)
- [“Step 4: Client Resource” on page 57](#)
- [“Step 5: Device Resources” on page 62](#)
- [“Step 6: Volume Pools and Label Templates” on page 67](#)
- [“Step 7: Labeling and Mounting Volumes” on page 73](#)
- [“Step 8: Storage Nodes” on page 74](#)
- [“Auto Media Management” on page 74](#)
- [“Using the Volumes Window” on page 75](#)



Important: A *target database* is the Oracle database that you want the NetWorker server to back up as a safeguard against data loss. You should institute mirroring of the online redo logs and the control file of your target database. Keep mirrored copies on different disks. If online redo logs are lost in a disk crash, all changes made to the database since its last backup will be lost permanently.

NetWorker Module for Oracle Configuration Options

This section describes the five supported options for setting up the NetWorker Module for Oracle in your Oracle and NetWorker environment.

- [“Option 1: All Components on the Same System” on page 45](#)
- [“Option 2: NetWorker Server on a Separate System” on page 46](#)
- [“Option 3: Recovery Catalog on a Separate System” on page 47](#)
- [“Option 4: Recovery Catalog and NetWorker Server on a Separate System” on page 48](#)
- [“Option 5: Components on Three Separate Systems” on page 49](#)

Each of these five configurations consists of the following six components:

- Oracle Server
- Oracle Recovery Manager (RMAN)
- Oracle Recovery Catalog
- Legato NetWorker Module for Oracle software (latest release)
- Legato NetWorker server
- Legato NetWorker client

The Oracle Server, RMAN, NetWorker client, and NetWorker Module for Oracle software must be installed on the *same* system.

The other two components—the Oracle Recovery Catalog and the NetWorker server software—can optionally reside on one or two other separate systems. For more information on the Recovery Catalog, see [“Oracle Recovery Catalog” on page 50](#).

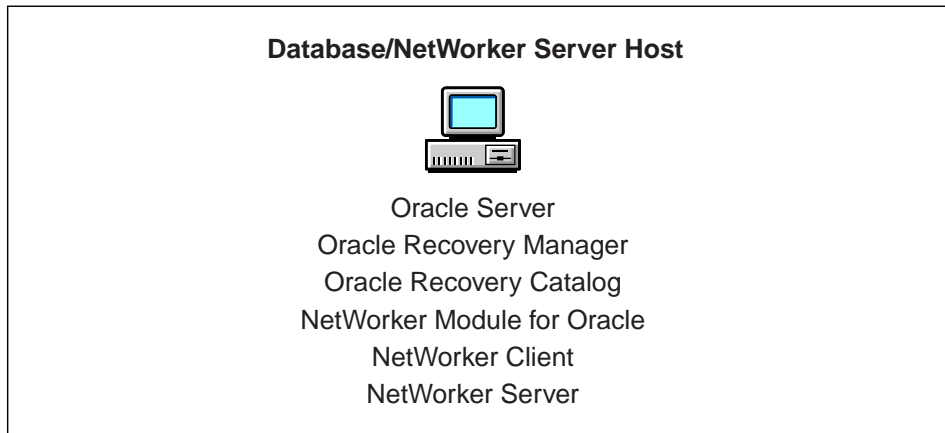
Option 1: All Components on the Same System

In this first configuration option, all six components are installed on the same system in your enterprise, as shown in [Figure 7](#). The advantages of this type of installation are that it provides higher performance than a backup over the network, and it requires only a single system. The main disadvantage of this configuration is the risk of it being a single point of failure.



Important: Oracle recommends that you keep your Recovery Catalog on a separate disk from the target database.

Figure 7. Configuration Option 1, with all six components installed on the same system.



Option 2: NetWorker Server on a Separate System

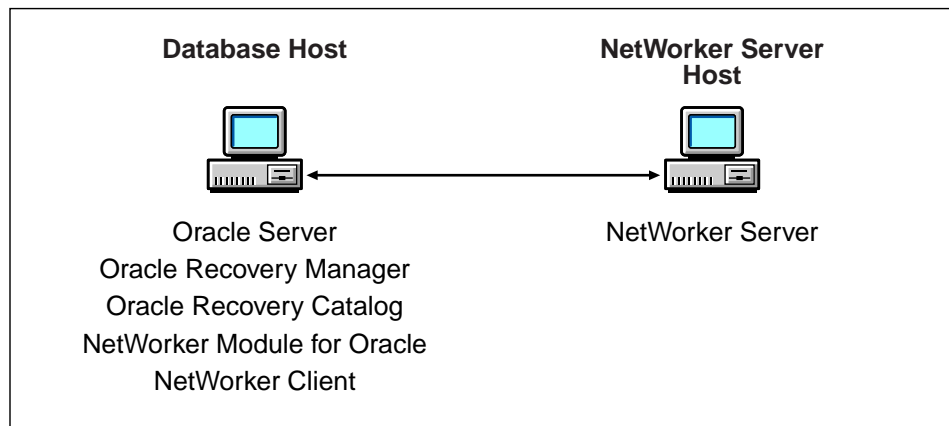
In this configuration, five of the six components are installed on the same system: the Recovery Manager (RMAN), Recovery Catalog, Oracle Server, NetWorker client, and NetWorker Module for Oracle. The NetWorker server is installed on a separate system, as shown in [Figure 8](#). In this case, the Oracle Server is a remote NetWorker client.

The advantage of this configuration is that it provides some independence for your NetWorker server and the NetWorker indexes, while it maintains the independence of having your backups on a separate system. The disadvantage of this type of installation is the risk of the Recovery Catalog being unavailable in a disaster recovery situation on your Oracle Server platform. Should the Recovery Catalog become unavailable during a system failure, you need to recover the Recovery Catalog before you can recover your Oracle database.



Important: Oracle recommends that you keep your Recovery Catalog on a separate disk from the target database.

Figure 8. Configuration Option 2, with five components installed on the same system and the NetWorker server installed on a different system.

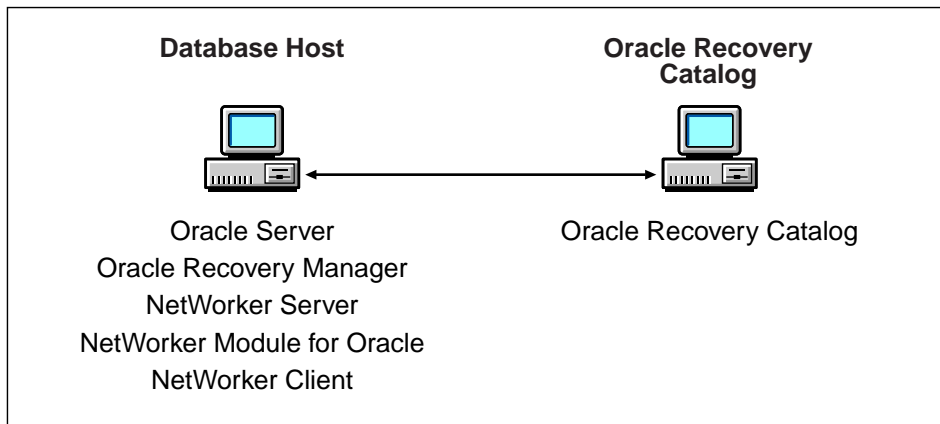


Option 3: Recovery Catalog on a Separate System

In this third possible configuration, five of the six components are again installed on the same system: the Recovery Manager (RMAN), Oracle Server, NetWorker server, NetWorker client, and NetWorker Module for Oracle. The Recovery Catalog is installed on a separate system, as shown in [Figure 9](#). This installation is one of those recommended by Oracle.

One of the advantages of this type of installation is the independence in terms of location of the Recovery Catalog. Another advantage is that the backup of the Oracle database is local to the NetWorker server, which generally gives higher performance than backups over the network. The disadvantage of this configuration is the additional maintenance required for the system hosting the Recovery Catalog.

Figure 9. Configuration Option 3, with five components installed on the same system and the Recovery Catalog on a separate system.

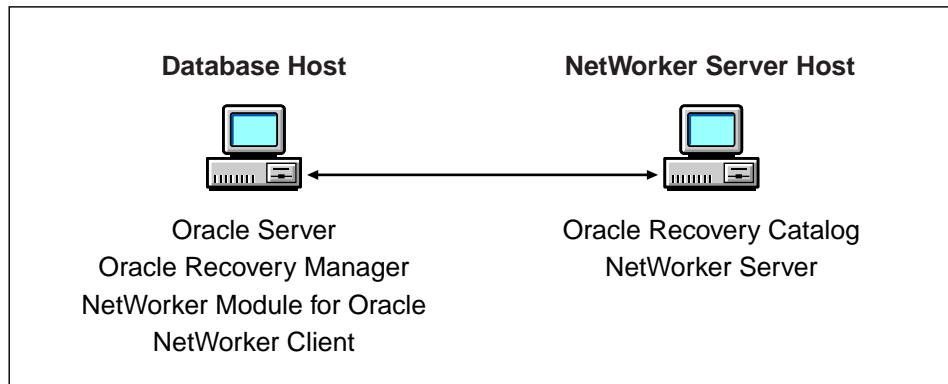


Option 4: Recovery Catalog and NetWorker Server on a Separate System

Another configuration option recommended by Oracle is shown in [Figure 10](#). In this configuration, the Recovery Manager (RMAN), Oracle Server, NetWorker client, and NetWorker Module for Oracle are all installed on the same system, while the Recovery Catalog and NetWorker server are both installed on a separate system.

The advantage of this type of installation is the independence, in terms of location, of both the Recovery Catalog and NetWorker server from the Oracle Server. The availability of both the Recovery Catalog and NetWorker server is critical to being able to perform a restore operation. The disadvantages of this configuration are the additional maintenance required for the system hosting the Recovery Catalog and NetWorker server, as well as the potential performance loss during backups over the network.

Figure 10. Configuration Option 4, with the Recovery Catalog and NetWorker server both installed on a separate system.



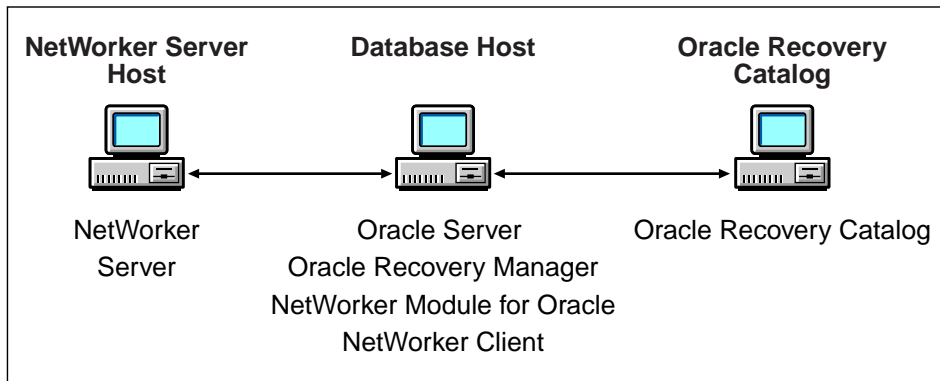
Option 5: Components on Three Separate Systems

In the most complex of the five possible configurations, the components are installed on three separate systems, as shown in [Figure 11](#) below.

The Recovery Manager (RMAN), Oracle Server, NetWorker client, and NetWorker Module for Oracle are all installed on the same system. The Recovery Catalog is installed on a second system, and the NetWorker server is installed on a third system. In this type of three-system installation, each system has a well-defined role in the overall backup system. This installation is also one of the configurations recommended by Oracle.

The advantage of this configuration is the independence of the Recovery Catalog, NetWorker server, and Oracle Server systems from each other. The disadvantage is the additional maintenance required for all three systems, plus the potential performance loss during backup of the Oracle Recovery Catalog and target database over the network.

Figure 11. Configuration Option 5, with the components installed on three separate systems.



Configuration Recommendations

Each of the five possible configuration options presented has its advantages and disadvantages. The level of protection you can afford depends on both your available resources and your priorities.

For sites with a small backup window, where performance is critical and backups over the network are undesirable, configuration Option 3 is recommended. For sites where rapid restore of the Oracle Server will be critical in a disaster recovery situation, either Option 4 or Option 5 is recommended. Option 4 and Option 5 are also recommended for sites that back up more than one database using RMAN.

Installation Requirements for Multiple Database Backup

Oracle Corporation recommends that any given site have only one Recovery Catalog database per enterprise.

You only need to install the NetWorker Module for Oracle once per system, regardless of how many separate RMAN installations are on that system. The NetWorker Module for Oracle also supports concurrent backup of separate databases on the same system using separate RMAN instances.

Oracle Recovery Catalog

The Oracle Recovery Catalog is where RMAN stores historical information about database backups. It is a collection of Oracle database tables containing structural information about target databases, along with the backup and restore history for each database.

The Recovery Catalog should be stored in the Recovery Catalog database, a dedicated database about 20 megabytes in size. If the catalog database fails, you must recover it before you can start recovering your target database. Inability to access the Recovery Catalog database implies inability to recover the target database.

For more information about the Recovery Catalog, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.



Important: Oracle recommends that you keep your Recovery Catalog on a separate system from the target database.

Basic Configuration Roadmap

Before performing basic Oracle and NetWorker system configuration procedures, be sure that you have installed NetWorker Module for Oracle using the instructions in the latest *Legato NetWorker Module for Oracle Installation Guide*. You must install the NetWorker Module for Oracle on the same system as your Oracle Server.

You must properly configure your Oracle Server and NetWorker systems before you can use NetWorker Module for Oracle with NetWorker for Oracle data storage management.

To complete the basic Oracle and NetWorker configurations:

1. Verify that you have properly installed and configured the appropriate Oracle software on your Oracle Server system. For details, see [“Step 1: Verifying the Oracle Server Configuration” on page 52](#).
2. If required, perform the procedures to enable *regular* filesystem backups of the Oracle Server, as outlined in [“Step 2: Enabling Regular Filesystem Backups” on page 52](#).
3. Configure the server resource to identify the NetWorker server, specify parallelism, and modify the NetWorker Administrator list as required. Ensure that the required users have administrative privileges on the NetWorker system. For details, see [“Step 3: Server Resource” on page 53](#).
4. Configure a client resource to identify the Oracle Server as a backup client of the NetWorker server. For details, see [“Step 4: Client Resource” on page 57](#).
5. Configure a separate device resource for each storage device to be used for Oracle backup and restore operations. Also, complete any required autochanger or silo configuration procedures. For details, see [“Step 5: Device Resources” on page 62](#).
6. Configure any required volume pool resources and corresponding label template resources. For details, see [“Step 6: Volume Pools and Label Templates” on page 67](#).
7. Label (and mount as required) your storage volumes in the Oracle backup devices. For details, see [“Step 7: Labeling and Mounting Volumes” on page 73](#).
8. Configure any required storage nodes. For details, see [“Step 8: Storage Nodes” on page 74](#).
9. Configure any required cluster systems. For details, see [“Chapter 7: Cluster and OPS Systems”](#).
10. Configure any required Oracle Parallel Server (OPS) systems. For details, see [“Chapter 7: Cluster and OPS Systems”](#).

You can view and configure NetWorker resources and their attributes using the NetWorker Administrator GUI. For details on running the GUI, see [“Using the NetWorker Administrator GUI” on page 38](#).

Step 1: Verifying the Oracle Server Configuration

Before configuring the NetWorker server and NetWorker Module for Oracle, the Oracle software must be properly installed and configured. Use these steps as a basic guideline for setting up your Oracle Server system:

1. Install and configure the Oracle8 or Oracle8i software components, including RMAN. For more details, refer to the appropriate *Oracle Installation Guide* for your particular platform.
2. Set up and configure the Recovery Catalog. For information on the Recovery Catalog, refer to the *Oracle Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.
3. Set up and configure the Oracle networking software, provided as Net8 in Oracle8 and Oracle8i.
4. Register the target database on the Oracle Server. Refer to the *Oracle Backup and Recovery Guide* for more details.

Note: Details on these steps are also available from Oracle support services. Oracle support contact information worldwide is listed at www.oracle.com/support.

Step 2: Enabling Regular Filesystem Backups

To set up your Oracle Server system as a client of one or more NetWorker servers for the purpose of *regular* filesystem backup, follow the instructions in this section. Otherwise, proceed to “[Step 3: Server Resource](#)” on page 53.

Before configuring your Oracle Server as a client of a NetWorker server for backup of the Oracle Server's *regular* filesystems, you must enable this type of backup. Enable the regular filesystem backup by adding the name of the NetWorker server to the proper *servers* file on the Oracle Server system.

Follow these steps for *each* NetWorker server that will back up the Oracle Server's regular filesystems:

1. On the Oracle Server, create the required *servers* file if it does not yet exist. On UNIX, the required file is `/nsr/res/servers`. On Windows, the file is:
 - `%SystemDrive%\win32app\nsr\res\servers` for NetWorker release 5.5.x and earlier
 - `%SystemDrive%\Program Files\nsr\res\servers` for NetWorker release 5.7 and later

2. Add the name of the NetWorker server to the end of the *servers* file. The NetWorker server name must be on a separate line, as the fully qualified system name (for example, *sammy.legato.com*) or an alias (for example, *sammy*).
3. If the Oracle Server is a Windows system, stop and restart the NetWorker Remote Exec service and (only on Windows 2000) the NetWorker Power Monitor service on the Oracle Server.

If you have *not* performed these steps, you will receive the following error message when you attempt to configure the Oracle Server as a client of the NetWorker server:

```
Can't access Oracle-Server-name due to network problem,  
missing client nsrexecd, or incorrect /.rhosts file,  
re-apply to create anyway
```

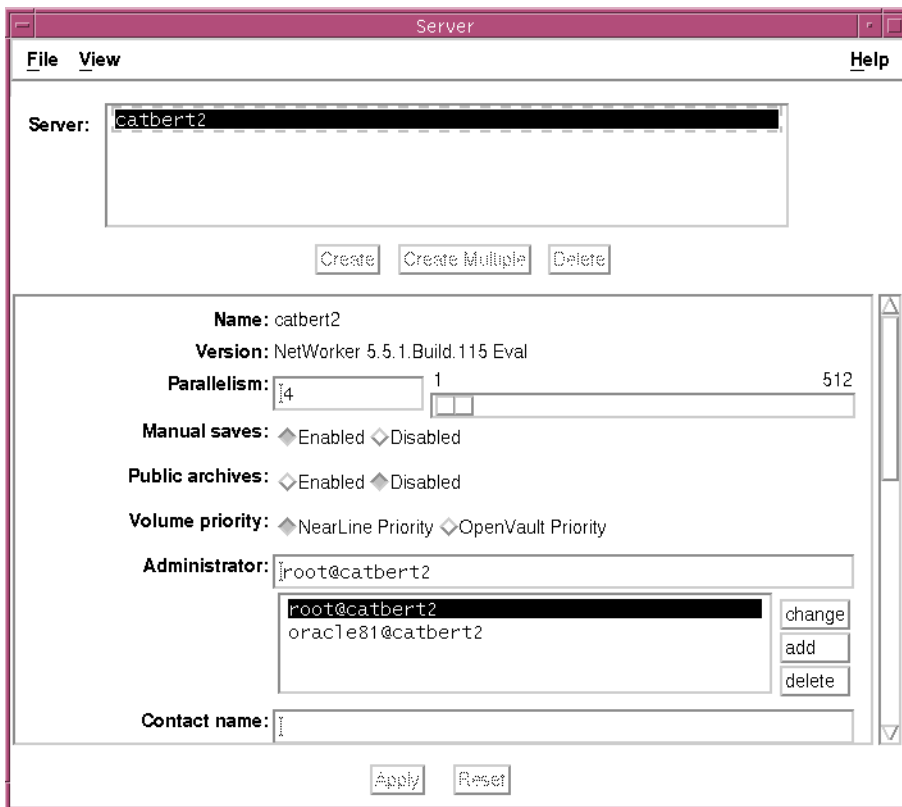
Step 3: Server Resource

After initial installation of the NetWorker server software, the NetWorker configuration contains a preconfigured *server* resource with attribute settings that influence the performance and security of backups.

To view the server resource configuration in the NetWorker Administrator GUI, perform the following steps, depending on whether the NetWorker server is a UNIX or Windows system:

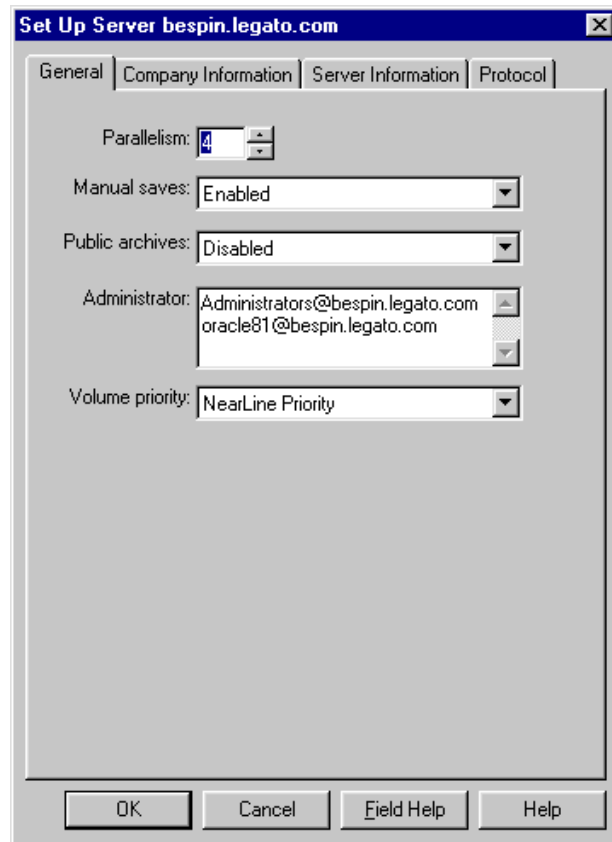
- On UNIX:
 1. Select Server Setup from the Server menu in the main NetWorker Administrator window.
 2. View the server resource in the Server window that appears, similar to the one shown in [Figure 12 on page 54](#).
- On Windows:
 1. Click the Configure Tab in the Server window (of the main Administrator window).
 2. Click the Set Up Server icon to open the Set Up Server dialog box.
 3. View the server resource in the Set Up Server dialog box that appears, similar to the one shown in [Figure 13 on page 55](#).

Figure 12. Server Window on UNIX



3

Figure 13. Set Up Server Dialog Box on Windows



The Server window on UNIX and the Set Up Server dialog box on a Windows system list the attribute settings of the server resource. Also, on Windows, the General (default) and Server Information tabs show the server resource attributes of interest.

The main attributes of the server resource are as follows:

- **Name**

This attribute lists the hostname of the NetWorker server.

- **Parallelism**

This attribute sets the maximum number of backup data streams that the NetWorker server sends to the attached backup devices at one time. The maximum parallelism value is determined by the version of NetWorker purchased. Backing up multiple data streams simultaneously increases the efficiency of the storage device operations.

- **Administrator**

While any user can view the NetWorker resource settings, only users specified in the Administrator attribute of the server resource have sufficient privilege to modify the NetWorker resource configurations. Only a NetWorker Administrator can grant NetWorker Administrator privileges to other users (or user groups on Windows) and change or delete entries in the NetWorker Administrator list.

The initial default setting of the Administrator attribute is *root@hostname* on UNIX and *Administrators@hostname* on Windows, where *hostname* is the NetWorker server system name.



Important: For NetWorker Module for Oracle, when working with the NetWorker 6.0 server, you must add the *oracle owner* name to the Administrator list in the server resource configured on the NetWorker server. The proper format for the *oracle owner* name in the list is *oracle@db-server-name*, where *db-server-name* is the fully qualified name of the Oracle Server system.

Oracle will attempt to remove an entry from the NetWorker client index in the following cases:

- Under Oracle8, the backup filename of your current backup has been used before (see [page 81](#) under “[Step 1: Creating RMAN Backup Scripts](#)”); the filename is identical to one already in the NetWorker index.
- Under Oracle8i, you are using the RMAN **change...delete** or **delete expired backup** command.

Only users with administrative privileges can remove a filename from the index of a *remote* NetWorker server. If you wish to be able to remove a filename from the index of a remote NetWorker server, add the required user name to the Administrator list in the server resource on that remote NetWorker server:

- If TNS Listener is used, add the name of the user who starts TNS Listener.
- If TNS Listener is not used, add the name of the user who runs RMAN.

For more information on the different attributes of the NetWorker server resource and how to modify the Administrator list, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.

Step 4: Client Resource

The client resource is a set of attributes assigned to the Oracle host and stored on the NetWorker server. The client resource provides the NetWorker server with information about items such as:

- The data to back up for the Oracle Server.
- How long to maintain entries for the data in the online index for recovery (browse policy).
- How long to keep the media containing the backed-up data (retention policy).

After initial installation of the NetWorker server software, the NetWorker configuration contains at least one preconfigured *client* resource—for the NetWorker server system itself.

Before you can use the NetWorker Module for Oracle with NetWorker to back up or restore Oracle data, there must be a client resource configured for the Oracle Server system. If the NetWorker server software is installed on the same system as the Oracle Server, the basic client resource for the Oracle Server is already in place after the NetWorker installation.

To view the client resources in the NetWorker Administrator GUI, perform the following steps, depending on whether the NetWorker server is a UNIX or Windows system:

- On UNIX:
 1. Select Client Setup from the Clients menu in the main NetWorker Administrator window.
 2. View the client resource in the Clients window that appears, similar to the one shown in [Figure 14 on page 58](#). The Clients window displays the attribute settings for the client highlighted in the upper Clients scrolling list.
- On Windows:
 1. Click the Configure Tab in the Server window (of the main Administrator window).

Step 4: Client Resource

2. Click the Manage Clients icon to open the Clients window. On a Windows operating system, the Clients window does *not* automatically show the attribute settings of the client resources.
3. In the Clients window, right-click the icon of the NetWorker client, and select Edit from the displayed menu to open the Edit Client dialog box, similar to the one shown in [Figure 15 on page 59](#).
4. In the Edit Client dialog box, the General (default) tab shows the client resource attributes used by the NetWorker server for operations on that client system. Click Field Help to learn more about each attribute shown.

Figure 14. Clients Window on UNIX

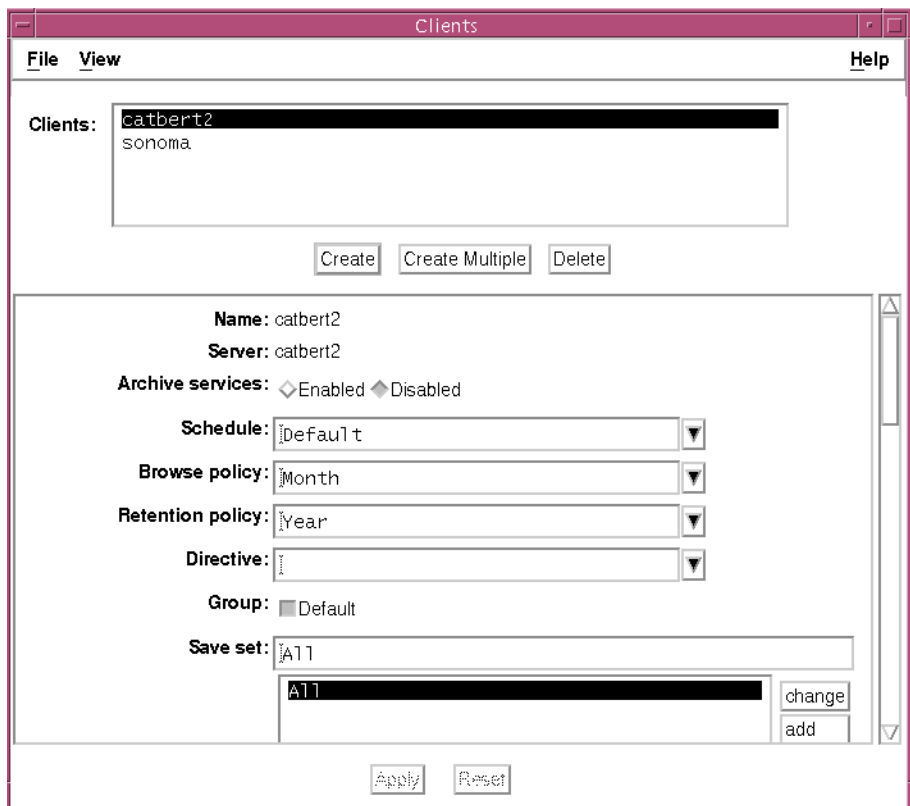
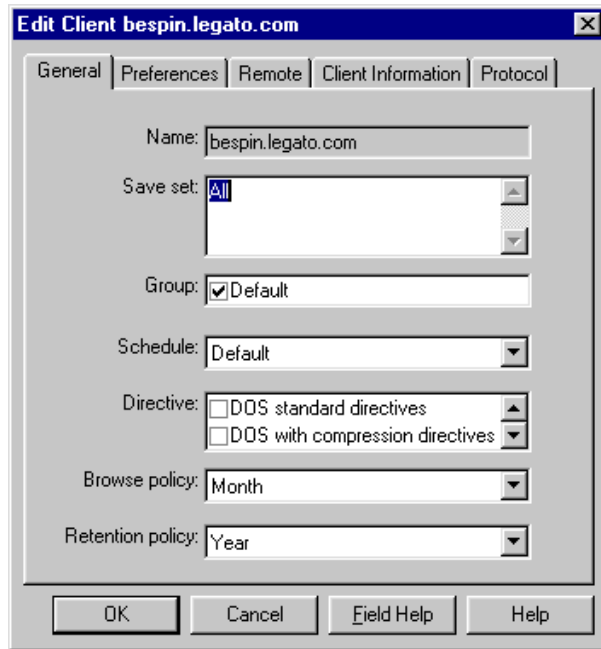


Figure 15. Edit Client Dialog Box on Windows



The main attributes required in the basic NetWorker client resource for an Oracle Server are as follows:

- **Name**
This attribute lists the hostname of the Oracle Server system.
- **Browse Policy**
This attribute specifies the length of time that the NetWorker server retains an entry for an Oracle backup in the online client index file. The default value of the browse policy is one month.
- **Retention Policy**
This attribute specifies the minimum period of time that the NetWorker server maintains information about Oracle backup data in the online media database. The default value of the retention policy is one year.

For more information about how the NetWorker server uses the browse and retention policies to manage Oracle data and storage volumes, see [“NetWorker and NetWorker Module for Oracle Operations” on page 34](#).

Note: The schedule, group, and save set attributes of the client resource for the Oracle Server are required only for scheduled Oracle backups, as explained in [“Chapter 5: Scheduled Oracle Backups”](#).



Important: You can only use NetWorker Module for Oracle with NetWorker to perform Oracle backups if there is a client resource configured for the Oracle host system.

To create a client resource for the Oracle Server, follow the instructions in the appropriate section:

- On a UNIX NetWorker server, see [“Creating a Client Resource on UNIX”](#) immediately below.
- On a Windows NetWorker server, see [“Creating a Client Resource on Windows”](#) on page 61.

Creating a Client Resource on UNIX

If the hostname of the Oracle Server system does not appear in the Clients window, create a new client resource for the Oracle Server:

1. Run the NetWorker Administrator GUI as one of the users in the NetWorker Administrator list of the server resource.
2. Select Client Setup from the Clients menu in the main NetWorker Administrator window to open the Clients window.
3. Click Create and enter the hostname of the Oracle Server system in the Name field.
4. If desired, select a value for the Browse policy. If you do not select a value for the Browse policy, the NetWorker server uses the default value of one month. The Browse policy cannot exceed the Retention policy.
5. If desired, select a value for the Retention policy. If you do not select a value for the Retention policy, the NetWorker server uses the default value of one year. The Retention policy must be greater than or equal to the Browse policy.



Important: To be able to restore backups of this Oracle Server to a different system, you must also add the fully qualified IP name of that system to the *Remote access* field in this client resource.

6. To apply the client resource settings, click Apply at the bottom of the Clients window.
7. To exit the Clients window, select Exit from the File menu.

For more information on the different attributes of a client resource and how to create a NetWorker client resource, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for UNIX.

Creating a Client Resource on Windows

If the hostname of the Oracle Server system does not appear in the Edit Client dialog box, create a new client resource for the Oracle Server:

1. Run the NetWorker Administrator GUI as one of the users in the NetWorker Administrator list of the server resource.
2. Click the Configure tab in the Server window (of the main Administrator window).
3. Click Manage Clients to open the Clients window.
4. Right-click the main Clients icon and select Create from the displayed menu to open the Create Client dialog box.
5. Enter the hostname of the Oracle Server system in the Name text box.
6. If desired, select a value from the Browse policy drop-down list. If you do not select a value for the Browse policy, the NetWorker server uses the default value of one month. The Browse policy cannot exceed the Retention policy.
7. If desired, select a value from the Retention policy drop-down list. If you do not select a value for the Retention policy, the NetWorker server uses the default value of one year. The Retention policy must be greater than or equal to the Browse policy.



Important: To be able to restore backups of this Oracle Server to a different system, add the fully qualified IP name of that system to the *Remote access* field in this client resource.

8. Click OK to apply the client resource settings and exit the Create Client dialog box.

For more information on the different attributes of a client resource and how to create a NetWorker client resource, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for Windows.

Step 5: Device Resources

An Oracle storage device is the drive that NetWorker uses to write data during an Oracle backup and to read data during an Oracle restore operation. The NetWorker configuration must include a device resource for each Oracle storage device used for backup and restore operations. In addition, each Oracle storage device must contain a labeled and mounted volume.

Before the NetWorker server can use storage devices, you must configure each storage device separately. A device can be stand-alone, a file, or located in an autochanger or silo tape library (STL). The type of the device determines how you configure the device.



Important: When you configure a tape device, you must specify a *nonrewinding* device name. The NetWorker server writes a file mark on the tape volume at the end of a backup and uses the position of that file mark to append data onto the volume during the next backup. If the device rewinds the tape volume at the end of a backup, the file mark position is lost and existing data on the volume is overwritten during the next backup.

Each edition of NetWorker supports a different maximum number of devices. Each enabled storage node connected to the NetWorker server can increase the device maximum. For more information about storage nodes, see [“Step 8: Storage Nodes” on page 74](#). For complete details on device configuration and management procedures on your NetWorker server, refer to the *Legato NetWorker Administrator’s Guide* for your particular NetWorker server platform.

Refer to the *Legato Compatibility Guide* for a complete list of the storage devices that NetWorker currently supports. The *Legato Compatibility Guide* is available from the Legato web site at www.legato.com.

View, create, modify, or remove NetWorker device resources using the NetWorker Administrator GUI. For details on running the NetWorker Administrator GUI, see [“Using the NetWorker Administrator GUI” on page 38](#).

To create, modify, or remove a NetWorker device resource, you must run the NetWorker Administrator GUI as one of the users in the Administrator list of the server resource. To view NetWorker resources, you can run the GUI as any system user. For more information on NetWorker Administrator privileges, see [“Step 3: Server Resource” on page 53](#).

To configure a NetWorker device resource, follow the instructions in the appropriate section:

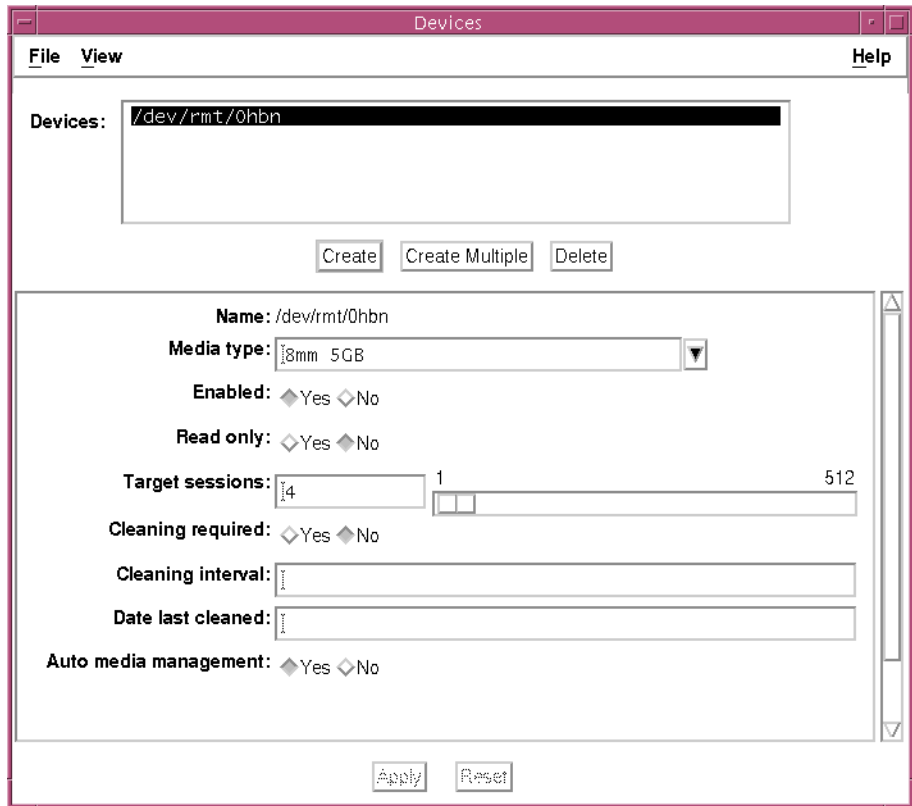
- On a UNIX NetWorker server, see [“Configuring a Device Resource on UNIX”](#) immediately below.
- On a Windows NetWorker server, see [“Configuring a Device Resource on Windows”](#) on page 65.

Configuring a Device Resource on UNIX

During the NetWorker installation process on UNIX, you can specify one or more backup devices. NetWorker automatically creates the required device resource for each device. For details on NetWorker installation procedures, refer to the *Legato NetWorker Installation Guide* for your particular UNIX platform.

Use the NetWorker Administrator GUI to view or modify the NetWorker device resources. Open the Devices window by selecting Devices from the Media menu in the main NetWorker Administrator window. A Devices window appears, similar to the one shown in [Figure 16 on page 64](#).

Figure 16. Devices Window on UNIX



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On UNIX, the Devices window lists each device configured on the NetWorker server. To view the attributes of a specific device, highlight the device name in the Devices scrolling list in the upper part of the window. The attributes for that device appear in the lower part of the window.

Figure 16 shows a single device in the Devices scrolling list. The device name */dev/rmt/0hbn* is highlighted in the list, and the resource attributes for the device appear in the lower part of the window. The Media type attribute for the device is 8mm 5GB.

If you add a new Oracle storage device to the NetWorker server or a storage node, you must create a new NetWorker device resource for it. When you properly configure an Oracle storage device in the NetWorker server, the device name appears in the Devices section of the main NetWorker Administrator window, as shown in [Figure 5 on page 39](#).

For details on how to create, modify, and remove a device resource in the NetWorker configuration, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for UNIX. The *Administrator's Guide* also describes autochanger and silo configuration procedures and media management topics such as cloning.



Important: When you create or modify a device resource, verify that the *Enabled* attribute is set to Yes in the Devices window to ensure that the device is enabled for Oracle operations.

After you have configured the required resources for your storage devices, see “[Step 6: Volume Pools and Label Templates](#)” on page 67 for information about using volumes in the devices.

Configuring a Device Resource on Windows

The NetWorker installation process on a Windows NT system includes the automatic configuration of a NetWorker device resource for a 4mm tape device. For details on NetWorker installation procedures, refer to the *Legato NetWorker Installation Guide* for Windows.

On Windows NT release 4.0, you must use the Tape Devices program in the Windows NT Control Panel to install the device driver for a storage device *before* you configure the NetWorker resource for that device.

Only devices currently registered with the Windows NT Registry are available for use with NetWorker. To determine what devices are available:

1. Open an MS-DOS window.
2. Change to the NetWorker directory (`%SystemDrive%\win32app\nsr\bin` or `%SystemDrive%\Program Files\nsr\bin`, by default).
3. Enter the following command at the system prompt to display all the devices currently available:

inquire

Devices that have a Registry entry of `\\.\TAPE#` are tape devices. Devices that have a Registry entry of `\\.\PHYSICALDRIVE#` are regular disk drives or optical drives.

Some physical hard drives can also have a `\\.\PHYSICALDRIVE#` Registry entry but are not compatible with NetWorker. Any devices not listed, or listed without a Registry entry, are unavailable to NetWorker.

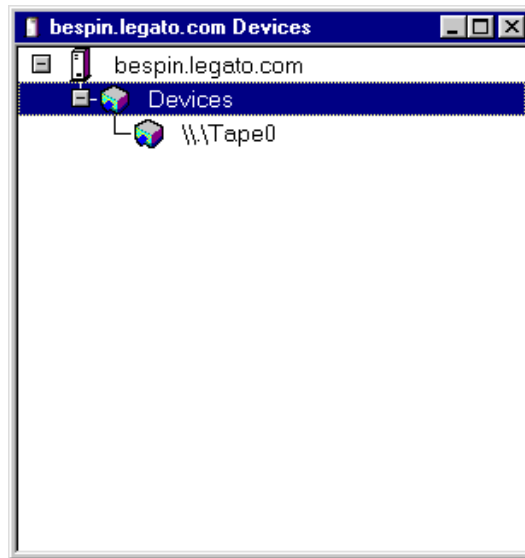
If a tape device does not appear in the Windows NT Registry, consider one of the following reasons:

- The tape device is not properly installed.
- The device driver is not properly installed.
- The driver might not be compatible with your device. See the device manufacturer for information on the latest supported drivers.

Use the NetWorker Administrator GUI to view or modify the NetWorker device resources. Open the Devices window:

1. Click the Configure tab in the Server window to make the Configure window active.
2. Click Devices to open the Devices window. A Devices window appears, similar to the one shown in [Figure 17](#).

Figure 17. Devices Window on Windows



On a Windows system, the Devices window lists each device configured on the NetWorker server but *not* the attributes of the device resources. To view the attributes of a specific device, right-click the device icon and select Edit from the pop-up menu. The Edit Device dialog box opens, displaying the attributes for the device.

If you add a new Oracle storage device to the NetWorker server or a storage node, you must create a new NetWorker device resource for it. When you properly configure an Oracle storage device in the NetWorker server, the device name appears in the Devices section of the Monitor window. To make the Monitor window active, click the Monitor tab in the Server window (of the main Administrator window).

For details on how to create, modify, and remove a device resource in the NetWorker configuration, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for Windows. The *Administrator's Guide* also describes autochanger and silo configuration procedures and media management topics such as cloning.



Important: When you create or modify a device resource, verify that the *Enabled* attribute is set to Yes in the device dialog box to ensure that the device is enabled for Oracle operations.

After you have configured the required resources for your storage devices, see [“Step 6: Volume Pools and Label Templates”](#) immediately below for information about using volumes in the devices.

Step 6: Volume Pools and Label Templates

NetWorker provides a means of directing your backups to groups of media or backup volumes called *pools*. Volume pools allow you to establish a logical and systematic method for tracking, organizing, and sorting your backup data. Label templates provide a consistent method for labeling the volumes in pools.

For complete details on volume pools and label templates and their configuration procedures, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.

What Is a Pool?

A *pool* is a specific collection of backup volumes that NetWorker uses to sort and store data. Each NetWorker volume pool is defined by its pool resource in the NetWorker server. The configuration settings specified in the pool resource act as a filter that NetWorker uses to determine which type of data to write to the volumes in that pool.

Each NetWorker volume belongs to a pool, either a preconfigured pool or one you create. Each pool has a specific label template associated with it, providing an automated method of identifying the media assigned to a pool. NetWorker uses pools of volumes in conjunction with their label templates to track what data is on which volume.

For more information on label templates, see [“Creating a Label Template” on page 69](#).

How NetWorker Uses Pools

When an Oracle backup occurs, NetWorker tries to match the characteristics of the data to the attributes configured for a pool resource. If the data matches the criteria of a pool configuration, NetWorker directs the data to a labeled volume belonging to that pool.

NetWorker checks whether a correctly labeled volume from the pool is mounted in a configured device. If a correctly labeled volume is mounted, NetWorker writes the data to the volume. If an appropriate volume is *not* mounted, NetWorker’s actions depend on whether there is a configured device with auto media management enabled:

- If auto media management is enabled, NetWorker can automatically label and mount an unlabeled or recyclable volume and proceed with the backup. For more information on auto media management, see [“Auto Media Management” on page 74](#).
- If auto media management is not enabled, NetWorker requests that a labeled volume be mounted and waits until an operator or an autochanger mounts an appropriate volume. NetWorker then proceeds with the backup to that volume.

Configuring Pools for Oracle Backups

Volume pools provide the ability to segregate Oracle data such as tablespaces and archived redo logs onto different sets of media. Pools also allow you to direct backup data to specific devices.

Each volume pool has a *Pool type* attribute. For NetWorker Module for Oracle, the only valid pool types are *Backup* and *Backup clone*.

NetWorker uses the choices you select in the pool configuration to sort backup data to specific volumes labeled for the pool. For example, you can sort your Oracle backup data by pool type and any combination of these criteria:

- Backup group
- NetWorker client

You might want to organize your backup data in different ways, such as by department or type of database. You can send your Oracle data backups to separate media by setting up volume pools for those backups.

To customize media organization for Oracle backups using volume pools:

1. Create label templates for Oracle data and archived redo log backups. For details, see [“Creating a Label Template”](#) immediately following this section.
2. Create the corresponding volume pools, using the instructions in [“Creating a Volume Pool”](#) on page 71.
3. If desired, set the `NSR_DATA_VOLUME_POOL` environment variable in the RMAN backup script to specify the volume pool for an Oracle backup. For details on this variable, see [“Setting the NSR_DATA_VOLUME_POOL Variable”](#) on page 73.

For more information about volume pools and NetWorker volume operations in general, refer to the *Legato NetWorker Administrator’s Guide* for UNIX or Windows. For more information about labeling volumes, see [“Step 7: Labeling and Mounting Volumes”](#) on page 73.

Creating a Label Template

Label templates provide a method for consistently naming and labeling volumes. NetWorker generates a label for a volume according to the rules of the label template associated with the volume pool configured in NetWorker.

The preconfigured label template associated with the Default pool is named Default. NetWorker automatically uses this Default label template to label volumes for the Default pool. The Default label template resource in NetWorker has the following attributes:

```
Name: Default
Fields: hostname, 001-999
Separator: .
```

For example, if the NetWorker server hostname is *jupiter*, NetWorker automatically labels the volumes for the Default pool as *jupiter.001*, *jupiter.002*, *jupiter.003*, and so on. You can override this default labeling scheme when you *manually* label a backup volume.

To create a new label template resource:

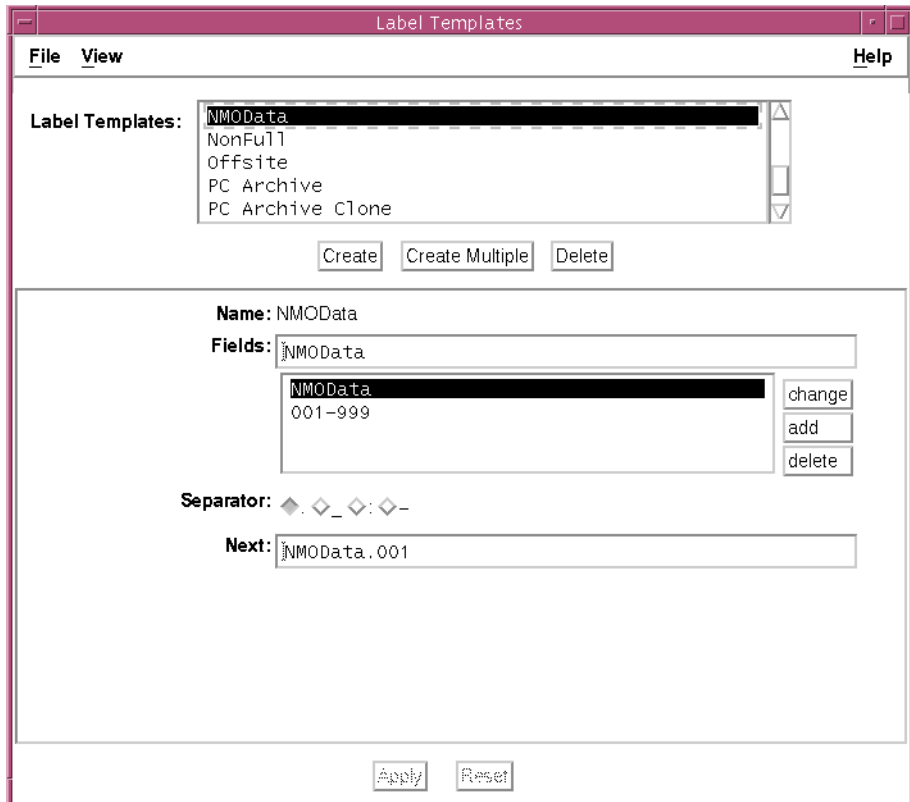
- Create a name for the label template.
- Specify the fields to use in the label, including the alphabetic or numeric range for the volumes.
- Select a separator to use between the fields.

For complete details on how to configure a label template resource and its attributes, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.

If you create a volume pool before creating the corresponding label template, NetWorker generates a label template for the pool using the pool name. To associate a customized label template with a volume pool, create the label template first and then assign it to the volume pool in the pool resource.

Figure 18 shows a customized label template on a UNIX NetWorker server.

Figure 18. Customized Label Template on UNIX



Creating a Volume Pool

To create a customized pool in NetWorker:

1. Run the NetWorker Administrator GUI as one of the users in the NetWorker Administrator list of the server resource.
2. On UNIX, open the Pools window and click Create. On Windows, open the Create Pool dialog box. For details, refer to the NetWorker online help or the *Legato NetWorker Administrator's Guide* for UNIX or Windows.
3. Enter a name for the volume pool, for example NMOData, in the *Name* field.
4. Verify that Yes is selected for *Enabled*.
5. Select Backup for the *Pool type*.
6. Select a customized label template or accept the one NetWorker generates, for example, NMOData.
7. Enter the pool's name in the *Save sets* list. NetWorker Module for Oracle uses this designation to meet the NetWorker requirement to define at least one attribute for a pool.
8. Select a device from the choices displayed.
9. Verify that Yes is selected for *Store index entries*.
10. Save the pool configuration.

When you save the pool configuration, NetWorker adds the pool to its list of volume pool resources.

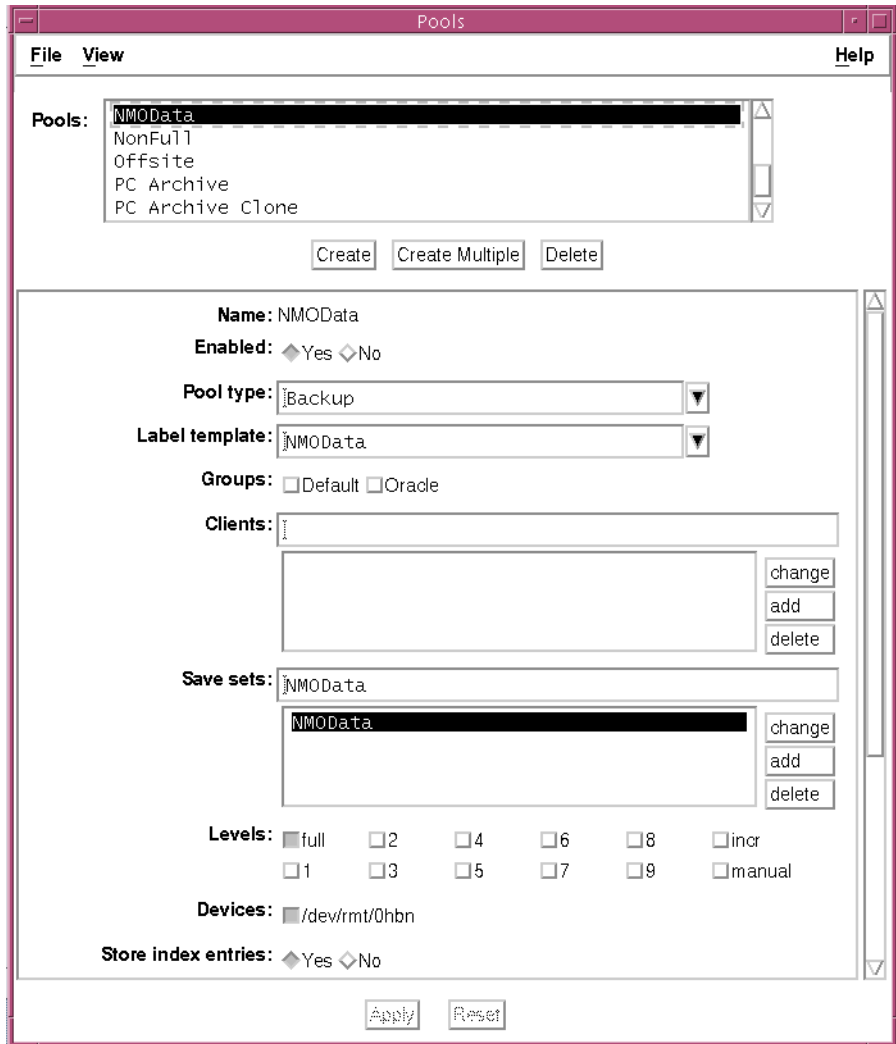
The indexes will write to the Default pool with the basic configuration. For information on how to redirect the indexes and/or bootstrap to a separate pool, refer to the *Legato NetWorker Administrator's Guide*.

[Figure 19](#) shows a customized pool resource on a UNIX NetWorker server.



Important: When you create a volume pool resource for a *scheduled* Oracle backup, you can select a backup group from the Groups listed. Do *not* select a group if the pool is to be used for a *manual* Oracle backup. For details on scheduled Oracle backups, see [“Chapter 5: Scheduled Oracle Backups”](#).

Figure 19. Customized Volume Pool on UNIX



3



Important: If you do not specify a customized volume pool for your Oracle backup volumes, NetWorker will route all Oracle backup data to the preconfigured volume pool named Default.

Setting the NSR_DATA_VOLUME_POOL Variable

To specify that the NetWorker server back up Oracle data to a pool *other than the Default pool*, you must set the NSR_DATA_VOLUME_POOL environment variable to the volume pool name in the RMAN backup script.

To send the data from a manual or scheduled Oracle backup to a specific pool, you must set the NSR_DATA_VOLUME_POOL variable in the RMAN backup script. For details on the two different types of Oracle backups, see [“Chapter 4: Manual Oracle Backups”](#) and [“Chapter 5: Scheduled Oracle Backups”](#).

You can also use the **set duplex** command in the RMAN script to generate up to four copies of an Oracle backup and store those copies on separate media. Depending on the value used with **set duplex** in the script, you might need to set some of the environment variables: NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2, or NSR_DATA_VOLUME_POOL3.

For more details on the NSR_DATA_VOLUME_POOL* variables, see [“Environment Variables in the RMAN Script” on page 143](#). For more details on using the **set duplex** command, see [“Appendix C: RMAN Commands”](#).

Step 7: Labeling and Mounting Volumes

Each configured Oracle storage device must have a labeled storage volume *mounted* in it before NetWorker can use the device and volume for backup and restore operations. A volume must also be unmounted from a device before it can be replaced by another volume.

When NetWorker labels a volume, it assigns the volume to a particular volume pool. After a volume is labeled, it becomes eligible to be used for backup when NetWorker needs a volume from the volume pool.

NetWorker uses unique volume labels to maintain a record of each volume in its online media database. For more information about how NetWorker uses the media database for tracking storage volumes and data, see [“NetWorker and NetWorker Module for Oracle Operations” on page 34](#).

You can have NetWorker *automatically* label and mount volumes in a device by enabling the auto media management attribute in the appropriate NetWorker device or autochanger resource. For details, see [“Auto Media Management” on page 74](#).

If you relabel a recyclable volume from the *same pool*, the volume label name and sequence number remain the same, but access to the original data on the volume is destroyed and the volume becomes available for new data.

For example, if NetWorker recycles a volume labeled *empire.003* in the same pool, it leaves the volume label as *empire.003*; it does *not* assign a new label with the next available sequence number, such as *empire.007*. However, the data on *empire.003* is now *permanently inaccessible*.

For complete details on how to label, mount, and unmount a volume in a storage device, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for UNIX or Windows.

Step 8: Storage Nodes

A *storage node* is a system connected to a NetWorker server and to one or more devices used in NetWorker backup, archive, and Hierarchical Storage Management (HSM) operations. Devices attached to a storage node are called *remote devices*.

A storage node runs special NetWorker software that controls devices. The data stored on media in remote devices is tracked in the online client file indexes and media database on the controlling NetWorker server. If the data to be backed up resides on storage nodes, the data does not need to go over the network to the NetWorker server during backup and restore operations.

From the NetWorker server, you can perform typical storage tasks such as labeling and mounting volumes for the storage node devices, as well as configuring NetWorker resources associated with storage nodes.

Storage nodes added to the NetWorker configuration can increase the NetWorker server's performance, provide more flexibility in designing the network, and centralize the control of data management activities to one or more NetWorker servers.

For complete details on storage nodes and remote devices and their configuration procedures, refer to the *Legato NetWorker Administrator's Guide* for UNIX or Windows.

Auto Media Management

NetWorker supports auto media management for stand-alone devices and autochangers. The auto media management feature gives NetWorker automatic control over a volume in a configured device or autochanger. If the auto media management feature is enabled, NetWorker can automatically label, mount, and overwrite a volume that it considers unlabeled, and automatically recycle a volume eligible for reuse.

NetWorker considers a volume *unlabeled* if one of the following conditions apply:

- The volume has no internal label.
- The volume is labeled with information other than a recognizable NetWorker label.
- The volume has a NetWorker label, but the density indicated on the label differs from the density of the device where the volume is loaded.



Important: As the auto media management feature can relabel a volume with a different density, it is possible to inadvertently overwrite valuable data. For this reason, be careful if volumes are shared between devices with different densities.

If auto media management is *not* enabled, NetWorker ignores an unlabeled volume in a device and does not consider it for backup.

To enable the auto media management feature, enable the auto media management attribute in the appropriate device or autochanger resource. For complete details on enabling and using auto media management, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for UNIX or Windows.

Using the Volumes Window

[“NetWorker and NetWorker Module for Oracle Operations” on page 34](#) describes the process that NetWorker uses to track each Oracle backup volume and the backup sets (save sets) on it. For details on the “status” value that NetWorker assigns to each save set and the “mode” value assigned to each volume, refer to the *Legato NetWorker Administrator's Guide* for UNIX or Windows.

You can use the Volumes window in the NetWorker Administrator GUI to view information about the complete inventory of Oracle backup volumes and the save sets on them. If you run the GUI as an administrative user, you can also use the Volumes window to perform the following volume operations:

- Change the status of save sets
- Change the mode of volumes
- Recycle storage volumes
- Remove storage volumes from the media index

For complete details on how to open the Volumes window and access the different types of available information, refer to the NetWorker online help and the *Legato NetWorker Administrator's Guide* for UNIX or Windows.

Chapter 4: Manual Oracle Backups

This chapter provides details on setting up and running manual Oracle backups. NetWorker Module for Oracle enables you to run manual Oracle backups using either the Recovery Manager (RMAN) command line interface or the Oracle Enterprise Manager (OEM) Backup Management Tools.

An important consideration with manual Oracle backups is the maintenance of regular NetWorker server bootstrap backups to ensure adequate preparation for future disaster recovery.

This chapter contains the following sections:

- [“Roadmap for Manual Oracle Backups” on page 78](#)
- [“Step 1: Creating RMAN Backup Scripts” on page 79](#)
- [“Step 2: Running Manual Oracle Backups” on page 81](#)
- [“Using the OEM Backup Management Tools” on page 82](#)
- [“NetWorker Server Bootstrap Backup” on page 82](#)
- [“Archived Redo Log Backups” on page 84](#)
- [“Recovery Catalog Backups” on page 84](#)
- [“Cancelling RMAN Backups” on page 84](#)
- [“Monitoring Manual Oracle Backups” on page 85](#)
- [“Diagnostic and Error Messages for Manual Backups” on page 86](#)

Roadmap for Manual Oracle Backups

Before configuring manual Oracle backups using the steps below, be sure you have followed the [“Basic Configuration Roadmap” on page 50](#) to complete the basic Oracle and NetWorker system configurations. You should have set up the basic NetWorker server, client, device, and pool resources as well as labeled and mounted the required backup volumes.



Important: For NetWorker Module for Oracle, when working with NetWorker 6.0 server, the *oracle_owner* name must appear in the Administrator list in the server resource configured on the NetWorker server. For more information on adding this name to the Administrator list, see [page 56](#).

To ensure a successful manual Oracle backup, perform the backup using either the RMAN command line interface or the OEM Backup Management Tools:

- To use the RMAN command line interface for the manual Oracle backup:
 1. Create the backup script to be used by RMAN for running the manual Oracle backup. For details, see [“Step 1: Creating RMAN Backup Scripts”](#) immediately following this section.
 2. Run the manual Oracle backup using the RMAN command line interface. For details, see [“Step 2: Running Manual Oracle Backups” on page 81](#).
- To use the OEM Backup Management Tools for the manual Oracle backup, see [“Using the OEM Backup Management Tools” on page 82](#).



Important: The NetWorker server bootstrap and client indexes are *not* automatically backed up at the end of a manual Oracle backup, as they are for a scheduled Oracle backup. After running a manual Oracle backup, you should perform a NetWorker server bootstrap backup according to the instructions in [“NetWorker Server Bootstrap Backup” on page 82](#).

You can use the information in [“Monitoring Manual Oracle Backups” on page 85](#) to keep track of the status of your manual Oracle backups.

For information on how to configure and run scheduled Oracle backups, see [“Chapter 5: Scheduled Oracle Backups”](#).

In addition to performing Oracle database backups using the appropriate RMAN scripts as described in this chapter, you should back up other important Oracle files (for example, *initoracle_sid.ora*) using regular filesystem backups. For more information, refer to the Oracle *Backup and Recovery Guide*.

Step 1: Creating RMAN Backup Scripts

You must create an appropriate RMAN script to perform the desired type of manual Oracle backup on an Oracle8 or Oracle8i system.

You can store your Oracle backup scripts as flat ASCII files. Alternatively, if you are using a Recovery Catalog, you can store your backup scripts in the Recovery Catalog database. For more information on storing backup scripts in the Recovery Catalog database, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

For example, the following RMAN script performs an Oracle8 or Oracle8i backup of the entire database to the volume pool *MondayFulls* of the (remote) NetWorker server *mars.legato.com*.

```
run {
    allocate channel t1 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_DATA_VOLUME_POOL=MondayFulls)';
    allocate channel t2 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_DATA_VOLUME_POOL=MondayFulls)';
    backup full filesperset 4
    format 'FULL_%d_%u'
    (database);
    release channel t1;
    release channel t2;
}
```

You must set the **type** option in the RMAN command **allocate channel** to **SBT_TAPE**. This value specifies a Media Management (in this case, NetWorker Module for Oracle) device.¹

1. If you allocate a device using the command **allocate channel t1 type disk** (with Oracle correctly configured and NetWorker Module for Oracle uninstalled), you can back up to disk files using Oracle's backup implementation. Obviously, in this case, the **parms** option has no effect.



Important: To ensure that a specific Legato environment variable is set during your Oracle backup—*other than the environment variables* in the `nsrnm0` script described in “[Step 2: Customizing the nsrnm0 Script](#)” on page 94—you must set that variable in the RMAN backup script.

To use any of the `NSR_` environment variables described in “[Environment Variables in the RMAN Script](#)” on page 143, you must set them in the RMAN backup script. Most of the `NSR_` variables are optional.

`NSR_SERVER` is also *mandatory* if you are backing up to a NetWorker server *different* from your Oracle host. In any case, you should *always* set `NSR_SERVER`. Also, the `NSR_DATA_VOLUME_POOL*` variables are *mandatory* if you are using the RMAN command **set duplex**.

Note: If you do *not* set `NSR_DATA_VOLUME_POOL` to a valid NetWorker volume pool name in the RMAN backup script, NetWorker will use the Default volume pool for the Oracle backups.

Contrary to statements in the *Oracle Backup and Recovery Guide* and *Oracle8i Recovery Manager User’s Guide and Reference*, each `NSR_` environment variable that you set in the RMAN script must be included in the **parms** option for *each* allocated channel. You *cannot* set the `NSR_` variables at the system command line (for example, using a **setenv** or **set** command).



Important: On Windows, when you set a `NSR_` environment variable in the RMAN script, as shown in the script example on [page 79](#), the value of that `NSR_` variable remains in effect for all subsequent allocated channels and for all subsequent RMAN scripts until either:

- Oracle is shut down; or
- the `NSR_` variable is “unset” for the channel using the **parms** option, as in the following example:

```
run {
  allocate channel t1 type 'SBT_TAPE'
  parms 'ENV=(NSR_SERVER=,NSR_DATA_VOLUME_POOL=)';
  :
  :
  release channel t1;
}
```

In the RMAN backup script example above, the **format** string `FULL_%d_%u` specifies the name of each backup piece. This name can be anything, *provided that each backup piece has a unique name on the NetWorker server*. You can use substitution variables such as `%d` and `%u` to guarantee unique names. A **format** string such as `FULL` or `FULL_%d` will *not* generate unique names. Similarly, the **format** string `FULL_%s` will *not* generate unique names for two databases being backed up to the same NetWorker server.

For more details on how to write RMAN scripts, refer to the *Oracle Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*. For details on how to use the OEM Backup Wizard to generate RMAN scripts, refer to your Oracle Enterprise Manager documentation. Also, see [“Appendix C: RMAN Commands”](#) for important Legato-specific information about RMAN commands in Oracle8i.

Step 2: Running Manual Oracle Backups

Chapter 3 explains how to configure Oracle and NetWorker for backup and recover operations.

After applying the information in Chapter 3, the NetWorker server should have the required server, client, device, and volume pool resources configured. A volume should be labeled (and mounted as required) in each configured backup device, or—if auto media management is enabled for a tape device or autochanger—a tape loaded in the tape device or autochanger for NetWorker to use automatically.

The Oracle Server should also have the TNS Listener (you will most probably use one) configured. If you will be using a Recovery Catalog, you should have the Recovery Catalog set up and the target database registered.

With these configurations in place and an RMAN backup script created as described in [“Step 1: Creating RMAN Backup Scripts”](#) on page 79, you can start a manual Oracle backup using the RMAN command line interface on the Oracle Server.

For example, if the RMAN backup script on [page 79](#) is stored in the file `/disk1/scripts/full_backup.txt` on a UNIX Oracle Server and the TNS Listener has been configured to connect to the databases `payroll` and `rcvcatdb`, you can run the manual Oracle backup using the following command:

```
% rman target internal/oracle@payroll rcvcat
rman/rman@rcvcatdb cmdfile
\'/disk1/scripts/full_backup.txt\'
```

On Windows, the command to run the RMAN script is either **rman80** (Oracle 8.0.x) or **rman** (Oracle 8.1.x). For more information on the command line options available with the **rman** or **rman80** command, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Using the OEM Backup Management Tools

You can use the Oracle Enterprise Manager (OEM) Backup Management Tools instead of the RMAN command line interface to start an Oracle backup. The OEM Backup Management Tools include a graphical user interface to RMAN that enables you to perform backup and restore operations through a point-and-click method.

The OEM Backup Management Tools provide a much simpler interface for running Oracle backups and restores. In Oracle8 and Oracle8i, the OEM Backup Management Tools generate the required RMAN commands.

For information on how to use the OEM Backup Management Tools, refer to the Oracle Enterprise Manager documentation included with your product kit.

4

NetWorker Server Bootstrap Backup

As mentioned in “[NetWorker Server Bootstrap](#)” on page 35, the bootstrap is a special save set that NetWorker creates in preparation for disaster recovery. The bootstrap save set contains the information needed to restore the following three components to the point just before the bootstrap was created:

- NetWorker server index
- Media index
- Resource database

From these three components, the complete NetWorker server environment can be recreated.

The NetWorker server automatically performs a backup of its bootstrap and the client index of the Oracle Server only at the end of a *scheduled* Oracle backup. This is done by the NetWorker **savegrp** program that performs the scheduled backup. The client index and NetWorker server bootstrap are vital for restoring Oracle data in the event of a disaster on the NetWorker server.



Important: If you run only manual Oracle backups and you do not manually back up the client index and bootstrap, you will *not* have backups of the online client index and NetWorker server bootstrap for use in the event of a disaster recovery on the NetWorker server.

After finishing a manual Oracle backup, you should back up the bootstrap and client index. To back up the bootstrap and index, log in as root user (on a UNIX NetWorker server) or Administrator or equivalent (on a Windows NetWorker server) and run the following command:

```
savegrp -O -l full -P printer-name -c Oracle-Server-name \  
-c NetWorker-server-name
```

You can specify the following values in the **savegrp** command:

- *printer-name* – Name of the printer where the bootstrap information is printed at the end of the bootstrap backup
- *Oracle-Server-name* – Hostname of the Oracle Server
- *NetWorker-server-name* – Hostname of the NetWorker server

For details on the **savegrp** command and its options, refer to the **savegrp** man page on UNIX. On Windows, refer to **savegrp** in the Command Line Utilities Help or *Legato Command Reference Guide*. For information on how to access these sources, see the appropriate section:

- [“UNIX Manual Pages” on page 23](#)
- [“Windows Command Line Utilities Help” on page 24](#)
- [“Legato Command Reference Guide” on page 24](#)

After successful completion of the bootstrap and client index backup using the **savegrp** command above:

- Information confirming the completion of **savegrp** is displayed in the NetWorker Administrator GUI.
- Information is sent to the *printer-name* printer about the saved bootstrap.

Store the bootstrap printout in a safe place. The printed bootstrap information includes dates, locations, and save set ID numbers for the bootstrap save sets backed up during the past month. With this information, you can determine which volumes are needed to recover the NetWorker server indexes and resource database files during a disaster recovery.

For more information on bootstrap backups and the **savegrp** command, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform. For more information on how to use the bootstrap backup during a disaster recovery, refer to the *Legato NetWorker Disaster Recovery Guide*.

Archived Redo Log Backups

In Oracle8 or Oracle8i, you can back up archived redo logs using the appropriate option of the RMAN **backup** command. *Archived redo log files are not backed up automatically during Oracle backups.* For a sample script to back up the archive log files in an OPS system, see [“Backing Up All Archive Log Files from Each Node” on page 131](#).

For more information on setting up and running archived redo log backups, refer to the *Oracle Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.



Important: Archived redo log backups allow you to recover the database to its original state before the disaster occurred. If you do not maintain archived redo log backups, you will only be able to recover your database up to the time of the last “consistent” backup. In this case, transactions that occurred between the time of the last “consistent” backup and the time your database was corrupted will be lost.

Recovery Catalog Backups

Backing up your Recovery Catalog should be part of your backup and recovery strategy. You should back up your Recovery Catalog after every target database backup.

For more information and guidelines on setting up and running Recovery Catalog backups, refer to the *Oracle Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Cancelling RMAN Backups

The following procedure for cancelling a hung Oracle8 or Oracle8i backup *might* work for you. If this procedure does *not* work, check with Oracle Corp. for assistance.

To cancel a hung Oracle8 or Oracle8i backup:

1. Include the **set command id to 'xxx'** command in the RMAN backup script used for the scheduled Oracle backup. Otherwise, you will not be able to successfully perform the query in the next step. For a sample script including this command, see [“Step 1: Creating RMAN Backup Scripts” on page 91](#).
2. Run the following query to determine the Oracle process ID corresponding to each RMAN channel:

```
select spid, client_info from v$process p, v$session s
where p.addr=s.paddr and client_info like '%id=%';
```

3. Run the following command to stop the Oracle backup process, where *pid* is the appropriate Oracle process ID:

```
kill -9 pid
```

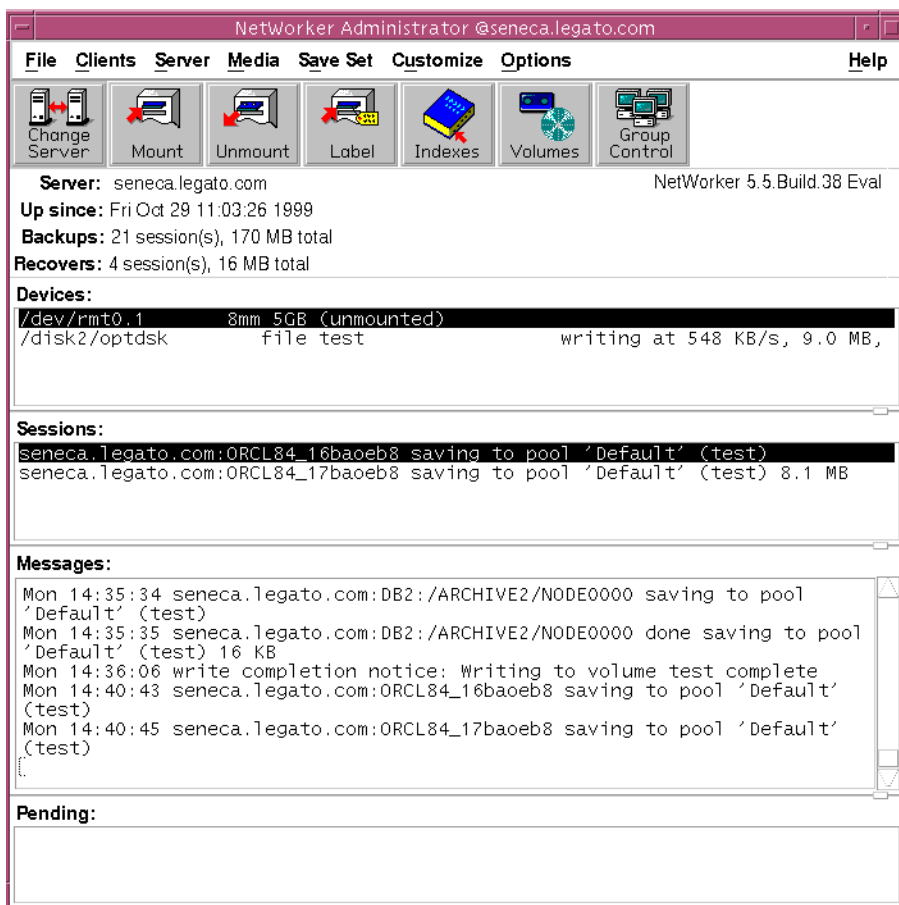
Monitoring Manual Oracle Backups

Use the NetWorker Administrator GUI to monitor the status of Oracle backup and restore operations. The GUI displays progress messages, completion messages that advise you when a backup or restore is complete, and information on why a backup or restore cannot proceed.

For more information on viewing these types of messages using the NetWorker Administrator GUI, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.

[Figure 20](#) shows the types of messages displayed in the Sessions and Messages sections of the main NetWorker Administrator GUI on UNIX during Oracle backups.

Figure 20. Oracle Backup Messages on UNIX



4

Diagnostic and Error Messages for Manual Backups

Diagnostic messages specific to the Legato products are recorded for a manual Oracle backup in the following log files by default:

- On UNIX:
 - /nsr/logs/daemon.log*
 - /nsr/applogs/dmo.messages*

- On Windows:
 - With NetWorker release 5.5.x and earlier:
%SystemDrive%\win32app\nsr\logs\daemon.log
%SystemDrive%\win32app\nsr\applogs\dmo.messages
 - With NetWorker release 5.7 and later:
%SystemDrive%\Program Files\nsr\logs\daemon.log
%SystemDrive%\Program Files\nsr\applogs\dmo.messages

For additional debugging information specific to the Legato products, set the environment variable `NSR_DEBUG_FILE` to a valid file pathname in the RMAN backup script. NetWorker will write debugging information to the specified file. For more information on the variable `NSR_DEBUG_FILE`, see [“Environment Variables in the RMAN Script” on page 143](#).

To obtain RMAN-specific error messages, specify the `msglog` parameter in the RMAN command, as in the following example:

```
% rman target ... rcvcat ... msglog filename
```


Chapter 5: Scheduled Oracle Backups

This chapter describes how to set up and run scheduled Oracle backups using NetWorker Module for Oracle. It outlines the procedures for testing and stopping scheduled Oracle backups as well as monitoring scheduled Oracle backups using the NetWorker Administrator GUI and specific log files.



Important: Before configuring and running scheduled Oracle backups using the instructions in this chapter, you should execute a manual Oracle backup successfully using the instructions in [“Chapter 4: Manual Oracle Backups”](#).

This chapter contains the following sections:

- [“Roadmap for Scheduled Oracle Backups”](#) on page 90
- [“Step 1: Creating RMAN Backup Scripts”](#) on page 91
- [“Step 2: Customizing the nsrnmo Script”](#) on page 94
- [“Step 3: Configuring a Backup Schedule”](#) on page 101
- [“Step 4: Configuring a Backup Group”](#) on page 102
- [“Step 5: Client Resource for a Scheduled Backup”](#) on page 104
- [“Testing Scheduled Backups”](#) on page 108
- [“Stopping Scheduled Backups”](#) on page 109
- [“Monitoring Scheduled Oracle Backups”](#) on page 110

NetWorker can be configured to run RMAN on a regular basis for scheduled Oracle backups. Typically, you might schedule a daily backup of the archived logs and a weekly full backup of the Oracle database.

NetWorker works with NetWorker Module for Oracle to back up your Oracle Server host according to the NetWorker schedule you set up. You must complete the configuration of the Oracle Server as a NetWorker client and specify what Oracle data you want backed up and how.

Roadmap for Scheduled Oracle Backups

Before configuring scheduled Oracle backups using the steps below, be sure you have followed the [“Basic Configuration Roadmap” on page 50](#) to complete the basic Oracle and NetWorker system configurations. You should have set up the basic NetWorker server, client, device, and pool resources as well as labeled and mounted the required backup volumes.



Important: For NetWorker Module for Oracle, when working with NetWorker 6.0 server, the *oracle owner* name must appear in the Administrator list in the server resource configured on the NetWorker server. For more information on adding this name to the Administrator list, see [page 56](#).

To configure scheduled Oracle backups:

1. Create the backup script to be used by RMAN for running the scheduled Oracle backup. For details, see [“Step 1: Creating RMAN Backup Scripts” on page 91](#).
2. Customize the **nsrnmno** script for the scheduled backup (the file *nsrnmno* on UNIX or *nsrnmno.bat* on Windows). Set the required environment variables in the **nsrnmno** script. For details, see [“Step 2: Customizing the nsrnmno Script” on page 94](#).
3. Configure the required backup schedule(s). For details, see [“Step 3: Configuring a Backup Schedule” on page 101](#).
4. Configure the required backup group(s). For details, see [“Step 4: Configuring a Backup Group” on page 102](#).
5. Configure a NetWorker client resource for the scheduled backup. For details, see [“Step 5: Client Resource for a Scheduled Backup” on page 104](#).

After completing these configuration steps:

- Run a test scheduled Oracle backup using the steps in [“Testing Scheduled Backups” on page 108](#).
- Review the steps for stopping a scheduled Oracle backup in [“Stopping Scheduled Backups” on page 109](#).

You can use the information in [“Monitoring Scheduled Oracle Backups” on page 110](#) to keep track of the status of your scheduled Oracle backups.

Step 1: Creating RMAN Backup Scripts

You must create an appropriate RMAN script to perform the desired type of scheduled Oracle backup on an Oracle8 or Oracle8i system.

For example, the following script contains a set of RMAN commands to perform an Oracle8 or Oracle8i backup of the entire database to the volume pool *MondayFulls* of the (remote) NetWorker server *mars.legato.com*. The Recovery Catalog is being used in this case.

```
connect target target_user/target_passwd@target_TNS;
connect rcvcat rcvcat_user/rcvcat_passwd@rcvcat_TNS;
run {
    set command id to 'xxx';
    allocate channel t1 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_DATA_VOLUME_POOL=MondayFulls)';
    allocate channel t2 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_DATA_VOLUME_POOL=MondayFulls)';
    backup full filesperset 4
    format 'FULL_%d_%u'
    (database);
    release channel t1;
    release channel t2;
}
```

The command **connect target** *target_user/target_passwd@target_TNS* is *mandatory* in each RMAN script for a scheduled backup. This command establishes the proper connection to the target database. Specify the correct values for the command parameters:

- *target_user* – User with SYSDBA privileges for the target database
- *target_passwd* – Password of the *target_user* (for connecting as SYSDBA), specified in the target database's *orapwd* file
- *target_TNS* – TNS alias of the target database



Important: Do not include the command **connect target internal/oracle** in the RMAN script for a scheduled Oracle backup. You must use a password file for your target database. To do so, you might need to use the *orapwd* utility and set your REMOTE_LOGIN_PASSWORDFILE *initoracle_sid.ora* parameter to *exclusive*. For more information, refer to the Oracle *Backup and Recovery Guide*.

The command **connect rcvcat** *rcvcat_user/rcvcat_passwd@rcvcat_TNS* is required if the Recovery Catalog is to be used for the scheduled backup. This command establishes the proper connection to the Recovery Catalog database. Specify the correct values for the command parameters:

- *rcvcat_user* – Owner of the Recovery Catalog database
- *rcvcat_passwd* – Password of the *rcvcat_user*, specified in the Recovery Catalog database's *orapwd* file
- *rcvcat_TNS* – TNS alias of the Recovery Catalog database

The command **set command id to 'xxx'** (where *xxx* can be any string of characters *enclosed in single quotes*) in each RMAN script for a scheduled Oracle backup enables stopping of the scheduled backup, if required. For details on how to stop a scheduled Oracle backup, see [“Stopping Scheduled Backups” on page 109](#).

The remainder of the RMAN script example above, starting with the first **allocate channel** command, is identical to the RMAN script on [page 79](#). For more details on creating RMAN backup scripts, see [“Step 1: Creating RMAN Backup Scripts” on page 79](#).

If a volume pool is associated with the scheduled backup group (through the pool resource), you can have the scheduled backup automatically use that pool by setting the NSR_GROUP environment variable in the RMAN backup script. Set the NSR_GROUP variable to the backup group name. For example,

if the scheduled backup group name is *Oracle backup*, set the NSR_GROUP variable in the **parms** option of each **allocate channel** command in the RMAN script as follows:

```
parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_GROUP=Oracle backup)';
```

If a non-Default volume pool is associated with the group (by specifying the group name in the volume pool resource), the scheduled backup will automatically use that non-Default pool.



Important: A NSR_DATA_VOLUME_POOL setting takes precedence over any pool associated with the scheduled backup group. If you set *both* NSR_DATA_VOLUME_POOL and NSR_GROUP in the same RMAN script for a scheduled backup but the NSR_GROUP group name is *not* specified in the pool resource of the NSR_DATA_VOLUME_POOL pool, the scheduled backup still uses the NSR_DATA_VOLUME_POOL pool. It is the user's responsibility to ensure that NSR_DATA_VOLUME_POOL and NSR_GROUP are set correctly in the RMAN script for a scheduled backup. It is recommended that you set either NSR_DATA_VOLUME_POOL or NSR_GROUP—but *not both*—in the RMAN script.

Note: Since each scheduled backup RMAN script requires a **connect target** command, each Oracle instance requires a *separate* scheduled backup RMAN script.

Each scheduled backup RMAN script must be stored as a flat ASCII file. The **run {...}** portion of the RMAN script can be stored in the Recovery Catalog database. The database administrator should give *minimal* permissions to the scheduled backup RMAN script file, to ensure that unauthorized users *cannot* see the sensitive userIDs and passwords of the target and Recovery Catalog databases.

If a single Oracle instance has multiple RMAN scripts associated with it (for example, to perform tablespace-level or file-level, full or incremental backups, and so on), the database administrator might choose to place the two common **connect** commands in a single file and invoke those two **connects** in all RMAN scripts using the @ command. In this case, the single file containing the two **connect** commands needs to be guarded carefully.

Testing RMAN Backup Scripts

When you have finished creating a scheduled backup RMAN script, run a test to troubleshoot the script before using it for your scheduled backups.

You can test-run the RMAN script using one of the following types of commands, where *script-name* is the script file pathname:

```
% rman cmdfile 'script-name'
```

or

```
% rman nocatalog cmdfile 'script-name'
```

Step 2: Customizing the nsrnm0 Script

You must customize the **nsrnm0** script on the Oracle host by modifying the environment variables in the script.

The NetWorker Module for Oracle installation on the Oracle host stores a sample **nsrnm0** script in the same directory as the NetWorker executables. The sample script filename is *nsrnm0* on UNIX and *nsrnm0.bat* on Windows.



Important: On UNIX, the NetWorker Module for Oracle installation also stores a template of the script in the file */etc/nsrnm0.sh*. Do not modify this file. On Windows, you should also save a copy of the original *nsrnm0.bat* file before modifying it.

You can create multiple versions of the **nsrnm0** script (for example, one for each Oracle instance) on the same Oracle host. Each version of the script must have a *unique* name, starting with the letters *nsr* or *save* and, on Windows, ending in *.bat* or *.cmd*.

To create a new version of the **nsrnm0** script, copy the sample script file (*nsrnm0* on UNIX or *nsrnm0.bat* on Windows) to a file with a different name and customize the environment variables in this new file. For example, you might create the file named *nsrnm0_prodDB* on UNIX or *nsrnm02.bat* on Windows.

All versions of the **nsrnm0** script must be located in the same directory as the NetWorker executables. Do *not* move the **nsrnm0** script(s) to a different directory.

The sample **nsrnm** script installed with NetWorker Module for Oracle contains seven environment variables, which you must customize for your particular scheduled Oracle backup. The variables are all initially *undefined* in the sample **nsrnm** script.

The environment variables `ORACLE_HOME` and `PATH` are *mandatory* for each scheduled backup; you *must* set them in the **nsrnm** script. The other five environment variables are *optional*; you can leave them undefined in the script, if desired.

In addition, if you wish the Oracle environment variable `TNS_ADMIN` to be in effect during a scheduled Oracle backup, you must add lines to define and export the `TNS_ADMIN` variable in the **nsrnm** script.

[Table 6 on page 149](#) includes a summary of all the environment variables that you can set in the **nsrnm** script for scheduled backups. You can also refer to the comments in the **nsrnm** script file itself for details on the variables.

The environment variables in the **nsrnm** script are described as follows:

- “`ORACLE_HOME`” immediately following this section
- “`PATH`” on [page 96](#)
- “`LD_LIBRARY_PATH`” on [page 96](#)
- “`NSR_RMAN_ARGUMENTS`” on [page 96](#)
- “`NSR_SB_DEBUG_FILE`” on [page 97](#)
- “`PRECMD`” on [page 97](#)
- “`POSTCMD`” on [page 99](#)
- “`TNS_ADMIN`” on [page 100](#)

ORACLE_HOME

This environment variable is *mandatory* for each scheduled backup. Set `ORACLE_HOME` in the **nsrnm** script file to the home directory of the Oracle Server installation. The RMAN executable (**rman** or **rman80**) must be located in the subdirectory *bin* of `$ORACLE_HOME`.

For example, if the Oracle Server installation is located in the directory `/disk3/oracle/app/oracle/product/8.0.4`, you must set `ORACLE_HOME` in the **nsrnm** script as follows:

```
ORACLE_HOME=/disk3/oracle/app/oracle/product/8.0.4
```

PATH

This environment variable is *mandatory* for each scheduled backup. Set PATH in the **nsrnm0** script file to include the directory containing the NetWorker Module for Oracle program **nsrnm0start** on your Oracle host. This directory also contains the NetWorker executables.

For example, if the program **nsrnm0start** is located in the directory `/usr/bin` on your Oracle host, you must set PATH in the **nsrnm0** script to the following type of value:

```
PATH=/usr/bin
```

LD_LIBRARY_PATH

This environment variable is *mandatory* for scheduled backups *on SGI and Tru64 UNIX only*. Set LD_LIBRARY_PATH in the **nsrnm0** script file to the directory containing the Oracle libraries, typically `$ORACLE_HOME/lib`.

For example, if the Oracle libraries are located in the directory `/disk3/oracle/app/oracle/product/8.0.4/lib` on your SGI system, you must set LD_LIBRARY_PATH in the **nsrnm0** script as follows:

```
LD_LIBRARY_PATH=/disk3/oracle/app/oracle/product/8.0.4/lib
```

Uncomment the line “`export LD_LIBRARY_PATH`” (by removing the # symbol from the start of the line) under the function heading “`export_environment_variables()`” in the **nsrnm0** script:

```
export_environment_variables()  
{  
export ORACLE_HOME  
export NSR_RMAN_ARGUMENTS  
:  
:  
export LD_LIBRARY_PATH  
}
```

NSR_RMAN_ARGUMENTS

This environment variable is *optional* for scheduled backups. If desired, you can set NSR_RMAN_ARGUMENTS to a double-quoted string containing any valid combination of parameters for the RMAN executable, **rman** or **rman80**.

For example, if you wish to use a Recovery Catalog and append RMAN output to the message log file `C:\win32app\nsr\applogs\msglog.log`, you can set `NSR_RMAN_ARGUMENTS` in the `nsrnm` script as follows:

```
NSR_RMAN_ARGUMENTS="msglog  
'C:\win32app\nsr\applogs\msglog.log' append"
```

If you are not using a Recovery Catalog and you wish to append RMAN output to the message log file `C:\win32app\nsr\applogs\msglog.log`, you can set `NSR_RMAN_ARGUMENTS` in the `nsrnm` script as follows:

```
NSR_RMAN_ARGUMENTS="nocatalog msglog  
'C:\win32app\nsr\applogs\msglog.log' append"
```

NSR_SB_DEBUG_FILE

This environment variable is *optional* for a scheduled backup. You can set `NSR_SB_DEBUG_FILE` to the name of the file to receive detailed debugging information for the scheduled backup. This file will exclude RMAN-specific debugging information, which is directed to `NSR_DEBUG_FILE` (if set in the RMAN script). For details on `NSR_DEBUG_FILE`, see [page 147](#).

For example, if you wish to send detailed debugging information for the scheduled backup to the file `/nsr/applogs/nsrnm.log`, you can set `NSR_SB_DEBUG_FILE` in the `nsrnm` script as follows:

```
NSR_SB_DEBUG_FILE=/nsr/applogs/nsrnm.log
```

PRECMD

This environment variable is *optional*. You can set `PRECMD` to the full pathname of a file containing a preprocessing script to be executed before the RMAN backup script. If the pre-command script fails (returns a nonzero value), the scheduled Oracle backup does not proceed (that is, the RMAN script is not executed).



Important: The script file must have permissions allowing execution by the root user, as the scheduled Oracle backup is always launched by root. The script should return a zero value when it succeeds and a nonzero value when it fails. The return of a nonzero value will cause the scheduled backup to fail.

Step 2: Customizing the nsrnm0 Script

An example of a preprocessing script for UNIX is shown as follows. This script is stored in the file whose full pathname is specified in the PRECMD variable in the **nsrnm0** script. This example script shuts down the Oracle database, presumably for an offline database backup. The **su** command is required in the script since the **nsrnm0** script runs as root user.

```
#!/bin/ksh
# Define Site Specifics Here
TARGET_DATABASE=orcl84
ERRFILE=/tmp/precmd.log
ORACLE_USER=oracle84
#
# Scheduled backup launches as "root" run PRECMD as
oracle user
su - $ORACLE_USER -c "{
# Shutdown target database and start in maintenance mode
export ORACLE_SID=$TARGET_DATABASE
svrmgrl <<EOF1 > $ERRFILE
connect internal
shutdown
startup mount
exit
EOF1
}"
# Do checking as root since "su" will always return its
status
export status
# Define status otherwise it is local to if [] statement
status=0
# Scan file for errors and only return true or false
grep -e error -e warning -e fatal $ERRFILE > /dev/null
2>&1
if [ $? -eq 0 ]; then
status=1
else
status=0
fi
exit $status
```

POSTCMD

This environment variable is *optional*. You can set POSTCMD to the full pathname of a file containing a post-processing script to be executed after the RMAN backup script. If the RMAN backup script fails, the failure is reported, and the post-processing script is executed nevertheless. If the post-processing script fails, an error message is reported.



Important: The script file must have permissions allowing execution by the root user, as the scheduled Oracle backup is always launched by root. The script should return a zero value when it succeeds and a nonzero value when it fails.

An example of a post-processing script for UNIX is shown as follows. This script is stored in the file whose full pathname is specified in the POSTCMD variable in the **nsrnm0** script. This example script starts up the Oracle database, presumably after an offline backup. The **su** command is required in the script since the **nsrnm0** script runs as root user.

```
#!/bin/ksh
# Define Site Specifics Here
TARGET_DATABASE=orcl84
ERRFILE=/tmp/postcmd.log
ORACLE_USER=oracle84

#
# Scheduled backup launches as "root" run POSTCMD as
user oracle84
su - $ORACLE_USER -c "{
# Mount target database as ready for use
export ORACLE_SID=$TARGET_DATABASE
svrmgrl <<EOF > $ERRFILE
connect internal
alter database open;
exit
EOF
}"
# Do checking as root since "su" will always return its
status
export status
# Define status otherwise it is local to if [] statement
status=0
```

Step 2: Customizing the nsrnm0 Script

```
# Scan file for errors and only return true or false
grep -e ORA- -e error -e warning -e fatal $ERRFILE >
/dev/null 2>&1
if [ $? -eq 0 ]; then
status=1
else
status=0
fi
exit $status
```

TNS_ADMIN

If the Oracle Net8 configuration files are located in a directory other than the default directory `$ORACLE_HOME/network/admin`, you must add the definition of the environment variable `TNS_ADMIN` to the `nsrnm0` script.

In this case, add a line to the `nsrnm0` script to set the value of `TNS_ADMIN` to the pathname of the directory containing the Oracle Net8 configuration files. Add this line *above* the function heading `export_environment_variables()` as shown below. Also, add another line *below* the function heading `export_environment_variables()`, to export the `TNS_ADMIN` variable as shown below.

For example, if the Oracle Net8 configuration files are located in the directory `/disk3/oracle/app/oracle/product/8.0.4/network/admin1`, you must add the lines to define and export `TNS_ADMIN` in the `nsrnm0` script as follows:

```
TNS_ADMIN=/disk3/oracle/app/oracle/product/8.0.4/
network/admin1

export_environment_variables()
{
export ORACLE_HOME
export NSR_RMAN_ARGUMENTS
:
:
export TNS_ADMIN
}
```

Step 3: Configuring a Backup Schedule

NetWorker uses backup schedules to automate its scheduled backups. The NetWorker Administrator GUI provides a graphical calendar for configuring the schedule resource, in which you can specify the days of the week to run a scheduled Oracle backup.

NetWorker provides several preconfigured schedules. You can create, modify, and remove both the preconfigured schedules and your own schedules. For details on how to do this, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.



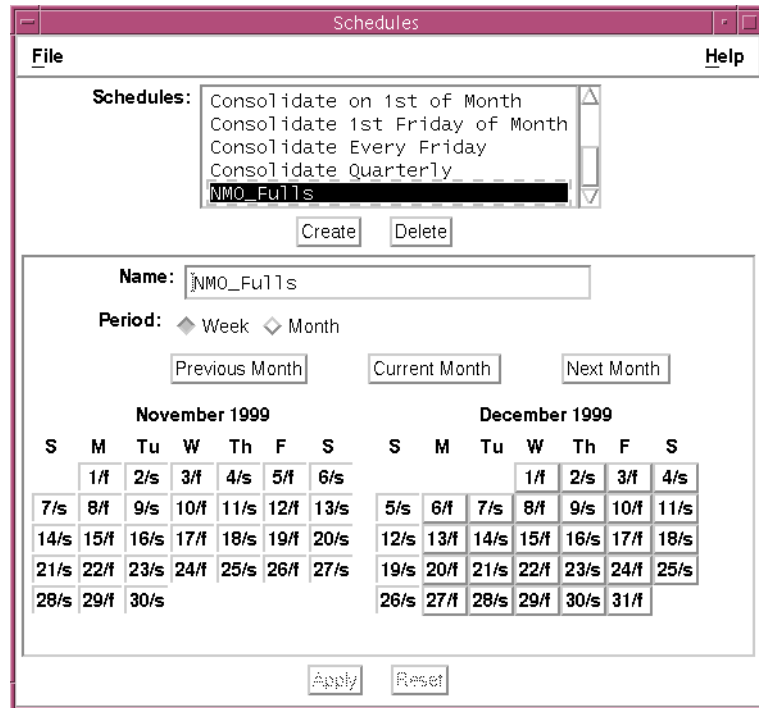
Important: For your scheduled Oracle backups, the NetWorker backup levels that appear in the NetWorker schedule resource do *not* determine the Oracle backup levels. The level of the Oracle backup is set in the RMAN backup script.

*You must specify the level of the Oracle backup as either full or incremental in the RMAN backup script. Enter the RMAN script name in the *Save set* field of the client resource as explained in [“Step 5: Client Resource for a Scheduled Backup”](#) on page 104.*

You must customize a NetWorker schedule resource for your Oracle backup. In the schedule resource, select a level for each day of the week. Level full, incremental, or level 1 to 9 specifies that NetWorker run the RMAN backup script on that day. Level *skip* specifies that NetWorker *not* run the backup script on that day. Enter the name of the NetWorker schedule in the *Schedule* field of the client resource as explained in [“Step 5: Client Resource for a Scheduled Backup”](#) on page 104.

Figure 21 shows a customized Oracle backup schedule configured on a UNIX NetWorker server. This schedule, *NMO_Fulls*, specifies that the Oracle backup run every Monday, Wednesday, and Friday. The actual Oracle backup level (full or incremental) is specified in the RMAN backup script.

Figure 21. Customized NetWorker Schedule for Oracle Backups



5

Step 4: Configuring a Backup Group

A NetWorker backup group is a set of NetWorker client resources, all of which start backing up data at a specified time (once you enable the Autostart feature in the group resource). You can assign one or more client resources configured for the Oracle Server host to a NetWorker backup group.

NetWorker provides a preconfigured backup group named Default with the following settings:

- Autostart = Disabled
- Start time = 3:33
- Client retries = 1
- Clones = No
- Clone pool = Default Clone

You can create, modify, and remove other NetWorker backup groups. You cannot remove the Default group, but you can modify it. If you want to use the Default group for testing your scheduled Oracle backups, change its *Autostart* attribute to *Enabled*.

Eventually, you will probably need to create your own backup group(s) for your scheduled Oracle backup(s). For details on how to configure a NetWorker backup group, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.



Important: Enable the *Autostart* attribute in the backup group for a scheduled Oracle backup. Otherwise, the scheduled backup will never occur.

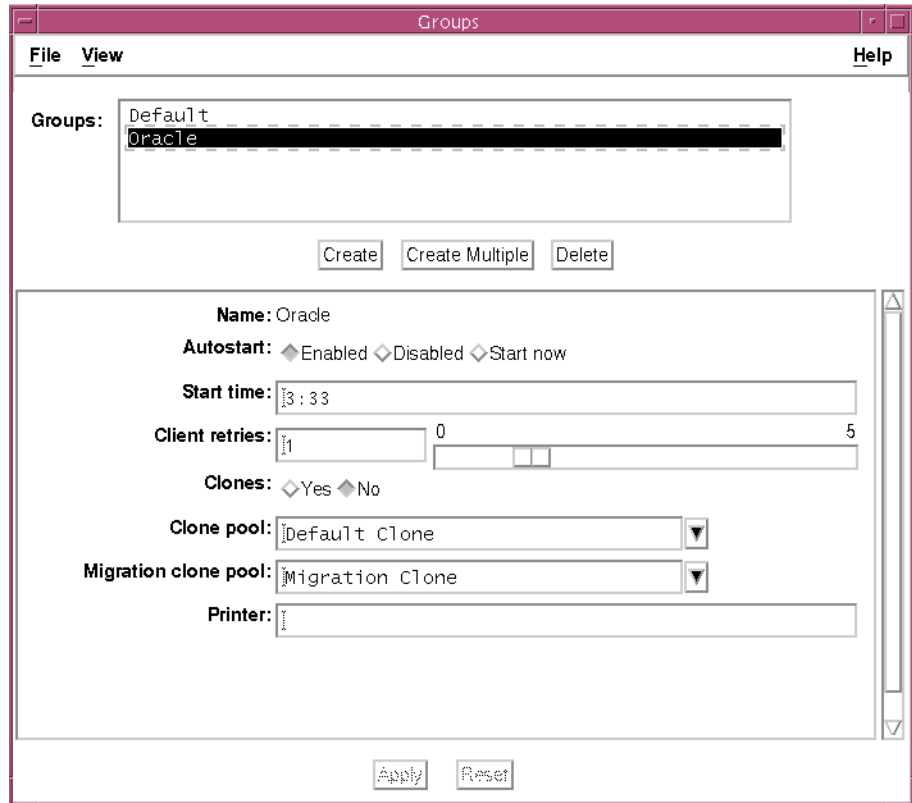
By configuring one or more NetWorker backup groups for scheduled Oracle backups, you can distribute the backups to alleviate network traffic and schedule the backups for a time of day when performance demands on your database and NetWorker server are lower.

[Figure 22](#) shows a customized Oracle backup group resource configured on a UNIX NetWorker server. The NetWorker clients belonging to this group will start the scheduled backup at 3:33 a.m.

Note: To have a scheduled Oracle backup automatically use a volume pool associated with the backup group, set the `NSR_GROUP` environment variable in the RMAN backup script.

For more information on setting the `NSR_GROUP` variable, see the information about `NSR_GROUP` on [page 92](#) and on [page 147](#).

Figure 22. Customized NetWorker Group for Oracle Backups



5

Step 5: Client Resource for a Scheduled Backup

At this point, it is assumed that you have configured a basic client resource for the Oracle Server using the instructions in [“Step 4: Client Resource” on page 57](#). This basic client resource is required for running manual Oracle backups. For details on manual Oracle backups, see [“Chapter 4: Manual Oracle Backups”](#).

For scheduled Oracle backups, you must specify additional attributes in the client resource for the Oracle Server.

To complete the client resource configuration for scheduled Oracle backups:

1. Run the NetWorker Administrator GUI as an administrative user and open the Clients window. For details on how to open the Clients window, see [“Step 4: Client Resource”](#) on page 57.
2. Enter the complete pathname of each RMAN script to be used for a scheduled backup in the *Save set* list. For example, if you create two separate RMAN backup scripts in the files `/disk/rman_scripts/online1` and `/disk/rman_scripts/online2` (to be run by the same `nsrnmno` script specified in [step 5](#)), enter the complete file pathnames in the *Save set* list:

```
/disk/rman_scripts/online1
```

```
/disk/rman_scripts/online2
```

For details on creating the RMAN backup script, see [“Step 1: Creating RMAN Backup Scripts”](#) on page 91.

3. Select a NetWorker schedule. For details on NetWorker backup schedules, see [“Step 3: Configuring a Backup Schedule”](#) on page 101.
4. Select a NetWorker group. For details on NetWorker backup groups, see [“Step 4: Configuring a Backup Group”](#) on page 102.
5. Enter the name of a single customized `nsrnmno` script (see [step 2](#)) in the *Backup command* field. For example, this could be `nsrnmno` or `nsrnmno_prodDB` on UNIX or `nsrnmno.bat` or `nsrnmno2.bat` on Windows.
6. Specify all known aliases for the Oracle Server host.
7. Leave the *Directive*, *Archive users*, *Remote user*, and *Password* fields blank. Leave the *Remote access* field unmodified if you are not backing up from a cluster or if you do not wish to recover to a host other than the one being backed up.
8. Save the client resource.



Important: Each Oracle installation (having a different `ORACLE_HOME`) requires a separate NetWorker client resource because the *Backup command* field of the client resource can contain only one `nsrnmno` script name and `ORACLE_HOME` is a mandatory variable for each `nsrnmno` script.

If multiple RMAN scripts are specified in the *Save set* list of the client resource, these RMAN scripts are executed in arbitrary order, possibly in parallel.

Step 5: Client Resource for a Scheduled Backup

If multiple RMAN scripts are specified in the *Save set* list of the client resource and the **nsrnm0** script contains a well-defined PRECMD and/or POSTCMD variable, the pre-command and post-command files will be:

- Common for all the RMAN scripts
- Executed once for each RMAN script

The sequence of execution of the “pre-command–RMAN script–post-command” triplets is arbitrary. Therefore, if you want to include pre- and post-processing with the backups of the various Oracle database instances of an Oracle installation, you might prefer to define a separate NetWorker client resource for each Oracle instance.

Note: If a scheduled Oracle backup is retried, the specified pre- and post-commands will be executed again for that backup.

To send an e-mail notification of the scheduled backup results to the owner of a save set, use the “view details” option on UNIX or “expert mode” on Windows to edit the client resource for the Oracle Server (or Oracle instance). Edit the Owner notification attribute and enter a notification command directed to the login ID of the owner, for example: `/usr/bin/mail -s “jupiter-mars-venus backup” jdoe`.

For details on how to configure a NetWorker client for scheduled backups, refer to the *Legato NetWorker Administrator’s Guide*.

Figure 23 shows a UNIX client resource configured for scheduled Oracle backups. Figure 24 shows a Windows client resource, with the Remote tab displaying the required *Backup command* field.

Figure 23. Oracle Client Resource in UNIX NetWorker Server

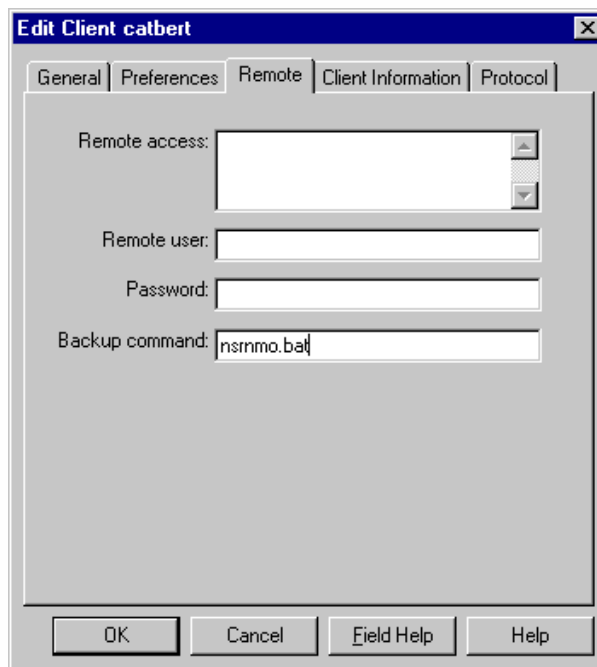
The screenshot shows the 'Clients' window in the UNIX NetWorker Server. The window title is 'Clients'. It has a menu bar with 'File', 'View', and 'Help'. Below the menu bar, there is a list of clients: 'catbert2' (selected) and 'sonoma'. Below the list are three buttons: 'Create', 'Create Multiple', and 'Delete'.

The configuration details for the selected client 'catbert2' are as follows:

- Name:** catbert2
- Server:** catbert2
- Archive services:** Enabled Disabled
- Schedule:** NMO_Full1s
- Browse policy:** Month
- Retention policy:** Year
- Directive:** [empty]
- Group:** Default Oracle
- Save set:** /disk/rman_scripts/online1
/disk/rman_scripts/online1
/disk/rman_scripts/online2
- Remote access:** [empty]
- Remote user:** [empty]
- Password:** [empty]
- Backup command:** nsrnm0

At the bottom of the window are two buttons: 'Apply' and 'Reset'.

Figure 24. Oracle Client Resource in Windows NetWorker Server



5

Testing Scheduled Backups

As mentioned in [“Testing RMAN Backup Scripts” on page 94](#), you should run a test of the RMAN script you create for a scheduled Oracle backup.

After you have finished setting up your NetWorker Module for Oracle environment for scheduled backups of the Oracle Server, you should also run a test scheduled backup manually using the NetWorker Administrator GUI.

All the required environment variables must be set in the `nsrnmobat` and RMAN scripts, the (optional) pre- and post-processing scripts must be in place, and the NetWorker server and Oracle Server must be correctly configured as described in the preceding sections of this chapter.

Then, you can run a test of your scheduled Oracle backup:

1. Run the NetWorker Administrator GUI as an administrative user on the NetWorker server. For more information, see [“Using the NetWorker Administrator GUI” on page 38](#).

2. On UNIX, select Group Control from the Server menu to open the Group Control window. On Windows, open the Groups window. For more information on the NetWorker Administrator GUI, refer to the *Legato NetWorker Administrator's Guide* for your particular NetWorker server platform.
3. In the Group Control window on UNIX or the Groups window on Windows, highlight the correct Group name for the scheduled Oracle backup. In the Group Control window, click Start. On Windows, click the appropriate button in the NetWorker Administrator program toolbar.



Important: For important information on how to stop the scheduled Oracle backup, see [“Stopping Scheduled Backups” on page 109](#).

4. When the Status of the selected group changes to Finished, the scheduled backup is complete. An e-mail “savegroup completion” message provides a report of the scheduled backup.

Error Messages for Scheduled Backups

If the scheduled backup fails, you receive an error message. To obtain more details from the NetWorker Administrator GUI, select Server>Group Control>Details.

For additional debugging information, set the environment variable `NSR_SB_DEBUG_FILE` in the `nsrnm` script. For more details on this variable, see [“NSR_SB_DEBUG_FILE” on page 97](#).

If the scheduling portion of your scheduled Oracle backup succeeds but the actual backup fails, you might receive error messages and debugging information in the locations described in [“Diagnostic and Error Messages for Manual Backups” on page 86](#). You must specify the RMAN parameter `msglog` in the `NSR_RMAN_ARGUMENTS` variable of the `nsrnm` script.

Stopping Scheduled Backups

NetWorker Module for Oracle does *not* currently support use of the Stop button in the NetWorker Administrator program for stopping scheduled Oracle backups. Although the progress message might indicate that the backup has exited prematurely (before finishing), the NetWorker Module for Oracle processes might still be running on the Oracle Server host.

To stop a *running* scheduled Oracle backup, you must interrupt the running **rman** process on the Oracle Server host.

To stop a *hung* scheduled Oracle backup, you must follow the procedure outlined in [“Cancelling RMAN Backups” on page 84](#).

Monitoring Scheduled Oracle Backups

You can monitor scheduled Oracle backups the same way you monitor manual Oracle backups. For more details, see [“Monitoring Manual Oracle Backups” on page 85](#).

In addition, you can monitor messages appearing in the Group Control window of the NetWorker Administrator GUI and review the report generated upon completion of the scheduled Oracle backup. For more details, refer to the *Legato NetWorker Administrator’s Guide* for your particular NetWorker server platform.

Chapter 6: Restoring Oracle Data

This chapter provides details on setting up and running Oracle data restore operations. NetWorker Module for Oracle enables you to run Oracle restores using either the Recovery Manager (RMAN) command line interface or the Oracle Enterprise Manager (OEM) Backup Management Tools.

This chapter also describes the basic procedures for recovering the Oracle database to a consistent state. See [“Disaster Recovery” on page 117](#) for different disaster recovery scenarios and information on preparing for disaster recovery.

This chapter contains the following sections:

- [“Preparing to Restore Data” on page 112](#)
- [“Restore Versus Recover” on page 112](#)
- [“Determining the Problem” on page 113](#)
- [“Roadmap for Oracle Data Recovery” on page 113](#)
- [“Step 1: Creating RMAN Restore Scripts” on page 114](#)
- [“Step 2: Running Oracle Restores” on page 115](#)
- [“Using the OEM Backup Management Tools” on page 116](#)
- [“Restoring to a Different Host” on page 116](#)
- [“Restoring the Recovery Catalog Database” on page 117](#)
- [“Disaster Recovery” on page 117](#)

Preparing to Restore Data

During an Oracle backup, the NetWorker server adds entries for the backup to the online client index and media index files. These entries provide information needed for restoring every Oracle data object backed up.

- To the client index, NetWorker adds information about the specific Oracle data backed up for the client.
- To the media index, NetWorker adds information about the location of each backup volume and the Oracle data written to the volume.

The client index entry is maintained until the browse policy expires in the NetWorker client resource configured for the Oracle Server. The media index entry is maintained until the retention policy expires in the client resource.

When the browse and retention policies for all the save sets on a backup volume expire, the volume becomes recyclable and eligible for automatic relabeling by NetWorker. When a volume is relabeled, the data on the volume becomes inaccessible and can no longer be restored.

For more information on how NetWorker uses browse and retention policies to manage Oracle backup data and track the location and status of the data on backup volumes, see [“NetWorker and NetWorker Module for Oracle Operations” on page 34](#).

[“NetWorker Server Bootstrap Backup” on page 82](#) describes how NetWorker automatically backs up the NetWorker server bootstrap and client indexes after each *scheduled* Oracle backup. You need to *manually* back up the bootstrap and client indexes after a manual Oracle backup. The bootstrap backup is essential for disaster recovery preparation.

Restore Versus Recover

Oracle makes a distinction between *restoring* and *recovering* a database. In Oracle terminology, to *restore* means to replace individual database files from backup media, whereas to *recover* means to apply redo logs in rolling forward the redo log transactions and making the database consistent. By contrast, NetWorker uses the term *recover* for all retrieval activities, as distinguished from the UNIX **restore** command. This chapter follows the Oracle terminology.

NetWorker Module for Oracle provides a means for RMAN to *restore* Oracle data (for example, Oracle instances or individual database objects) backed up by NetWorker to your Oracle Server. After you have restored Oracle data using RMAN, you must apply the redo logs to *recover* your target database through the standard Oracle recovery process.

You must always restore Oracle data using RMAN according to the instructions in [“Roadmap for Oracle Data Recovery”](#) on page 113. Oracle restores through the NetWorker server interface are *not* supported.

Determining the Problem

The first sign of a disk crash will usually be an I/O error. Oracle will usually document the I/O error in the trace file and in the alert log.

If only one database file is affected, your database may have encountered a bad spot on the disk. This can be circumvented by reformatting the disk to make a new list of bad blocks. However, this can be time-consuming, so it is prudent to have a spare disk available to swap in while you reformat.

If several database files are affected, all on the same disk, you could have a disk controller problem or a disk head crash. A bad controller can be replaced, and data on the disk will often be in perfect shape. But after a head crash, you will need to use that spare disk as a replacement.

Keep an extra disk on hand as a “hot spare,” in case a disk failure occurs. Format it and verify that it works. If a disk failure does occur, it is much faster to use a spare disk than it is to rename database files and update the control file accordingly.

Roadmap for Oracle Data Recovery

You will only be able to restore Oracle data that has been backed up according to the instructions in [“Chapter 4: Manual Oracle Backups”](#) or [“Chapter 5: Scheduled Oracle Backups”](#).



Important: For NetWorker Module for Oracle, when working with the NetWorker 6.0 server, the *oracle owner* name must appear in the Administrator list in the server resource configured on the NetWorker server. For more information on adding this name to the Administrator list, see [page 56](#).

Step 1: Creating RMAN Restore Scripts

To recover your target Oracle database when one or more files of the database are damaged:

1. Perform the Oracle data *restore* operation using either the RMAN command line interface or the OEM Backup Management Tools:
 - To use the RMAN command line interface for the Oracle restore:
 - a. Create the restore script to be used by RMAN for running the Oracle restore. For details, see [“Step 1: Creating RMAN Restore Scripts” on page 114](#).
 - b. Run the Oracle restore using the RMAN command line interface. For details, see [“Step 2: Running Oracle Restores” on page 115](#).
 - To use the OEM Backup Management Tools for the Oracle restore operation, see [“Using the OEM Backup Management Tools” on page 116](#).
2. Complete the Oracle database *recovery* operation. You can perform the recovery either using an RMAN restore script or after the RMAN restore script has completed successfully. For more information, refer to your Oracle documentation.

See [“Restoring to a Different Host” on page 116](#) for a description of how to restore your Oracle database to a different system from the one where it was originally backed up.

Step 1: Creating RMAN Restore Scripts

You must create an appropriate RMAN script to perform the desired type of Oracle restore operation on an Oracle8 or Oracle8i system.

You can store your Oracle restore scripts as flat ASCII files. Alternatively, if you are using a Recovery Catalog, you can store your restore scripts in the Recovery Catalog database. For more information on storing the restore scripts in the Recovery Catalog database, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User’s Guide and Reference*.

For example, the following RMAN script performs an Oracle8 or Oracle8i restore of an Oracle tablespace, using the (remote) NetWorker server *mars.legato.com*. The Oracle data is restored to the NetWorker client *jupiter.legato.com*.

```
run {  
    allocate channel t1 type 'SBT_TAPE'  
    parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_CLIENT=jupiter.legato.com)';
```

```

allocate channel t2 type 'SBT_TAPE'
parms 'ENV=(NSR_SERVER=mars.legato.com,
NSR_CLIENT=jupiter.legato.com)';

sql 'alter tablespace users offline immediate';

restore (tablespace users);

sql 'alter tablespace users online';

release channel t1;

release channel t2;

}

```

All the information in [“Step 1: Creating RMAN Backup Scripts” on page 79](#) about using the **allocate channel** command and setting the NSR_ environment variables in the RMAN backup script also applies to RMAN restore scripts.

Step 2: Running Oracle Restores

Chapter 3 explains how to configure Oracle and NetWorker for Oracle backup and recover operations.

After applying the information in Chapter 3, the NetWorker server should have the required server, client, device, and volume pool resources configured. The volume required for the restore operation should be mounted in a configured backup device, or—if auto media management is enabled for a tape device or autochanger—the tape loaded in the tape device or autochanger for NetWorker to use automatically.

The Oracle Server should also have the TNS Listener (you will most probably use one) configured. If you will be using a Recovery Catalog, you should have the Recovery Catalog set up and the target database registered.

With these configurations in place, the appropriate RMAN restore script must be ready for use as described in [“Step 1: Creating RMAN Restore Scripts” on page 114](#). Then, you can start an Oracle data restore using the RMAN command line interface on the Oracle Server.

For example, if the RMAN restore script on [page 114](#) is stored in the file */disk1/scripts/restore.txt* on a UNIX Oracle Server and the TNS Listener has been configured to connect to the databases *payroll* and *rcvcatdb*, you can run the Oracle restore using the following command:

```

% rman target internal/oracle@payroll rcvcat
rman/rman@rcvcatdb cmdfile
\'/disk1/scripts/restore.txt\'

```

On Windows, the command to run the RMAN script is either **rman80** (Oracle 8.0.x) or **rman** (Oracle 8.1.x). For more information on the command line options available with the **rman** or **rman80** command, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Using the OEM Backup Management Tools

You can use the Oracle Enterprise Manager (OEM) Backup Management Tools instead of the RMAN command line interface to start an Oracle restore operation. The OEM Backup Management Tools include a graphical user interface to RMAN that enables you to perform restore operations through a point-and-click method.

The OEM Backup Management Tools provide a much simpler interface for running Oracle restores. In Oracle8 and Oracle8i, the OEM Backup Management Tools generate the required RMAN commands.

For information on how to use the OEM Backup Management Tools, refer to the Oracle Enterprise Manager documentation included with your product kit.

Restoring to a Different Host

In some circumstances, you might need to restore your database to a different system from the one where it was originally backed up.

To restore your Oracle database to a secondary system:

1. Install and configure NetWorker Module for Oracle on the secondary system where you will be restoring the Oracle data.
2. Install and configure RMAN on the secondary system.
3. Create an appropriate RMAN script for the restore operation.
4. In the RMAN script, set the `NSR_SERVER` environment variable to specify the name of the NetWorker server.
5. In the RMAN script, set the `NSR_CLIENT` environment variable to either the name of the NetWorker client that was backed up or the value of `NSR_CLIENT` used during the backup.
6. Use the appropriate RMAN command to run the script to restore the Oracle database file(s).



Important: If you believe that you might need to restore a database to a secondary system, you should install and configure both NetWorker Module for Oracle and RMAN on the secondary system well in advance.

Restoring the Recovery Catalog Database

If you use a Recovery Catalog for backups, the loss of that Recovery Catalog can be disastrous for the successful restore of the target database.

As part of your Oracle backup strategy, you should back up your Recovery Catalog frequently. For details, refer to the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Disaster Recovery

You can use NetWorker to recover from different types of disasters on your NetWorker server. The degree of data loss during a disaster can range from one or more files lost when a disk crashes, to an entire computer system. The degree of severity of the disaster determines the procedures you need to perform to recover data on your NetWorker server.

The *Legato NetWorker Disaster Recovery Guide* explains how to recover the NetWorker server from various types of disasters. You can access the *Disaster Recovery Guide* on the Legato web site. For more information on how to access the guide, see [“Product Documentation” on page 14](#).

The Oracle *Backup and Recovery Guide* and *Oracle8i Recovery Manager User's Guide and Reference* contain information on how to prepare for a disaster recovery of your Oracle database.

It is important to develop a plan for recovering from a disaster on your computer system. You need to back up important data on a daily basis. You also need to develop and test a plan for recovering your data should you experience a disk crash or loss of data. The more time and effort you invest in creating and testing your disaster recovery plan, the better prepared you will be for a possible disaster.

With respect to NetWorker backups, recall that the bootstrap is a critical file, backed up only after *scheduled* Oracle backups. If you perform only manual Oracle backups, you should back up the bootstrap and client index manually. For more information, see [“NetWorker Server Bootstrap Backup” on page 82](#).

Along with the bootstrap information, keep accurate records of your network and system configurations, and maintain all your original software in a safe location. For a comprehensive disaster recovery, you need the following items:

- Original operating system media and patches
- Original NetWorker media
- Device drivers and media device names
- Filesystem configuration
- IP addresses and hostnames
- Bootstrap information

With respect to Oracle backups, recall that certain Oracle files such as *initoracle_sid.ora* are *not* backed up by RMAN. You should back up such files manually. For example, you can back up the files using the NetWorker client installed on the Oracle Server host.

Chapter 7: Cluster and OPS Systems

Before beginning this chapter, be sure you have properly installed NetWorker Module for Oracle on the Oracle Server system according to the procedures in the latest *Legato NetWorker Module for Oracle Installation Guide*.

Also, be sure you have followed the steps in the section [“Basic Configuration Roadmap” on page 50](#) to complete the basic configuration of the Oracle Server and NetWorker systems.

This chapter details the support provided with the latest release of NetWorker Module for Oracle for cluster and Oracle Parallel Server (OPS) systems. The following sections describe the configuration procedures required to enable NetWorker Module for Oracle operations on the supported types of cluster and OPS systems.

This chapter contains the following sections:

- [“Cluster Support”](#) immediately below
- [“OPS Support” on page 122](#)

Cluster Support

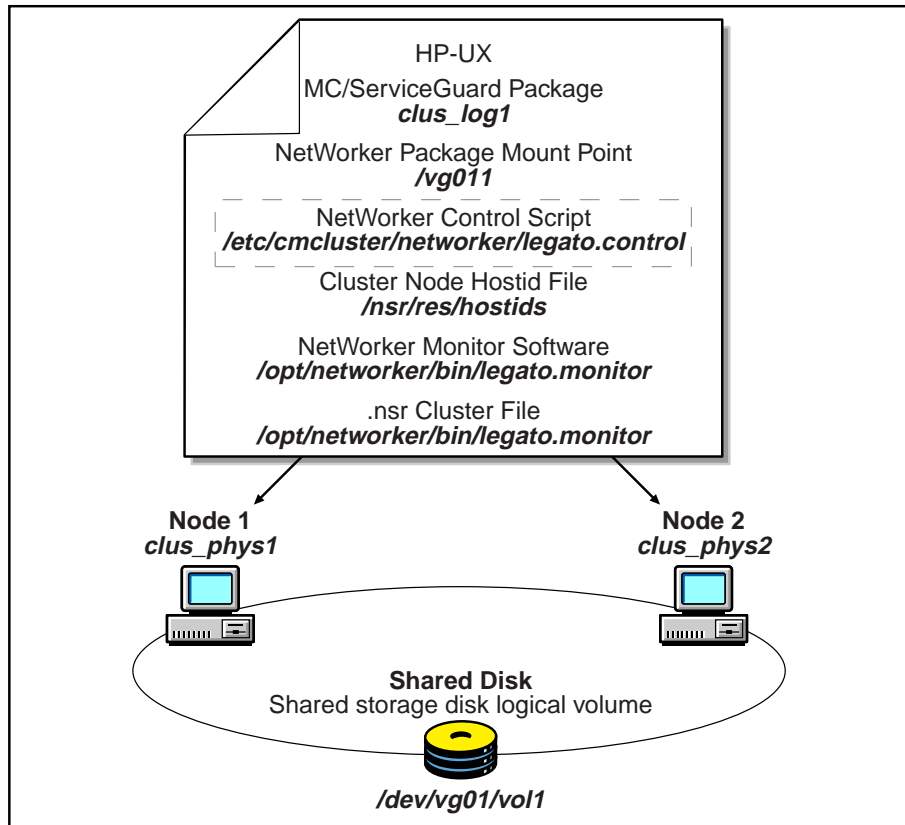
NetWorker Module for Oracle supports cluster environments. NetWorker Module for Oracle enables you to recover Oracle data to any physical node in a cluster system, regardless of which physical node was originally backed up.

A cluster system typically includes multiple nodes connected by a shared SCSI bus to which common storage is attached. In a cluster system, you can define cluster services such as disk services and assign those services their own Internet Protocol (IP) addresses and names. The services and their associated storage can migrate for failover between the physical nodes in the cluster.

NetWorker treats each cluster service as an independent client and stores the associated indexes under the name of the service. After properly configuring a cluster service as a NetWorker client, you can use NetWorker Module for Oracle in conjunction with NetWorker to back up and restore the storage associated with the service, independent of the actual node that provides the service.

Figure 25 shows a typical cluster configuration on HP-UX.

Figure 25. HP-UX Cluster System



Follow the configuration steps outlined in the “[Cluster Configuration Roadmap](#)” below to enable Oracle backup and restore operations using NetWorker Module for Oracle on a cluster system.

Cluster Configuration Roadmap

NetWorker Module for Oracle and NetWorker can together back up and restore an Oracle database configured on cluster disk services. You must complete the configuration of the NetWorker server and Oracle Server before you can use the NetWorker Module for Oracle with NetWorker for Oracle backup and restore operations in a cluster system.



Important: For NetWorker Module for Oracle, when working with the NetWorker 6.0 server, the *oracle owner* name must appear in the Administrator list in the server resource configured on the NetWorker server. For more information on adding this name to the Administrator list, see [page 56](#).

To properly configure Oracle backup and restore operations with NetWorker Module for Oracle on a cluster system:

1. Configure the storage for the database as a cluster disk service. For details, refer to the appropriate cluster administration guide from your particular cluster software vendor.
2. Configure a client resource on the NetWorker server for the cluster disk service and each physical host that you will use to run backups and restores. In each client resource, use the fully qualified IP name as the client name. For details on how to configure a client resource, see “[Step 4: Client Resource](#)” on [page 57](#).
3. Set the NSR_CLIENT environment variable to an appropriate value.

Setting NSR_CLIENT on a Cluster System

During an Oracle backup, the NetWorker server creates entries about the backed up data in the online client index file. During an Oracle restore, the data is retrieved by first searching this client index file.

The NSR_CLIENT environment variable provides the following information to the NetWorker server:

- During a backup, the name of the client whose index file should be used to record the backup information.
- During a restore, the name of the client whose index file should be used to search for the save set to be restored.

If NSR_CLIENT is *not* set, NetWorker uses the name of the local host.

As a result, the value of `NSR_CLIENT` (either the default value or an explicitly defined value) used for a backup should be the *same* as the value of `NSR_CLIENT` used for the restore of that backup. You might prefer to set `NSR_CLIENT` to the name of the virtual (as opposed to the physical) host, so the backup and restore scripts will successfully run unmodified, regardless of any physical host which might be down at the time.



Important: If `NSR_CLIENT` is set to any value other than the default value during a backup or restore, you must modify the *Remote access* field of that NetWorker client resource. For more information, refer to the *Legato NetWorker Administrator's Guide*.

For all Oracle8 backups and restores, you must set `NSR_CLIENT` in the RMAN scripts. Setting `NSR_CLIENT` in the system environment has no effect. For more information, see [“Step 1: Creating RMAN Backup Scripts” on page 79](#).

OPS Support

NetWorker Module for Oracle supports Oracle Parallel Server (OPS) systems for parallelism and high availability. An OPS system requires proper installation of cluster management software on each cluster node.

For an explanation of specific terms used throughout this section on OPS support, see [“Terminology” on page 123](#).

After proper configuration of OPS and the associated cluster system, NetWorker Module for Oracle enables you to perform Oracle backups on either a single node or parallel nodes of the OPS system.

As mentioned in the *Legato NetWorker Module for Oracle Installation Guide*, you must install NetWorker Module for Oracle on each node that you want to use for Oracle backup and recover operations.

A parallel Oracle backup uses Oracle instances running in parallel on multiple nodes of the cluster to back up the Oracle data. NetWorker Module for Oracle also enables you to recover the Oracle data to any physical node in the cluster, regardless of which physical node originally performed the backup.

In the RMAN backup script that you create for running a parallel Oracle backup on an OPS system, you can allocate multiple channels for the backup and specify that each channel run on a specific node.

An important requirement of the RMAN script is that you set the `NSR_CLIENT` environment variable to the *same* value for *each* channel. For more information on setting the variable in the RMAN script, see [“Step 1: Creating RMAN Backup Scripts” on page 79](#). For a sample RMAN backup script, see [“Creating RMAN Backup Scripts” on page 124](#).

Follow the configuration steps outlined in [“OPS Configuration Roadmap” on page 123](#) to enable Oracle backup and restore operations using NetWorker Module for Oracle on an OPS system.

Terminology

OPS and its applications can occupy an entire clustered system or only part of the system. For example, OPS might occupy three nodes of a five-node configuration, while the other nodes are used for non-Oracle applications. OPS must run on a shared disk, and each node needs access to the disk.

A node in an OPS system is a physical machine with a hostname such as *node1.legato.com*. An Oracle instance is a group of Oracle Server processes running on a node.

An Oracle database (for example, named *databs1*) comprises a set of data files, which are used by the Oracle instances and can be shared between the nodes. All instances share the same datafiles and control file. Each node must have its own set of redo log files and its own archived redo logs.

OPS Configuration Roadmap



Important: For NetWorker Module for Oracle, when working with the NetWorker 6.0 server, the *oracle owner* name must appear in the Administrator list in the server resource configured on the NetWorker server. For more information on adding this name to the Administrator list, see [page 56](#).

To properly configure Oracle backup and restore operations with NetWorker Module for Oracle on an OPS system:

1. Install the proper cluster management software on each cluster node. For details, refer to the appropriate cluster installation documentation from your particular cluster software vendor.
2. Configure the cluster for use with OPS. For details, refer to the appropriate OPS documentation from Oracle Corp.

3. Install and configure the OPS software. You might need to install the required patches from Oracle to complete the OPS installation and linking procedures.
4. Install NetWorker Module for Oracle on *each* node of the cluster that you want to use for backup and recover operations. For more information, refer to the *Legato NetWorker Module for Oracle Installation Guide*.
5. Create the appropriate RMAN backup script for each desired type of Oracle backup on the OPS system. For details, see [“Creating RMAN Backup Scripts” on page 124](#).
6. Create the appropriate RMAN restore script for each desired type of Oracle restore on the OPS system. For details, see [“Creating RMAN Restore Scripts” on page 125](#).
7. Review the additional issues concerning Oracle recover operations in [“Archived Redo Logs” on page 128](#).

Creating RMAN Backup Scripts

You can use a single RMAN backup script to run a parallel Oracle backup with NetWorker Module for Oracle on an OPS system. In the backup script, you can allocate multiple channels for the backup and specify that each channel run on a specific node.



Important: Set the NSR_CLIENT environment variable to the *same* value for *each* channel. Set the NSR_CLIENT variable in *each* **allocate channel** command of the script. You can set NSR_CLIENT to the fully qualified IP name of any node that is configured as a NetWorker client. To later restore data from this backup, you must set this *same* NSR_CLIENT value for *each* channel in the RMAN restore script.

Note: The NSR_CLIENT variable specifies which client index file the NetWorker server should use to store information about the backup.

If the NetWorker server is a *remote* system from the node running the RMAN backup script, you must also set the NSR_SERVER variable in *each* **allocate channel** command of the script to the name of the NetWorker server.

For example, suppose an OPS system consists of two nodes named *node1.legato.com* and *node2.legato.com*. The Oracle instances named *instance1* and *instance2* are running on *node1.legato.com* and *node2.legato.com*, respectively. The NetWorker server is located on a separate node.

The following RMAN backup script is to be run on *node1.legato.com*, using the NOCATALOG mode of RMAN. The script sets NSR_SERVER to the remote NetWorker server name and NSR_CLIENT to *node2.legato.com*. As a result, the NetWorker server will store the backup information in the *node2.legato.com* client index file. Two channels are allocated to each of the nodes, *node1.legato.com* and *node2.legato.com*.

```
run {
    allocate channel t1 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=node3.legato.com,
    NSR_CLIENT=node2.legato.com)';

    allocate channel t2 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=node3.legato.com,
    NSR_CLIENT=node2.legato.com)'
    connect 'internal/oracle@connect-string-of-node2';

    allocate channel t3 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=node3.legato.com,
    NSR_CLIENT=node2.legato.com)';

    allocate channel t4 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=node3.legato.com,
    NSR_CLIENT=node2.legato.com)'
    connect 'internal/oracle@connect-string-of-node2';

    backup
    filesperset 1
    format 'instance1_%s_%p'
    (database);

    release channel t1;
    release channel t2;
    release channel t3;
    release channel t4;
}
```

For a sample script to back up all the archive log files in an OPS system, see [“Backing Up All Archive Log Files from Each Node” on page 131](#).

Creating RMAN Restore Scripts

You can use a single RMAN script to run a parallel Oracle restore with NetWorker Module for Oracle on an OPS system. NetWorker Module for Oracle does *not* support multiple RMAN restores running at the same time.

In the restore script, you can allocate multiple channels for the restore and specify that each channel run on a specific node.



Important: Set the `NSR_CLIENT` environment variable to the *same* value for *each* channel. Set the `NSR_CLIENT` variable in *each* **allocate channel** command, to the *same* value (fully qualified IP node name) as used in the original RMAN script for the Oracle backup.

Note: The `NSR_CLIENT` variable specifies which client index file the NetWorker server should use to obtain information about the backup.

If the NetWorker server is a *remote* system from the node running the RMAN restore script, you must also set the `NSR_SERVER` variable in *each* **allocate channel** command of the script to the name of the NetWorker server.



Important: To run an Oracle restore on an OPS system, none of the nodes can be open. Only the node running the RMAN restore script needs to be mounted.

Using the same example as in [“Creating RMAN Backup Scripts” on page 124](#), suppose an OPS system consists of two nodes named `node1.legato.com` and `node2.legato.com`. The Oracle instances named `instance1` and `instance2` are running on `node1.legato.com` and `node2.legato.com`, respectively. The NetWorker server is located on a separate node.

The following RMAN restore script is to be run on `node2.legato.com`, to restore from the backup created using the RMAN backup script in [“Creating RMAN Backup Scripts” on page 124](#).

This restore script sets `NSR_SERVER` to the remote NetWorker server name and `NSR_CLIENT` to `node2.legato.com`. As a result, the NetWorker server will obtain the backup information from the `node2.legato.com` client index file. Two channels are allocated to each of the nodes, `node1.legato.com` and `node2.legato.com`.

```
run {  
    allocate channel t1 type 'SBT_TAPE'  
    parms 'ENV=(NSR_SERVER=node3.legato.com,  
NSR_CLIENT=node2.legato.com)';
```

```

allocate channel t2 type 'SBT_TAPE'
parms 'ENV=(NSR_SERVER=node3.legato.com,
NSR_CLIENT=node2.legato.com)';

allocate channel t3 type 'SBT_TAPE'
parms 'ENV=(NSR_SERVER=node3.legato.com,
NSR_CLIENT=node2.legato.com)'
connect 'internal/oracle@connect-string-of-node1';

allocate channel t4 type 'SBT_TAPE'
parms 'ENV=(NSR_SERVER=node3.legato.com,
NSR_CLIENT=node2.legato.com)'
connect 'internal/oracle@connect-string-of-node1';

restore
database;

release channel t1;
release channel t2;
release channel t3;
release channel t4;

}

```



Important: If you wish to restore Oracle data to a node different from the node specified by the `NSR_CLIENT` variable, you must add the new node name to the *Remote access* field in the NetWorker client resource for the “`NSR_CLIENT`” node.

For example, suppose a parallel Oracle backup was performed with `NSR_CLIENT` set to `node1.legato.com` for each channel in the RMAN backup script. In order to be able to restore the backup data to `node2.legato.com`, you must add `node2.legato.com` to the *Remote access* field in the NetWorker client resource for `node1.legato.com`.

For more information on modifying the client resource, see [“Creating a Client Resource on UNIX” on page 60](#) or [“Creating a Client Resource on Windows” on page 61](#).

For a sample script to restore all the archive log files in an OPS system, see [“Restoring All Archive Log Files from Each Node” on page 132](#).

Archived Redo Logs

Each node in an OPS system maintains a separate set of redo logs. Redo logs that become full are archived on the local node. As a result, the archive redo logs are divided among the nodes of the system.

If one of the OPS nodes is down for any reason (for example, due to a disk crash) when you run an Oracle restore and recovery, you might receive an Oracle message stating that the database cannot be recovered due to a missing archive log.

To prepare for this type of situation, you have several options, including:

- mirroring the disk
- initiating File Transfer Protocol (FTP) of the archive logs from the system in question to another system



Important: Oracle recommends not using hard-mounted NFS in this situation. If hard-mounted NFS fails, your Oracle database can become inaccessible.

To enable RMAN to recover an OPS system from any node of a cluster, you must share the archive logs that are stored on each node. To share the archive logs stored on each node with the other nodes of the OPS system, use HA-NFS or NFS (soft-mounted) on UNIX and NetBIOS on Windows.

For information on how to share the archive logs, see the appropriate section:

- [“Sharing Archive Logs on UNIX Using HA-NFS” on page 129](#)
- [“Sharing Archive Logs on UNIX Using Soft-Mounted NFS” on page 129](#)
- [“Sharing Archive Logs on Windows” on page 130](#)

To verify the proper creation of the shared archive log directories, see [“Testing the Shared Archive Log Directories” on page 131](#).

For sample scripts to back up and restore all the archive log files in an OPS system, see the appropriate section:

- [“Backing Up All Archive Log Files from Each Node” on page 131](#)
- [“Restoring All Archive Log Files from Each Node” on page 132](#)

Sharing Archive Logs on UNIX Using HA-NFS

To share the archive logs stored on each node with the other nodes of the UNIX OPS system using HA-NFS:

1. Create a directory in the filesystem of the HA-NFS server.
2. On each node, mount this directory in the archive destination.

```
mount hanfs-server:/all_archivelogs
/export/home/app/oracle/product/815/admin/ops/arch
```



Important: The archive log filename must be unique for each node.

Sharing Archive Logs on UNIX Using Soft-Mounted NFS

To share the archive logs stored on each node with the other nodes of the UNIX OPS system using soft-mounted NFS, perform these steps on each node:

1. Create an archive log directory for each cluster member.

```
mkdir $ORACLE_HOME/admin/ops/admin/arch1
mkdir $ORACLE_HOME/admin/ops/admin/arch2
```

2. Share the first archive log directory.
3. Soft-mount all the remote archive log directories to the new local directories using unique naming (node 1 to *arch1*, node 2 to *arch2*, and so on). For example, on node 1:

```
mount -F nfs -o soft,rw,retry=10,timeo=30
node2:/u01/app/oracle/product/815/admin/ops/arch2
/u01/app/oracle/product/815/admin/ops/arch2
```

4. Change the *initoracle_sid.ora* parameters for the local archive log destinations and add a second destination (any remote node) to ensure the availability of all the logs when the node is down.

```
LOG_ARCHIVE_DEST_1 =
"location=/u01/app/oracle/product/815/admin/ops/arch1"
LOG_ARCHIVE_DEST_2 =
"location=/u01/app/oracle/product/815/admin/ops/arch2"
```

Sharing Archive Logs on Windows

To share the archive logs stored on each node with the other nodes of the OPS system on Windows, perform these steps on each node:

1. Create a volume for the archive logs on the node using a unique drive letter, for example, K: or L: or M:.
2. In the volume, create a directory for the archive destination.

```
mkdir drive-letter:\archivelogs
```

3. Share the *archivelogs* directory.

```
net share database-name-logs=drive-letter:
```

4. Mount all the archive log volumes of the remote nodes using the original drive letters (for example, K: or L: or M:), so that each node has the same directory structure.

```
net use drive-letter: \\node-name\database-name-logs
```

5. Change each *initoracle_sid.ora* file to add a second archive destination for each node, which can be the archive destination of any other member of the cluster. This step is required to allow access to the logs when the node is down. Also, enable log archive mode.

```
LOG_ARCHIVE_DEST_1 =  
"location=local-drive-letter:\archivelogs"  
  
LOG_ARCHIVE_DEST_2 =  
"location=remote-drive-letter:\archivelogs"  
  
(up to 5 destinations are allowed)  
  
LOG_ARCHIVE_START = true  
  
LOG_ARCHIVE_FORMAT = %t_%s.dbf
```

6. Configure the Windows service OracleServiceSID on each node to be started using an account that has access to all the archive destinations of all the nodes and restart the service.

Testing the Shared Archive Log Directories

To verify the proper creation of the shared archive log directories, connect to each instance and perform a command to switch the archive logs file.

For an instance named *OPS1*, run **svrmgrl** and enter these commands:

```
connect internal/oracle@ops1;
alter system switch logfile;
exit;
```

Similarly, for a second instance named *OPS2*, run **svrmgrl** and enter these commands:

```
connect internal/oracle@ops2;
alter system switch logfile;
exit;
```

After using the **switch** command, verify that archive log files were created in the *LOG_ARCHIVE_DEST_1* and *LOG_ARCHIVE_DEST_2* locations.

Backing Up All Archive Log Files from Each Node

You can back up all the archive log files in an OPS system from a single node (for example, a node named *ops1.legato.com*) using the following type of RMAN script:

```
run {
    allocate channel t1 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_CLIENT=ops1.legato.com)';
    connect internal/oracle@ops1;

    allocate channel t2 type 'SBT_TAPE'
    parms 'ENV=(NSR_SERVER=mars.legato.com,
    NSR_CLIENT=ops1.legato.com)';
    connect internal/oracle@ops2;

    backup
    filesperset 10
    (archivelog all delete input format 'al_%s_%p');
    release channel t1;
    release channel t2;
}
```

For RMAN to back up the archive logs for a separate node (for example, a node named *ops2.legato.com*), allocate a channel for that instance. For example, in the backup script above, use these commands:

```
allocate channel t2 type 'SBT_TAPE'  
parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_CLIENT=ops1.legato.com)'  
connect internal/oracle@ops2;
```

Restoring All Archive Log Files from Each Node

You can restore all the archive log files in an OPS system from a single node (for example, a node named *ops1.legato.com*) using the following type of RMAN script:

```
run {  
    allocate channel t1 type 'SBT_TAPE'  
    parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_CLIENT=ops1.legato.com)'  
    connect internal/oracle@ops1;  
    allocate channel t2 type 'SBT_TAPE'  
    parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_CLIENT=ops1.legato.com)'  
    connect internal/oracle@ops2;  
    restore  
    (archive log all);  
    release t1;  
    release t2;  
}
```

For RMAN to restore the archive logs for a separate node (for example, a node named *ops2.legato.com*), allocate a channel for that instance. For example, in the restore script above, use these commands:

```
allocate channel t2 type 'SBT_TAPE'  
parms 'ENV=(NSR_SERVER=mars.legato.com,  
NSR_CLIENT=ops1.legato.com)'  
connect internal/oracle@ops2;
```

Appendix A: NetWorker Functionality

This appendix provides a brief overview of how the NetWorker server performs backup and restore operations on regular filesystem data. It also outlines basic NetWorker operations with storage nodes. Illustrations of the backup and restore processes provide a graphical overview of the storage management procedures employed by the NetWorker server.

NetWorker client-server technology uses a network protocol, Remote Procedure Call (RPC), to back up data. The NetWorker server software consists of several server-side services and programs. The NetWorker client software consists of client-side services and user interface programs. These services and programs perform the following functions:

- Oversee backup and restore processes.
- Maintain client configuration files.
- Maintain an online client index.
- Maintain an online media database.

How NetWorker Backs Up Data

NetWorker calls upon several services and programs when it receives a request for a backup. These services coordinate the tasks associated with a backup or restore. They record information about what was backed up and the media containing the backed-up data.

NetWorker Services and Programs

This section provides a description of the services and programs managed by the NetWorker server. [Table 3](#) lists the name and function of each service and program.

Table 3. Services and Programs Managed by the NetWorker Server

Service/Program	Function
ansrd	Monitors active restore sessions. Spawned by nsrd in response to a restore session. Monitors active save sessions for clients that do not have direct save capability.
nsrexec (asavegrp)	Monitors the progress of individual save sets.
nsrck	Performs index consistency checking and repairs to maintain the integrity of the client file index.
nsrd	Controls all NetWorker activity on the server: <ul style="list-style-type: none"> • Authorizes and coordinates save and restore procedures • Maintains the NetWorker configuration resource database • Initiates queries to the database on behalf of other services
nsrim	Manages the NetWorker server's client file index.
nsrindexd	Provides the means for inserting entries into the NetWorker server's client file index.
nsrmmd	Provides device support, during backup and restore by: <ul style="list-style-type: none"> • Generating mount requests • Labeling devices • Multiplexing during a multi-client backup • De-multiplexing during restore • Generating requests for volume mounting and unmounting
nsrmmdbd	Manages the NetWorker server's media database.
savegrp	Coordinates NetWorker clients during the save process.

The master service, **nsrd**, is managed by the NetWorker server and is responsible for several tasks:

- Starting other services
- Allocating media services
- Authorizing backup and restore services for the client
- Contacting clients for scheduled backups
- Maintaining NetWorker configuration information
- Monitoring backup and restore sessions
- Maintaining server statistics and message logs

The NetWorker server service, **nsrd**, calls the NetWorker client service, **nsrexecd**, and several client-side programs when it receives a scheduled or manual backup request. The temporary server agent service, **ansrd**, monitors the progress of the backup session if the client does not have direct save capability. [Table 4](#) provides a description of the client-side services and programs.

Table 4. Services and Programs Managed by the NetWorker Client

Service/Program	Function
nsrexecd	Authenticates the NetWorker server's remote execution request and executes the save and savefs commands on the client.
recover	Browses the NetWorker server's online client index and restores the specified file(s) to primary disk storage.
save	Sends specified files in a multiplexed data stream to the NetWorker server, for backup to media by nsrmmd . Creates an entry in the client file indexes and media database by nsrindexd .
savefs	Sends information about the save sets to back up for the client, and identifies the save set data that was modified since the previous level save.

What Happens during a Scheduled NetWorker Backup?

When you configure a backup group on the NetWorker server, you schedule a start time for the backup. At this scheduled time, **nsrd** begins the group's backup by invoking **savegrp**.

savegrp queries the client resources to determine:

- Which clients configured on the server are members of the backup group
- What level of backup to perform
- How many save sets to run concurrently
- When the most recent backup of the group occurred

If the **savegrp** program finds that any of this information is not available on the NetWorker server, it sends a request to the client-side service, **nsrexecd**, to run **savefs** on each client in the backup group in order to gather necessary details.

savefs identifies the database files to back up for the specified client and sends this information to **savegrp**. After **savegrp** receives this information, it prepares a work list for the server. NetWorker arranges the order of this work list based on the Priority attribute assigned to each client. The client resource with the lowest value assigned in the Priority attribute field is contacted first for backup.

If problems were encountered with the client file index during the previous backup session, **nsrd** invokes the **nsrck** service to check the consistency and state of the NetWorker server's client file indexes and media database. Then **nsrd** starts **nsrindexd**, the insertion service for the client file index.

savegrp contacts the first client on the server's work list. This client's **nsrexecd** program is invoked and starts a backup session of the first save set. The **save** program sends **nsrd** all the backup criteria, including the group, client, save set, and level of backup. **nsrd** uses this information to determine the associated volume pool and forwards this information to the appropriate media service.

The media service, **nsrmmd**, performs the following functions:

- Sends a message to the NetWorker server to request a mount of the media assigned to the volume pool indicated by **nsrd**.
- Writes the data sent by **save** to storage media.
- Forwards storage information to **nsrmmdbd** for recording in the NetWorker server's media database.

Whenever there is a lull in save set activity from the client, the NetWorker server queries for another save set within the group. **savegrp** concurrently backs up the maximum number of save sets specified by the parallelism attributes, thereby utilizing the maximum potential of the backup devices.

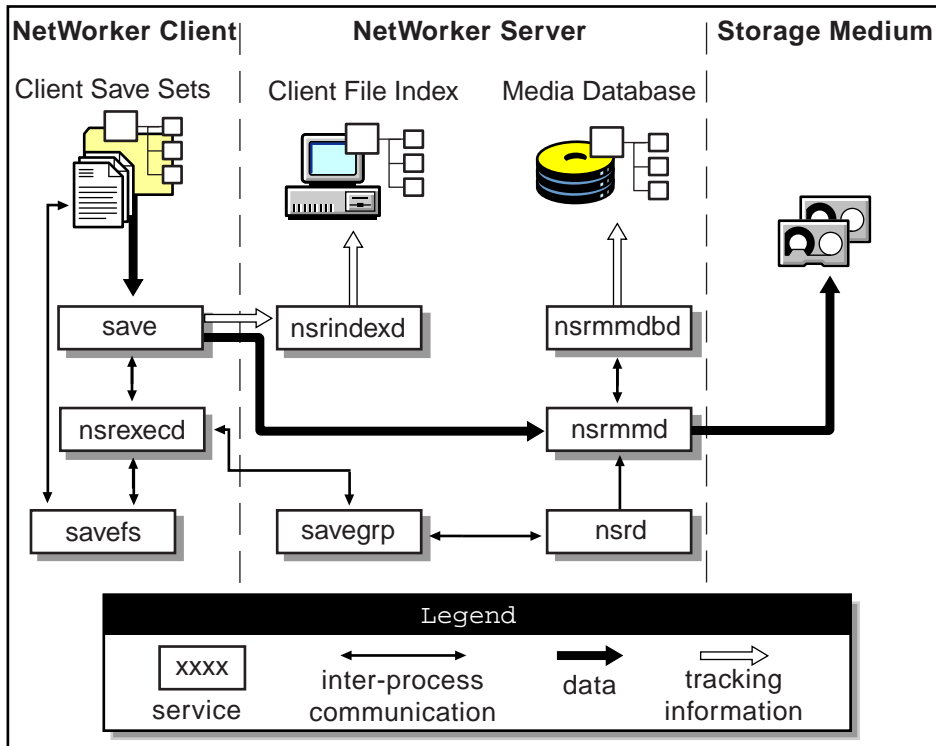
savegrp repeats this process for each item on the server's work list until all clients in the group are backed up. When the work list is complete, a backup of the NetWorker server's bootstrap file occurs when the server is either part of the group being backed up or is not part of any enabled group. When the

backup of the bootstrap file is complete, a printout of the bootstrap file is sent to the default printer. This printout of the bootstrap file helps if the NetWorker server ever needs to be restored in a disaster recovery situation.

The final results of the **savegrp** execution are sent to the server and are included in a "savegroup completion report." This report is sent according to the notification set up for the savegroup event. Refer to the *Legato NetWorker Administrator's Guide* for details on using and customizing notifications.

Figure 26 shows how the services and programs managed by the NetWorker client and server interact during a scheduled backup.

Figure 26. How NetWorker service processes and programs interact during a scheduled backup



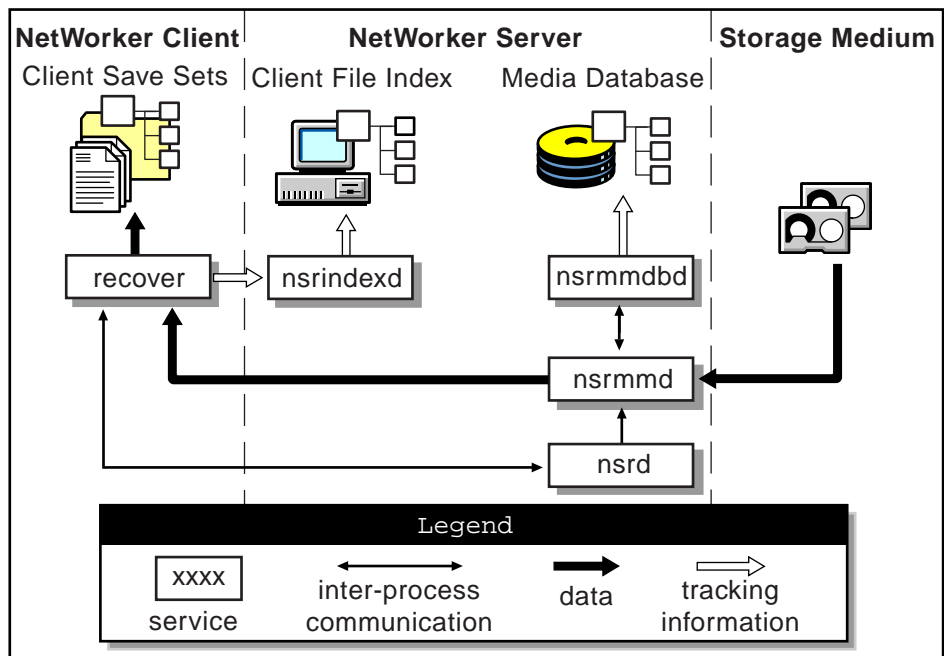
How NetWorker Restores Data

When NetWorker receives a restore request from a client, the server's **nsrd** service contacts the server's media database service, **nsrmmdbd**, to determine which media contains the requested save set. Once the save set's media location is obtained, **nsrmmdbd** issues a mount request. The media is positioned at the beginning of the save set, and the save set is passed to **nsrmmdbd**. The media service then forwards the save set to the client's **recover** program, which restores the data to the client's filesystem.

If the server's media database service, **nsrmmdbd**, is unable to locate the required volumes, or if there are no enabled devices on the NetWorker server, the restore request fails.

Figure 27 shows how the services and programs managed by the NetWorker client and server interact while restoring data to a NetWorker client.

Figure 27. How NetWorker service processes and programs interact during a scheduled restore



NetWorker Operations with Storage Nodes

A storage node is a computer that contains NetWorker client and media management daemons and programs. A storage node is connected to one or more storage devices that are used in NetWorker operations, such as backup and restore. Media management daemons on the storage node computer read and write data on storage volumes.

Backup and restore operations with storage nodes are very similar to backup and restore operations on the NetWorker server. The major difference is where the data resides.

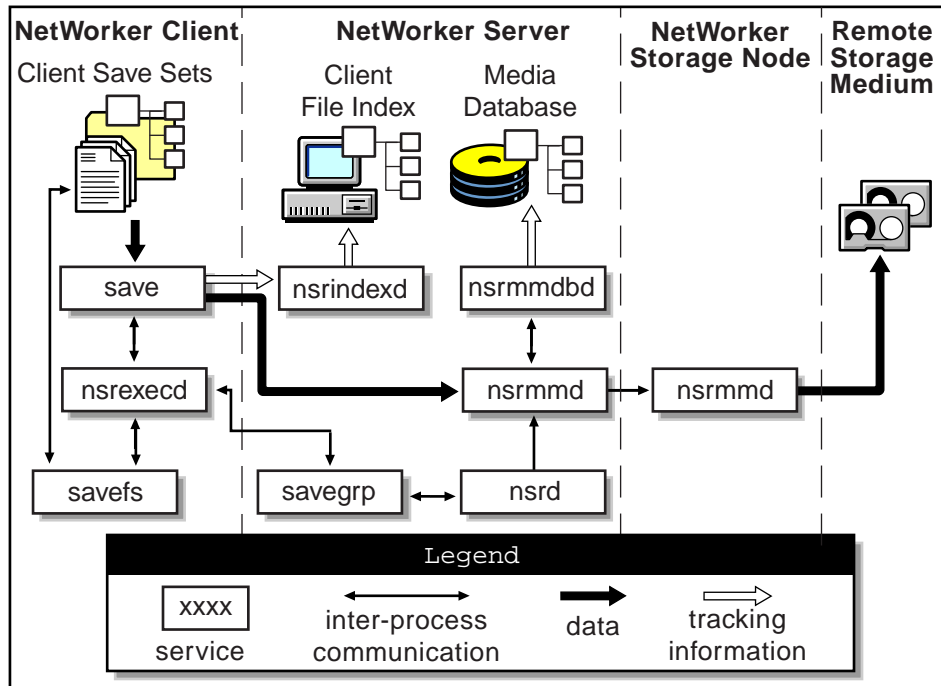
A storage node is controlled by a NetWorker server. The NetWorker server's **nsrd** master daemon starts the **nsrmm** media management daemon on the storage node, and during backup, the NetWorker server routes appropriate data to each media management daemon according to the Storage Node Affinity attribute in the Clients resource.

After data is written to the storage devices connected to storage node machines (remote devices), the NetWorker server tracks the location of the data. On the NetWorker server, the **nsrindexd** daemon writes entries in the client file indexes to track the location of each file in a save set, and the **nsrmmdbd** daemon writes entries in the media database to track the location of each save set on media.

[Figure 28 on page 140](#) shows how the NetWorker server, client, and storage node daemons and programs interact during a scheduled save in a NetWorker setup that includes a storage node and a remote storage device.

A

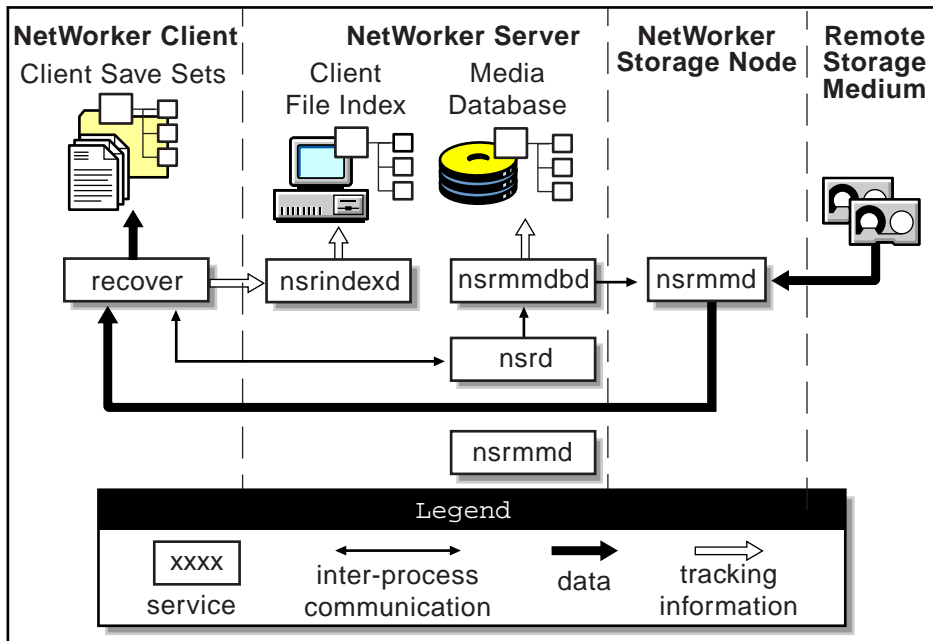
Figure 28. How NetWorker service processes and programs interact during a save session with a storage node



When the NetWorker server receives a restore request from a client, it contacts **nsrmmmd**, the media management daemon, on the storage node instead of on the server machine. The **nsrmmmd** daemon reads the data from media and sends the data to the NetWorker client, where the **recover** program rebuilds the data.

Figure 29 on page 141 shows an example of how a recover process works in a NetWorker setup that includes a storage node and a remote storage device.

Figure 29. How NetWorker service processes and programs interact during a restore session with a storage node



A

Appendix B: Environment Variables

This appendix describes the environment variables that you can set for Oracle backup and restore operations using NetWorker and NetWorker Module for Oracle.

You must set the Legato environment variables described in [“Environment Variables in the RMAN Script” on page 143](#) in the RMAN script only.

There are eight environment variables that you must set only in the scheduled backup script `nsrnm0` if you wish them to be in effect during a scheduled Oracle backup. For details on these eight variables, see [“Environment Variables in the nsrnm0 Script” on page 148](#).

For details on the different types of Oracle backup and restore operations, see the appropriate chapter:

- [“Chapter 4: Manual Oracle Backups”](#)
- [“Chapter 5: Scheduled Oracle Backups”](#)
- [“Chapter 6: Restoring Oracle Data”](#)

Environment Variables in the RMAN Script

Except for the eight variables described in [“Environment Variables in the nsrnm0 Script” on page 148](#), you must set all environment variables in the RMAN backup or restore script, in order for those variables to be in effect during an Oracle backup or restore operation.

The NSR_ environment variables described in [Table 5](#) are NetWorker-specific environment variables that you can set for *either* a manual or scheduled Oracle backup. You must set these variables only in the RMAN backup or restore script. Setting these variables in the environment using a `setenv` (UNIX) or `set` (Windows) command has *no effect*.

Contrary to statements in the Oracle documentation, you must set the NSR_ variables in the **allocate channel** command of your RMAN script, using the **parms** option. Setting a NSR_ variable in the **backup** command in the RMAN script has *no effect*. See [“Step 1: Creating RMAN Backup Scripts” on page 79](#) for more information on setting the NSR_ variables in the RMAN backup script.

Variables NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2, and NSR_DATA_VOLUME_POOL3 are *mandatory* when using the **set duplex** command in the RMAN script. For more information on these NSR_DATA_VOLUME_POOL* variables, see [“Duplex Option of the Set Command” on page 151](#).

NSR_SERVER is also *mandatory* if the NetWorker server computer is different from the Oracle host. In any case, you should *always* set NSR_SERVER in the RMAN script. The other NSR_ variables listed in [Table 5](#) are optional.

For more information on the effects of these NetWorker-specific variables, refer to the *Legato NetWorker Administrator’s Guide* for your particular NetWorker server platform.

[Table 5](#) lists all the NetWorker-specific (NSR_) environment variables that can be set *only* in the RMAN script. The table includes a description of each variable, the default value of the variable, and the valid values you can assign to the variable in the RMAN script.

Table 5. Environment Variables in the RMAN Script

Variable	Description	Default and Valid Values
NSR_CHECKSUM	<ul style="list-style-type: none">• Value of TRUE specifies that NetWorker perform checksumming on the data• Value of FALSE specifies no checksumming	<ul style="list-style-type: none">• FALSE (default)• TRUE

Table 5. Environment Variables in the RMAN Script (Continued)

Variable	Description	Default and Valid Values
NSR_CLIENT	<ul style="list-style-type: none"> • NetWorker client resource to use for a backup or restore session • Recommended for backups or restores of Oracle running on a cluster or OPS system • Might be needed for disaster recovery 	<ul style="list-style-type: none"> • Host from which the session is initiated (default) • Valid NetWorker client name
NSR_COMPRESSION	<ul style="list-style-type: none"> • Value of TRUE specifies that NetWorker perform compression on the backup data • Value of FALSE specifies no compression 	<ul style="list-style-type: none"> • FALSE (default) • TRUE
NSR_DATA_VOLUME_POOL	<ul style="list-style-type: none"> • Mandatory if using command "set duplex" (set to 1, 2, 3, or 4) • Name of volume pool to use for Oracle backup, including a duplexed Oracle backup • Note: The NSR_DATA_VOLUME_POOL setting takes precedence over any pool associated with the scheduled backup group. For a scheduled Oracle backup, set either NSR_DATA_VOLUME_POOL or NSR_GROUP—but <i>not both</i>—in the RMAN backup script. 	<ul style="list-style-type: none"> • "Default" pool (default) • Valid NetWorker pool name • Name must be different from name used by another NSR_DATA_VOLUME_POOL* variable



Table 5. Environment Variables in the RMAN Script (Continued)

Variable	Description	Default and Valid Values
NSR_DATA_VOLUME_POOL1	<ul style="list-style-type: none"> • Mandatory if using command "set duplex" (set to 2, 3, or 4) • Name of volume pool to use for duplexed Oracle backup 	<ul style="list-style-type: none"> • Undefined (default) • Valid NetWorker pool name • Name must be different from name used by another NSR_DATA_VOLUME_POOL* variable
NSR_DATA_VOLUME_POOL2	<ul style="list-style-type: none"> • Mandatory if using command "set duplex" (set to 3 or 4) • Name of volume pool to use for duplexed Oracle backup 	<ul style="list-style-type: none"> • Undefined (default) • Valid NetWorker pool name • Name must be different from name used by another NSR_DATA_VOLUME_POOL* variable
NSR_DATA_VOLUME_POOL3	<ul style="list-style-type: none"> • Mandatory if using command "set duplex" (set to 4) • Name of volume pool to use for duplexed Oracle backup 	<ul style="list-style-type: none"> • Undefined (default) • Valid NetWorker pool name • Name must be different from name used by another NSR_DATA_VOLUME_POOL* variable

B

Table 5. Environment Variables in the RMAN Script (Continued)

Variable	Description	Default and Valid Values
NSR_DEBUG_FILE	<ul style="list-style-type: none"> • Optional • Only used for debugging purposes • Enables debugging by specifying the complete pathname of a file to receive debugging output • If undefined (by default), no debugging information is generated 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the debug file
NSR_ENCRYPTION	<ul style="list-style-type: none"> • Value of TRUE specifies that NetWorker perform encryption on the backup data • Value of FALSE specifies no encryption 	<ul style="list-style-type: none"> • FALSE (default) • TRUE
NSR_GROUP	<ul style="list-style-type: none"> • Name of the NetWorker group to use for a scheduled backup • Setting NSR_GROUP causes the scheduled backup to automatically use a volume pool associated with the group (if NSR_DATA_VOLUME_POOL is <i>not</i> set in the same RMAN script) 	<ul style="list-style-type: none"> • Undefined (default) • Valid NetWorker group name of 1024 characters or less

Table 5. Environment Variables in the RMAN Script (Continued)

Variable	Description	Default and Valid Values
NSR_NO_BUSY	<ul style="list-style-type: none"> Value of TRUE specifies that the scheduled backup fail immediately when the NetWorker server is busy Value of FALSE specifies that the backup wait for the NetWorker server to accept the connection 	<ul style="list-style-type: none"> FALSE (default) TRUE
NSR_SAVESET_EXPIRATION	<ul style="list-style-type: none"> Date when the save set will expire If 0 (default), save set will <i>never</i> expire 	<ul style="list-style-type: none"> 0 (default) Valid date in nsr_getdate(3) format
NSR_SERVER	<ul style="list-style-type: none"> Mandatory if NetWorker server is different from Oracle host; otherwise, highly recommended Hostname of the NetWorker server to perform the Oracle backup 	<ul style="list-style-type: none"> Most appropriate server (default) Valid NetWorker server name

Environment Variables in the nsrnmo Script

The environment variables described as follows must be set *only* in the **nsrnmo** script provided with the NetWorker Module for Oracle software, in order to be in effect during *scheduled* Oracle backups. Setting these variables in the environment using a **setenv** (UNIX) or **set** (Windows) command has *no effect*.

“[Step 2: Customizing the nsrnmo Script](#)” on page 94 provides more details on these environment variables.

Table 6 lists all the environment variables that can be set *only* in the **nsrnm** script. The table includes a description of each variable, the default value of the variable, and the valid values you can assign to the variable in the scheduled backup script.

Table 6. Environment Variables in the nsrnm Script

Variable	Description	Default and Valid Values
LD_LIBRARY_PATH	<ul style="list-style-type: none"> • Mandatory on SGI and Tru64 UNIX only • Directory containing the Oracle libraries, typically <i>\$ORACLE_HOME/lib</i> 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the Oracle library directory
NSR_RMAN_ARGUMENTS	<ul style="list-style-type: none"> • Optional • Double-quoted string containing any valid combination of RMAN arguments 	<ul style="list-style-type: none"> • Undefined (default) • Valid string of RMAN arguments
NSR_SB_DEBUG_FILE	<ul style="list-style-type: none"> • Optional • Only used for debugging purposes • Enables debugging by specifying the complete pathname of a file to receive debugging output for a scheduled Oracle backup • If undefined (by default), no debugging information is generated 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the debug file
ORACLE_HOME	<ul style="list-style-type: none"> • Mandatory • Home directory of the Oracle Server installation 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the Oracle Server installation directory
PATH	<ul style="list-style-type: none"> • Mandatory • Must include the path to the directory containing the NetWorker Module for Oracle program nsrnmstart 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the directory containing nsrnmstart

Table 6. Environment Variables in the nsrnmo Script (Continued)

Variable	Description	Default and Valid Values
POSTCMD	<ul style="list-style-type: none"> • Optional • Command to run after the scheduled Oracle backup is complete 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the post-command script
PRECMD	<ul style="list-style-type: none"> • Optional • Command to run before the scheduled Oracle backup starts 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of the pre-command script
TNS_ADMIN	<ul style="list-style-type: none"> • Mandatory if Oracle Net8 files in non-default location • Pathname of directory containing Oracle Net8 configuration files 	<ul style="list-style-type: none"> • Undefined (default) • Valid pathname of Oracle Net8 directory

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Appendix C: RMAN Commands

This appendix describes RMAN commands in Oracle8i that are dependent on the Media Management (in this case, Legato) implementation. The features of these commands specific to NetWorker Module for Oracle are outlined below.

“Change...Delete” and “Delete Expired Backup” Commands

If you are using a *remote* NetWorker server for a **change...delete** or **delete expired backup** command, the appropriate user name must be included in the Administrator list in the NetWorker server resource, as described on [page 56](#).

Duplex Option of the Set Command

You can use the **set duplex** command in the RMAN backup script to generate up to four copies of an Oracle backup and store those copies on separate media. Set **duplex** to the value 1, 2 (or **on**), 3, or 4 to produce 1, 2, 3, or 4 copies, respectively, of every Oracle backup set generated by subsequent **backup** commands.

The following table outlines the results of setting **duplex** to each of the valid values.

Set Duplex Command	Oracle Backup Results
set duplex=1	The backup set is directed to NSR_DATA_VOLUME_POOL.
set duplex=2 or set duplex=on	Two copies of the backup set are directed to the separate pools specified by NSR_DATA_VOLUME_POOL and NSR_DATA_VOLUME_POOL1. These two pools must be different.

Set Duplex Command	Oracle Backup Results
set duplex=3	Three copies of the backup set are directed to the separate pools specified by NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, and NSR_DATA_VOLUME_POOL2. These three pools must be different.
set duplex=4	Four copies of the backup set are directed to the separate pools specified by NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2, and NSR_DATA_VOLUME_POOL3. These four pools must be different.

There are *no* default values for the environment variables NSR_DATA_VOLUME_POOL, NSR_DATA_VOLUME_POOL1, NSR_DATA_VOLUME_POOL2, and NSR_DATA_VOLUME_POOL3. Define these variables in the RMAN script, using the **parms** option of the **allocate channel** command.

Each pool specified by one of these NSR_DATA_VOLUME_POOL* variables must be properly configured, and each pool must be different from the other pool(s) used. If a pool is not properly defined or configured, the Oracle backup will hang, waiting for the proper configuration of that pool.

To enable use of the **set duplex** command, set the parameter **BACKUP_TAPE_IO_SLAVE** to TRUE in the file *initoracle_sid.ora*. For details, refer to the Oracle *Backup and Recovery Guide*.



Important: During an Oracle restore, RMAN will select one of the copies to use, and if it fails for some reason, the restore will fail. In this case, you could use the **crosscheck** or **change backuppiece...unavailable** command and retry the restore. For more information, see the Oracle *Backup and Recovery Guide* or *Oracle8i Recovery Manager User's Guide and Reference*.

Pool Option of the Backup Command



Important: NetWorker Module for Oracle does not support the **pool** option of the RMAN **backup** command, with the exception of **pool=0**.

If you specify any nonzero value for the **pool** option of the RMAN **backup** command, the RMAN session will terminate and NetWorker Module for Oracle will return the following error message:

```
Oracle pool is not supported
```

To specify the NetWorker volume pool to be used by NetWorker Module for Oracle, set the `NSR_DATA_VOLUME_POOL` environment variable in the RMAN script. For more information on the `NSR_DATA_VOLUME_POOL` variable, see “[Appendix B: Environment Variables](#)”.

Proxy Copy



Important: NetWorker Module for Oracle does not support proxy copy.

The **proxy only** option of the RMAN **backup** command will cause the Oracle backup to fail. To perform a regular backup, do *not* specify the **proxy only** option.

As mentioned in the *Oracle Backup and Recovery Guide* and *Oracle8i Recovery Manager User's Guide and Reference*, the **proxy** option of the RMAN **backup** command will default to a regular backup.

Send Command

NetWorker Module for Oracle does *not* support the use of the **send** command.

Trace Option of the Backup Command

You can set the **trace** option of the RMAN **backup** command to the value 0, 1, or 2. The default value of **trace** is 0.

Trace Option of the Backup Command

The output of **trace** is written to the file `/nsr/applogs/dmo.messages` on UNIX and to one of these files on Windows:

- `%SystemDrive%\win32app\nsr\applogs\dmo.messages` for NetWorker release 5.5.x and earlier
- `%SystemDrive%\Program Files\nsr\applogs\dmo.messages` for NetWorker release 5.7 and later

The following table outlines the conditions traced when you set the **trace** option to each of the three valid values.

Trace Value	Conditions Traced
0 (default)	<ul style="list-style-type: none">• All error conditions
1	<ul style="list-style-type: none">• All error conditions• Entry and exit for each SBT function (the Legato implementation of the Oracle SBT interface)
2	<ul style="list-style-type: none">• All error conditions• Entry and exit for each SBT function (the Legato implementation of the Oracle SBT interface)• Values of all function parameters• First 32 bytes of each read/write buffer

Appendix D: Troubleshooting

This appendix provides a brief summary of items to check if NetWorker Module for Oracle is not functioning properly. The following check list refers to sections of this *Administrator's Guide* and the *Legato NetWorker Module for Oracle Installation Guide* that are often overlooked.

Troubleshooting Check List

Use the following check list to troubleshoot any problems in running Oracle backup and restore operations using NetWorker Module for Oracle. To set up your Oracle backup and restore system correctly:

1. Configure the Oracle Server and TNS Listener (if used) according to the instructions in your Oracle documentation. Without NetWorker Module for Oracle installed on the Oracle Server host, you should be able to perform a backup and restore using the **allocate channel t1 type disk** command (see footnote on [page 79](#)). For more information, see [“Step 1: Verifying the Oracle Server Configuration” on page 52](#).
2. Install and configure your NetWorker server and NetWorker client. For details, see [“Chapter 3: Basic Configuration”](#). Refer to the *Legato NetWorker Administrator's Guide* for additional information.
3. Be sure the combination of your operating system(s), Oracle Server, NetWorker server, and NetWorker client is supported. For more information, refer to [“Step 1: Installation Requirements”](#) in Chapter 2 of the *Legato NetWorker Module for Oracle Installation Guide*.
4. Install and enable NetWorker Module for Oracle according to the instructions in the *Legato NetWorker Module for Oracle Installation Guide*. On UNIX, use the commands listed in the table "NetWorker Module for Oracle Library File Installation" in Chapter 2 of the *Installation Guide* to *relink* the library. Shut down and restart Oracle as required. Use the correct *libnwora.** library file. To verify the library file, use the **what libnwora.***

command on UNIX or check the version number and size of the library file on Windows. Compare your library file with the *libnwor.** file in the NetWorker Module for Oracle software package—the two files should be identical. Be sure Oracle is not linked to another *libnwor.**, *libobk.** (BusinessSuite Module for Oracle version of *libnwor.**), or *liblsm.** (Legato Storage Manager version of *libnwor.**) file.

5. Perform a *manual* Oracle backup using NetWorker Module for Oracle and the proper RMAN script. In the RMAN script, use the **allocate channel t1 type 'SBT_TAPE'** command and set the required NSR_ environment variables. See [“Step 1: Creating RMAN Backup Scripts” on page 79](#) for a simple start-up RMAN script. If your manual backups *fail*, check the debugging files for NetWorker Module for Oracle and the NetWorker server. For additional Legato-specific debugging information, you can set the NSR_DEBUG_FILE environment variable in the RMAN script. For more information, see [“Diagnostic and Error Messages for Manual Backups” on page 86](#).
6. Perform a *scheduled* Oracle backup using NetWorker Module for Oracle and the proper RMAN and **nsrnm** scripts. To create the RMAN script, add the **connect target** and **connect rcvcat** commands described in [“Step 1: Creating RMAN Backup Scripts” on page 91](#) to your working RMAN manual backup script. Customize your **nsrnm** script as described in [“Step 2: Customizing the nsrnm Script” on page 94](#). If your manual backups succeed but your scheduled backups *fail*, you can set the NSR_SB_DEBUG_FILE environment variable to generate debugging information for your scheduled backup. For more information, see [“Error Messages for Scheduled Backups” on page 109](#).

Glossary

This glossary contains terms and definitions found in this manual. Most of the terms are specific to NetWorker products.

Administrators group	Windows user group whose members have all the rights and abilities of users in other groups, plus the ability to create and manage all the users and groups in the domain. Only members of the Administrators group can modify Windows OS files, maintain the built-in groups, and grant additional rights to groups.
annotation	A comment that you associate with an archive save set, to help identify that data later on. Annotations are stored in the media index for ease of searching and are limited to 1024 characters.
API	<i>See Application Programming Interface.</i>
Application Programming Interface (API)	An agreed-upon set of computer library routines designed to accomplish a particular task.
Application-Specific Module (ASM)	A program that, when used in a directive, specifies the way a set of files or directories is to be backed up and recovered.
archive	The process by which NetWorker backs up directories or files to an archive volume and then optionally deletes them to free up disk space.
archive clone pool	A volume pool composed exclusively of archive clone save sets.

archive pool	A volume pool composed exclusively of archive save sets.
archive volume	A tape or other storage medium used for NetWorker archives, as opposed to a backup volume.
ASM	<i>See Application-Specific Module.</i>
autochanger	A mechanism that uses a robotic arm to move media among various components located in a device including slots, media drives, media access ports, and transports. Autochangers automate media loading and mounting functions during backups and recovers.
auto media management	A feature enabling the NetWorker server to automatically label, mount, and use a suitable volume loaded in a drive.
Backup Operators group	A Windows group whose members have the capability of logging on to a domain from a workstation or a server, backing it up, and restoring the data. Backup Operators also can shut down servers or workstations.
backup set	<i>See save set.</i>
backup volume	Backup media, such as magnetic tape or optical disk.
bootstrap	Information that includes the server index, media index, and configuration files needed for recovering NetWorker after a disk crash.
browse policy	The policy that determines how long entries for your files remain in the online file index.
carousel	A tray or tape cartridge that holds multiple backup volumes.
client	A computer that accesses the NetWorker server to back up or recover files. Clients may be workstations, PCs, or file servers.
client file index	A database of information maintained by the NetWorker server that tracks every file or filesystem backed up. The NetWorker server maintains a single client file index for each client system.

clone	The process by which NetWorker makes an exact copy of saved data (save sets). NetWorker can clone individual save sets or the entire contents of a backup volume.
clone volume	A duplicated volume. NetWorker can track four types of volumes: backup, archive, backup clone, and archive clone. Save sets of different types may not be intermixed on one volume.
command line	The shell prompt, where you enter commands.
compressasm	A NetWorker directive used for compressing and decompressing files.
database administrator (DBA)	The person normally responsible for installing, configuring, and maintaining Oracle database systems.
DBA	<i>See database administrator.</i>
device	The backup device (tape drive, optical drive, or autochanger) connected to a NetWorker server or storage node; used for backing up and recovering client files.
directive	An instruction directing NetWorker to take special actions on a given set of files.
enabler code	A special code provided by Legato that allows you to run a specific NetWorker software product.
fileserver	A computer with disks that provides services to other computers on the network.
filesystem	1. A file tree on a specific disk partition or other mount point. 2. The entire set of all files. 3. A method of storing files.
grooming	The process of removing files after a successful archive.
group	A client or group of clients that starts backing up its files at a designated time during a scheduled NetWorker backup.
heterogeneous networks	Networks with systems of different platforms that interact meaningfully across the network.

himt	A choice in the Devices window; represents half-inch magnetic tape.
instance	The combination of Oracle processes that runs each time a database starts up.
interoperability	The ability of software and hardware on multiple computers from multiple vendors to communicate meaningfully.
media	Magnetic tape or optical disks used to back up files.
media index	A database of information maintained by NetWorker that tracks every backup volume.
media manager	The NetWorker component that tracks save sets to backup volumes.
NetWorker	A Legato network-based software product to back up and recover filesystems, including Oracle database files.
NetWorker client	A computer that can access the backup and recover services from a NetWorker server.
NetWorker server	The computer on a network running the NetWorker software, containing the online indexes and providing backup and recover services to the clients on the same network.
notice	A response to a NetWorker event.
nsrhost	The logical <i>hostname</i> of the computer that is the NetWorker server.
offline backup	A backup of Oracle database objects performed while the corresponding Oracle instance is shut down and unavailable to users.
online backup	A backup of Oracle database objects performed while the corresponding Oracle instance is running and available to users.

online indexes	The databases located on the server that contain all the information pertaining to the client backups and backup volumes.
operator	The person who monitors the server status, loads backup volumes into the server devices, and otherwise executes day-to-day tasks using NetWorker.
Oracle8 Server	A computer running an Oracle8 release 8.0.x RDBMS.
Oracle8i Server	A computer running an Oracle8i release 8.1.x RDBMS.
pathname	Instructions for accessing a file. An <i>absolute pathname</i> tells you how to find a file beginning at the root directory and working down the directory tree. A <i>relative pathname</i> tells you how to find the file starting where you are now.
pool	A type of NetWorker server resource enabling you to sort backup data to selected volumes. It is also a set of backup volumes containing data that meets the specific criteria determined by the attributes of the corresponding pool resource.
preconfigured	Existing selections or configurations for different NetWorker features.
print	Send data to a printer.
qic	A choice in the Devices window; represents quarter-inch cartridge tape.
RDBMS	An acronym for Relational Database Management System, which refers to the primary architecture of an Oracle database.
recover	The NetWorker command used to browse the server index and to recover files from a backup volume to a client's disk.
Recovery Manager (RMAN)	An Oracle8 or Oracle8i utility that acts as an intelligent interface to Oracle databases and works with third-party media management products such as NetWorker Module for Oracle to back up and restore Oracle database objects.

recycle	A volume whose data has passed both its browse and retention policies and is available for relabeling.
Registry	A database of configuration information central to Windows operations. The overall effect centralizes all Windows settings and provides security and control over system, security, and user account settings.
remote device	A storage device attached to a NetWorker storage node.
retention policy	A NetWorker policy that determines how long entries will be retained in the media database and thus be recoverable.
retrieval	The process of locating and copying back files and directories that NetWorker has archived.
RMAN	<i>See Recovery Manager.</i>
root	The UNIX superuser account. By convention, the privileged system maintenance login on a UNIX system.
save	The NetWorker command that backs up client files to backup volumes and makes data entries in the online index.
save set	A set of files or a filesystem backed up onto backup media using NetWorker.
save set ID	An internal identification number assigned to a save set by NetWorker.
scanner	The NetWorker command used to read a backup volume when the online indexes are no longer available.
server	The computer on a network running the NetWorker software, containing the online indexes, and providing backup and recover services to the clients on a network.
shell prompt	A cue for input in a shell window where you enter a command.
SID	An acronym for Oracle System Identifier, a unique name for an Oracle database instance. This value is typically set in an ORACLE_SID environment variable.

SQL	An acronym for Structured Query Language.
stand-alone device	A backup 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 attached to a computer whose backup operations are administered from the controlling NetWorker server.
system administrator	The person normally responsible for installing, configuring, and maintaining NetWorker.
TNS	<i>See Transparent Network Substrate.</i>
Transparent Network Substrate (TNS)	An Oracle networking technology that provides a single interface to all standard network protocols.
user	A person who can use NetWorker from his or her workstation to back up and recover files.
volume	Backup media, such as magnetic tape or optical disk.
volume ID	The internal identification assigned to a backup volume by NetWorker.
volume name	The name you assign to a backup volume when it is labeled.
volume pool	A feature that allows you to sort backup data to selected volumes. A volume pool contains a collection of backup volumes to which specific data has been backed up.

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