

Legato® Storage Manager

Administrator's Guide

Release 3 (8.1.7) for Windows® 2000 and Windows NT®

September 2000

Part No. A85274-01

This *Legato® Storage Manager Administrator's Guide* contains complete information for using Legato Storage Manager (LSM) as an Oracle® data storage management system. It describes the initial configuration procedure for LSM. It then explains how to use LSM for managing Oracle backup devices and volumes, monitoring Oracle backup and restore operations, and managing Oracle backup data. See your Oracle Server Installation Guide for installation instructions.

ORACLE™



Legato Storage Manager Administrator's Guide, Release 3 (8.1.7) for Windows 2000 and Windows NT
Part No. A85274-01

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Primary Authors: Anita Puronto

Graphic Designer: Valarie Moore

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Part No. A85274-01

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Preface

This *Legato® Storage Manager Administrator's Guide* contains complete information for using Legato Storage Manager (LSM) as an Oracle® data storage management system. It describes the initial configuration procedure for LSM. It then explains how to use LSM for managing Oracle backup devices and volumes, monitoring Oracle backup and restore operations, and managing Oracle backup data.

Major Topics:

- [Audience](#)
- [How This Guide Is Organized](#)
- [Document Conventions](#)
- [Required Oracle Documentation](#)
- [Contacting Customer Support](#)
- [Your Comments Are Welcome](#)

Audience

The information in this guide is for system administrators and Oracle database administrators (DBAs) who are responsible for maintaining Oracle Server backup and recovery systems. It includes information on configuring an Oracle data storage management system for Oracle8 and Oracle8i level servers on Windows® 2000 or Windows NT®.

You need a working knowledge of Oracle concepts and terminology, especially as related to Oracle database backup and recovery, to use this guide effectively. This guide does *not* include LSM installation instructions. For information about installing LSM, refer to the Oracle Server Installation Guide for your Windows system.

How This Guide Is Organized

The *Legato Storage Manager Administrator's Guide* has five chapters and three appendices, followed by a glossary and an index. The first two chapters introduce you to LSM and its major features. They describe how to properly configure LSM to work with the other components of a complete Oracle backup and recovery system. Chapters 3 through 5 contain details about how to use LSM to manage Oracle backups and recoveries as well as the devices and volumes used during the Oracle backup and restore operations. Additional information relating to running LSM is contained in the appendices.

Chapter 1, "Introduction"

This chapter surveys the main features of LSM and how they compare with the features of the Legato NetWorker® upgrade product. It explains how LSM functions with other major components of an Oracle8 or Oracle8i backup and recovery system.

Chapter 2, "Preparing to Use LSM"

This chapter provides a more detailed view of the internal LSM organization of resources and attributes and how they are used during Oracle backup and restore operations. It also includes information about the proper configuration of LSM resources.

Chapter 3, "Media Management"

This chapter focuses on the procedures for configuring and managing the storage devices and volumes LSM uses for Oracle backup and restore operations. It explains how LSM uses volume pools to sort the Oracle storage volumes and describes the system that LSM uses to manage the life cycle of the data backed up to those volumes.

Chapter 4, "Backup and Restore Operations"

This chapter provides information about using LSM for Oracle backup and restore operations, after you have configured the required LSM Server resources. It covers the methods for running Oracle backups and restores, including the LSM Server bootstrap backups that are essential for disaster recovery. This chapter also outlines the procedures for monitoring Oracle backups and restores by means of the LSM Administrator GUI and specific log files.

Chapter 5, "Disaster Recovery"

This chapter describes different types of system disasters on your LSM Server and how to recover from them. It stresses the importance of preparing for a disaster.

Appendix A, "Scanner"

This appendix describes how to use the `scanner` program to recreate client file index entries or recreate media database entries, if no entries for a storage volume exist in the media file.

Appendix B, "Client Server Communications"

Many of the problems that LSM users report when they set up and configure LSM are actually problems with the communications in their networks. This appendix contains a procedure for testing the communications in the network.

Appendix C, "Using Label Templates"

LSM labels (initializes) each storage volume with a unique internal label that corresponds to a pool. During backup and other operations, LSM can identify the pool to which a volume belongs by its label. LSM applies a label template to create a unique internal label for each volume. This appendix discusses the setup and use of label templates.

Document Conventions

Because UNIX® is case-sensitive, conventions in this document may differ slightly from those used in Oracle product documentation.

The following conventions apply to text in this guide:

| | |
|------------------------|---|
| <code>monospace</code> | Monospace type indicates Windows command-line commands, directory names, pathnames, and filenames. |
| brackets [] | Words enclosed in brackets indicate key names (for example, Press [Return]). Note that brackets have a different meaning when used in command syntax. |
| <i>italics</i> | Italic type indicates a variable, including variable portions of filenames, document titles, or emphasis. |
| UPPERCASE | Uppercase letters indicate Structured Query Language (SQL) statements, initialization parameters, or environment variables. |

Command syntax is shown in `monospace` font in this guide. The following conventions apply to command syntax:

| | |
|-----------------|---|
| backslash \ | A backslash indicates a command that is too long to fit on a single line. Enter the line as printed (with a backslash) or enter it as a single line without a backslash: <pre>dd if=/dev/rdsk/c0t1d0s6 of=/dev/rst0 bs=10b \ count=10000</pre> |
| braces { } | Braces indicate required items: <code>.DEFINE {macro1}</code> |
| brackets [] | Brackets indicate optional items: <code>cvtcrt termname [outfile]</code> Note that brackets have a different meaning when used in regular text. |
| ellipses ... | Ellipses indicate an arbitrary number of similar items: <code>CHKVAL fieldname value1 value2 ... valueN</code> |
| <i>italics</i> | Italic type indicates a variable. Substitute a value for the variable: <i>library_name</i> |
| boldface | Bold type indicates commands or text you type: connect |

boldface italic Bold type indicates commands or text you type and need to substitute a variable: `nwadmin -s server-name`

vertical line | A vertical line indicates a choice within braces or brackets:
`SIZE filesize [K|M]`

Required Oracle Documentation

This document provides Legato Storage Manager user information. Installation, configuration and tuning recommended for a production database system is discussed in detail in the following manuals:

- *Oracle Server Installation Guide* for your operating system
- *Backup and Recovery Guide* for your level of Oracle Server

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To order documentation, call the appropriate number listed below.

- In the United States, call Documentation Sales at: **1.800.252.0303**.
- In the United Kingdom, call Oracle Direct Response at: **+44.990.332200**.
- In other European countries, contact your local Oracle Support office.
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Please prepare the following information before you call:

- ☐ Your CSI number (if applicable) or complete contact details, including any special project information.
- ☐ The release levels of the Oracle Server and associated products (for example, Oracle8i Server release 8.1.6, and Oracle Forms release 4.5.6.3.2).
- ☐ Operating system name and release level, including patches and packages.
- ☐ Details of error codes, numbers, and descriptions associated with the problem.
- ☐ A full description of the issue, including:
 - What happened? For example, the command used and result obtained. Keep in mind what did *not* happen, as well as what did happen.
 - When did it happen? For example, time of day, or after a particular command, or after an operating system or Oracle upgrade.
 - Where did it happen? For example, on a particular system, or within a particular procedure or table.
 - What is the extent of the problem? For example, is your production system unavailable, or is the impact less severe? Is the problem getting worse?
- ☐ Copies of any trace files, core dumps, or log files recorded near the time of the incident.

For installation-related problems, please have the following information available:

- ☐ Listings of the contents of the ORACLE_HOME directory, and any staging area, if applicable.
- ☐ Contents of the installation log files in the \$ORACLE_HOME/orainst directory: `install.log`, `sql.log`, `make.log`, and `os.log`.

For more information, contact <http://www.oracle.com/support>.

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Introduction

This chapter provides an overview of Legato Storage Manager (LSM) for Oracle. It surveys the major features and functionality of LSM and explains how LSM operates in conjunction with the other components of an integrated Oracle backup and recovery system.

Major Topics:

- [What is Legato Storage Manager?](#)
- [Overview of LSM Features](#)
- [Overview of Oracle Backup and Recovery System](#)
- [Additional Legato Documentation](#)

What is Legato Storage Manager?

LSM is a comprehensive Oracle data storage management system. LSM augments the Oracle backup and recovery subsystem in Oracle7 on Windows NT, or Oracle8 and Oracle8i on UNIX®, Windows 2000, or Windows NT, by means of its media management functionality.

LSM provides Oracle data storage management service to the Oracle Server. You use LSM to configure the Oracle backup devices and the storage volumes in those devices. LSM interacts with the backup/restore utility on the Oracle Server during Oracle backup and restore operations. That utility is Enterprise Backup Utility (EBU) in Oracle7 on Windows NT and Recovery Manager (RMAN) in Oracle8 and Oracle8i. Data storage management for Oracle7 is *not* discussed in this release level of this book. This book provides information on data storage management for Oracle8 and Oracle8i on *Windows 2000 and Windows NT only*.

You initiate an Oracle backup or restore by running the appropriate backup/restore utility on the Oracle Server. During the backup, LSM receives the Oracle data from the Oracle utility and stores that data on the backup volumes. During the restore operation, LSM retrieves the required data from the backup volumes and passes it to the Oracle utility. LSM also maintains information records about the Oracle backups in its online index files, using this information to track the backed-up data.

As part of an overall Oracle backup and recovery system, LSM provides:

- Complete storage device and volume management services
- Convenient tracking of Oracle backup data on storage volumes
- Management of Oracle backup data throughout a complete data life cycle
- Complete disaster recovery protection for Oracle databases

Overview of LSM Features

LSM has two major components:

- LSM Server
- LSM Administrator GUI

As the main component of LSM, the LSM Server comprises all the programs and information files essential to running LSM. The LSM Server is the component that uses the Oracle backup devices and volumes and maintains information about Oracle backups in its online index files.

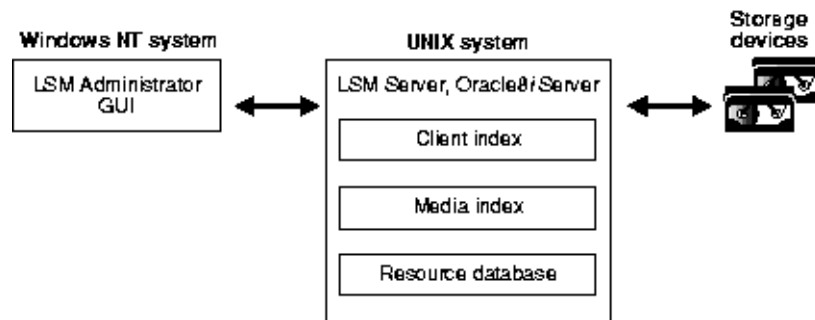
You must install the LSM Server on the same Windows 2000 or Windows NT computer as the Oracle Server. You must also connect the Oracle backup devices to the Oracle Server computer.

The LSM Administrator GUI is a graphical user interface to access the LSM Server and its resources. You can run the LSM Administrator GUI to connect to and configure the LSM Server, storage devices, and storage volumes. You can also use the LSM Administrator GUI to monitor the status of Oracle backup and restore operations.

The LSM Administrator GUI can run on the Oracle Server computer. You install both the LSM Server and LSM Administrator GUI components during the LSM installation procedure on the Oracle Server computer. In addition, you can install and run the LSM Administrator GUI separately on a Windows 2000 or Windows NT platform.

Figure 1-1 illustrates the general organization of LSM and its major components.

Figure 1-1 LSM Components



In Figure 1-1, the LSM Server has been installed on a Windows system with the Oracle8i Server, and the LSM Administrator GUI has been installed on a separate Windows system on the network. The LSM Administrator GUI connects to the LSM Server over the network. The LSM Server uses the two online index files shown--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 LSM users to browse this index information.

Note: LSM has a subset of the features in the Legato NetWorker upgrade product from Legato Systems, Inc. The upgrade product consists of the latest combination of Legato NetWorker and NetWorker Module for Oracle. Information about upgrading from LSM is available in the LSM splash screen that appears when you start the LSM Administrator GUI. For more information about upgrading from LSM, contact your Legato representative.

You use LSM to configure and manage the storage devices connected to the Oracle Server as well as the storage volumes used in those devices. LSM stores the backup data passed from the Oracle Server's backup/restore utility on storage volumes mounted in the devices. During Oracle data recovery, LSM retrieves the backed-up Oracle data from the appropriate storage volumes and passes it to the Oracle utility.

You start an Oracle backup or restore by running one of the following programs:

- Command-line interface of the Oracle backup/restore utility on the Oracle Server
- Oracle Enterprise Manager (OEM) Backup Management Tools

The Oracle backup/restore utility, Recovery Manager (RMAN), creates the Oracle backup data objects and then passes them to LSM.

As an optional component of the Oracle backup and recovery system, OEM Backup Management Tools provide a graphical user interface to RMAN. OEM Backup Management Tools direct RMAN on the Oracle Server to perform the backup. You must install OEM Backup Management Tools on a Windows 2000 or Windows NT system, which can be either the Oracle Server computer or a separate computer on the network.

It is possible to install the LSM GUI on the same computer as OEM Backup Management Tools. Again, you can use the LSM Administrator GUI to connect to and configure LSM Server, manage the storage devices and volumes, and monitor the status of Oracle backups and restores. You can also configure and use LSM by means of LSM command-line utilities on the Oracle Server.

LSM supports the backup of Oracle tablespaces, datafiles, control files, and archived logs. However, it supports the backup of *only Oracle data* on the Oracle Server computer--*not* the backup of *any other filesystem data* on that computer or the backup of data on *any other computer* connected to the same network.

Note: If you want to back up non-Oracle filesystem data on the Oracle Server in addition to Oracle data, you can contact your Legato Systems, Inc. representative for more information.

LSM supports a maximum of four concurrent tertiary storage devices (tape only) and a maximum of four Oracle data streams being backed up simultaneously to the available storage devices. LSM does *not* support certain other features of the upgrade Legato NetWorker storage management product, such as autochangers (or jukeboxes), silos, cloning, and scheduled Oracle backups.

In summary, the following list outlines the major features of LSM, running on the same computer as the Oracle Server:

- With Oracle7, support for Windows NT 4.0 only
- With Oracle8 and Oracle8i, support for Windows 2000, Windows NT 4.0, AIX® 4.1.4 or later, HP-UX® 10.20 and 11.00, Solaris™ 2.5.1 or later, and Tru64 UNIX 4.0A or later.
- LSM configuration and use by means of the LSM Administrator GUI, which can run on either the Oracle Server or a separate Windows computer
- Configuration and management of the storage devices and volumes used for Oracle backups
- Support for backup and restore of Oracle tablespaces, datafiles, control files, and archived logs
- Support for backup and restore of *only Oracle data on the Oracle Server--not* other filesystem data on that computer or data on another computer on the network
- During Oracle backup, storage of the Oracle data objects created by the Oracle backup/restore utility onto volumes in the backup devices
- During recovery of Oracle data, retrieval of the appropriate Oracle data objects from appropriate storage volumes
- Monitoring of the progress of Oracle backup and restore operations
- Management of the Oracle backup data life cycle by means of two online indexes
- Browsing of online index information for Oracle backups

- Support for up to four concurrent storage devices
- Support for up to four simultaneous data streams

LSM does *not* support certain features of the standard Legato NetWorker storage management system--autochangers, silos, cloning, and scheduled backups.

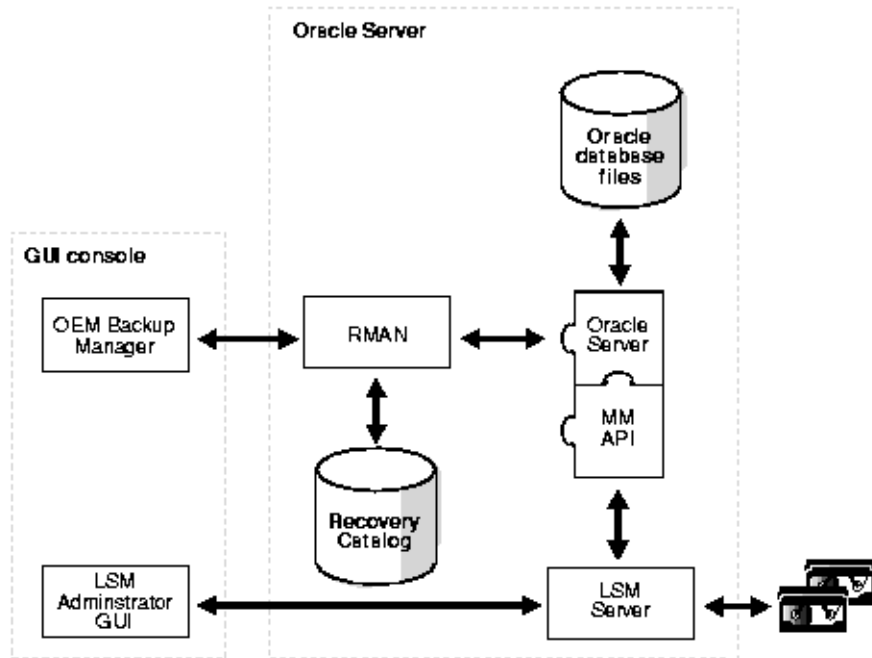
Overview of Oracle Backup and Recovery System

LSM functions 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 LSM and the Oracle components work together. The following is a description of the functional details of their interaction.

LSM interacts with the Oracle backup and recovery subsystem during 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)
- OEM Backup Management Tools (optional)

[Figure 1-2](#) illustrates the architecture of the overall Oracle backup and recovery system and shows the functional relationship between LSM, RMAN, and the Oracle Server.

Figure 1–2 Oracle8 or Oracle8i Backup and Recovery System

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

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

Although a Recovery Catalog is not mandatory, Legato *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 detailed information about RMAN and the Recovery Catalog and Oracle8i backup and recovery operations, refer to the Oracle *Backup and Recovery Guide*.

Before running an Oracle backup or recovery, you must properly install and configure LSM software on the Oracle Server. The LSM installation automatically configures the Oracle Server as a storage management client of the LSM Server. Then, you can use the LSM Administrator GUI to configure the necessary backup devices and label backup volumes. For more information about LSM configuration, see [Chapter 2, "Preparing to Use LSM"](#).

You can start an Oracle backup or recovery by issuing the appropriate commands to RMAN through one of the following:

- RMAN command-line interface
- OEM Backup Management Tools

OEM Backup Management Tools generate RMAN commands that are sent to the Oracle Server. OEM Backup Management Tools have a simple interface, where users can perform backup and recovery through a point-and-click method. For information about performing backup and recovery using 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 LSM Server, through the MM API. The LSM Server, in turn, stores the Oracle data to the appropriate backup tape device.

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

At the end of the Oracle backup, the LSM Server updates the online client and media indexes with information about the backup media used and Oracle data stored on it. LSM takes care of the storage management tasks while RMAN passes the data from the Oracle Server to LSM. LSM automatically backs up the client and media indexes once every day as part of the regular LSM Server *bootstrap* backup.

When you initiate an RMAN restore request, the MM API translates the object names requested by RMAN into a format understood by the LSM Server and forwards it to the LSM Server. The LSM Server searches its online media index 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.

Additional Legato Documentation

To take best advantage of the information in this *Legato Storage Manager Administrator's Guide*, use it in conjunction with the information available in the following documentation.

Online Help

Note: Several features documented in the online help are not supported by LSM--such as archiving, cloning, registration and authorization, and using autochangers (jukeboxes) or silos.

The Windows version of the LSM Administrator GUI has an extensive online help component. You can access the online help both by selecting Help Topics from the Help menu and by clicking the Help button in dialog boxes.

Click the Help Topics toolbar button or select Help Topics from the Help menu to display the Help Topics dialog box, common to most online help systems running on Windows computers. The Help Topics dialog box provides a contents tab, index tab, and keyword search feature to help you find the help topic you need.

Click the Contents tab (the default tab) to display a table of contents organized into books and topics. Double-click a book to display the additional books and/or topics the book contains. Double-click a topic to open the Help dialog box in the upper right corner of your computer screen. You can move and resize the Help dialog box.

Click the Index tab to display a scrollable index of keywords and terms, much like an index found in a printed book. Double-click the keyword or term that pertains to the subject on which you want help. If there is only one relevant topic, it automatically appears. If there are multiple topics, you can select the one you want to see.

Click the Find tab to display a help wizard that leads you through a process to find help topics based on keywords you enter.

LSM also provides Help buttons in most of its dialog boxes. Click the Help button in an LSM dialog box to display the help topic associated with that LSM feature.

When a help topic appears on your computer screen, you can move and resize the window just like with any other Windows help topic. The Help window also contains buttons that enable you to print the topic, view the previous topic, or return to the Help Topics dialog box.

'How Do I' Help

The 'How Do I' help feature provides online information for commonly used LSM functions. 'How Do I' help is similar to Windows online help and has its own Help Topics dialog box. Select 'How Do I' from the Help menu to access 'How Do I' help.

'What Is This' Help

The 'What Is This' help feature on many Windows applications provides a short description of each feature in the LSM Administrator GUI program. You access this help by clicking a button, icon, or other graphical feature with the right mouse button. Right-click the mouse on these items to display a pop-up menu next to the pointer. Here you can select the 'What Is This' command, as well as other commands. Selecting the 'What Is This' command displays a pop-up box that contains information about what the item is and what actions you can take with it.

'Field' Help

The 'Field' help feature appears when you click the 'Field' help button in certain dialog boxes. Because of LSM's architecture, the items that appear in a dialog box can vary depending on the configuration of the LSM Server to which you are connected. To meet the dynamic nature of these dialog box contents, 'Field' help provides a dynamic help system based on the items you see on screen.

Dialog boxes with 'Field' help still have buttons for accessing the Windows online help. The online help topic for a dialog box indicates whether you need to access 'Field' help to view a description of the dialog box contents.

Legato Command Reference Guide

Note: The *Legato Command Reference Guide* is derived from the corresponding guide for the Legato NetWorker upgrade product. You might see features documented in this guide that are not supported by LSM--such as archiving, cloning, registration and authorization, and using autochangers (jukeboxes) or silos.

The *Legato Command Reference Guide* is included with the Windows version of LSM and provides technical information describing each of the LSM commands. It acts as a reference for the syntax and function of the LSM commands that you can issue from the command line.

The *Legato Command Reference Guide* is available in HTML and PDF form on the Oracle for Windows Documentation CD-ROM. It is located in the same directory on the CD-ROM as the *Legato Storage Manager Administrator's Guide*, in the subdirectory named *CMNDREF*.

The HTML or PDF files that comprise the guide are not installed on your local disk during Oracle or LSM installation. You can view the files on the CD-ROM or copy the files to your local disk for viewing.

- To access the HTML version of the guide, open the file *command.htm* in your web browser.
- To access the PDF version of the guide, open the file *command.pdf* using the Adobe® Acrobat® Reader, available from the Adobe web site at www.adobe.com. The guide uses the advanced search feature available in the latest releases of Acrobat Reader.

When you open the *command.htm* or *command.pdf* file, you will see a master page containing a description of the different types of LSM command utilities. The PDF master page also includes information on how to use the advanced search feature of Acrobat Reader to search the *Legato Command Reference Guide*.

Preparing to Use LSM

This chapter gives a more detailed description of the internal components of Legato Storage Manager (LSM) and their organization as a set of *resources* and *attributes*. It describes how LSM uses these components and how you can configure them in preparation for Oracle backup and restore operations. This chapter also provides information about using the LSM Administrator GUI program.

The information presented in this chapter assumes that you have already installed the LSM software on your Oracle Server. For information about installing LSM, refer to the Oracle installation guide for your particular system, as shipped with your LSM product.

Major Topics:

- [LSM Architecture](#)
- [Overview of LSM Operations](#)
- [Using the LSM Administrator GUI](#)
- [Configuration Roadmap](#)
- [Post-Installation Procedures](#)
- [Configuring LSM Resources](#)

LSM Architecture

As explained in [Chapter 1, "Introduction"](#), LSM has a set of features configured for Oracle data storage management service. The process of installing LSM on the Oracle Server preconfigures LSM's features to default settings that enable you to start using LSM for Oracle data storage operations with a minimum of additional configuration.

The LSM Server can use its programs for Oracle data storage operations only if all the required LSM configurations are in place--most of the required configurations are already in place immediately after LSM installation. The LSM client-server technology uses a Resource Allocation Protocol (RAP) whereby the LSM Server maintains its configurations as a set of internal *resources*. There are several different types of internal LSM resources (for example, client, server, device, and pool types of resources).

LSM configuration is a process of creating, modifying, or removing LSM resources by using the LSM Administrator GUI or available LSM commands. Each LSM resource also has its own components known as *attributes*, to which you assign values.

For example, the value of the Name attribute of an LSM resource defines the name of that particular resource. When you create a new LSM resource, you often need to assign a unique name to that resource by assigning a unique value to its Name attribute.

On Windows systems, an LSM resource is represented by a dialog box in the LSM Administrator GUI. The resource attributes are represented by the various text boxes, drop-down lists, and similar components in the dialog box.

The remainder of this chapter describes LSM configuration in more detail. Before you can use a device attached to the LSM Server for Oracle backups, you must have a device type of resource for it in the LSM Server. An important step in LSM configuration for Oracle operations is creating the required resource in the LSM Server for each attached storage device. By modifying the set of resources maintained by LSM, you can modify LSM performance and functionality.

The LSM Server maintains all the information about its configured resources in an online *resource database* file, as shown in [Figure 1-1](#).

[Table 2-1](#) lists the main types of resources that LSM uses for Oracle data storage management.

Table 2–1 LSM Resource Types

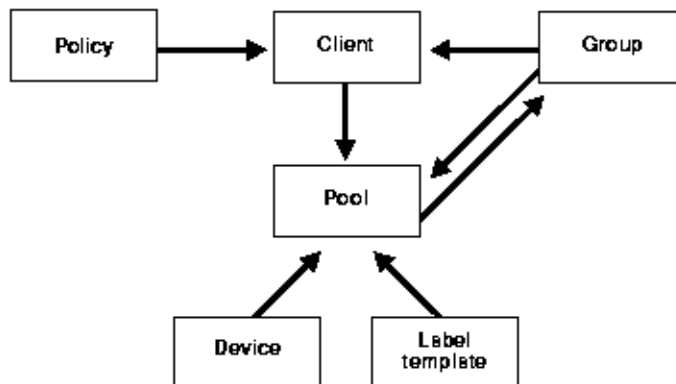
| Resource Type | Function |
|----------------|---|
| Client | Identifies the Oracle Server as the LSM backup client and specifies the policies that LSM uses for the Oracle backup data management. |
| Device | Describes a storage device connected to the Oracle Server that LSM can use for the Oracle backup and restore operations. |
| Group | Lists the specifications for the automatic LSM Server bootstrap backup. |
| Label Template | Provides instructions for LSM 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. |
| Policy | Names and defines a time period used for managing the backup data life cycle. |
| Pool | Names a collection of backup volumes and specifies the criteria that Oracle data must meet to be written to this named collection. |
| Server | Identifies the LSM Server characteristics. (Only one server type of resource can exist per LSM Server.) |

The resource types listed in [Table 2–1](#) are the only ones you need to configure to enable full LSM functionality for Oracle data storage. LSM does not use or support all the resource types available with Legato NetWorker. For example, LSM does *not* support the autochanger, registration, and schedule types of resources.

Some of the resources described in [Table 2–1](#) exist as attributes of the other resources. These interdependent relationships affect the order in which you implement the configuration of the LSM resources because LSM requires component resources to be defined before they can be listed as attributes of other resources.

[Figure 2–1](#) shows the dependencies between the LSM resources. The resources with outgoing arrows are both independent resources themselves and attributes of the resources where the arrows end.

Figure 2–1 Resource Configuration Dependencies

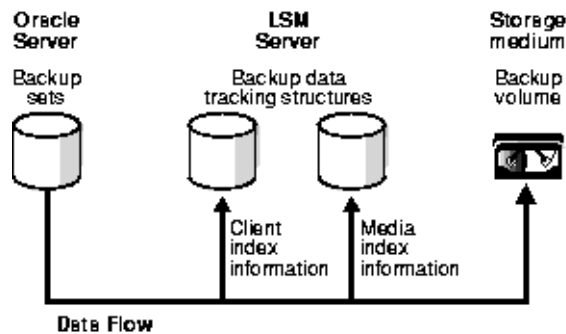


You must first define resources that are attributes of other resources. For example, you must define a policy type of resource before you can assign it as an attribute in a client type of resource. Also, you cannot assign a custom label template named "file" to a pool resource until you have created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

After LSM installation on the Oracle Server, the LSM Server has a set of preconfigured resources of the types listed in [Table 2–1](#) that are available for immediate use. These preconfigured resources and their default attribute values are described in the section "[Configuring LSM Resources](#)" on page 2-16. That section also explains the additional resource configuration you need before you can start to use LSM for Oracle backups and restores.

Overview of LSM Operations

[Figure 2–2](#) illustrates a simplified model for the Oracle backup operation using LSM. As explained in the section "[Overview of Oracle Backup and Recovery System](#)" on page 1-6, Oracle Server processes create the Oracle data backup sets during the backup operation. These backup sets are passed to the LSM Server, which writes the Oracle data to backup volumes in the storage devices. The LSM Server also tracks the location and status of the backup data on the storage volumes.

Figure 2–2 Data Backup Flow

The LSM Server tracks the location and status of the Oracle backup data by means of two special online index files that it maintains--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 *media index* file contains a database of indexed entries tracking the location and content of each storage volume managed by LSM. The media index includes information about the life cycle status of all the data on each Oracle backup volume.

At the end of an Oracle backup, the LSM Server adds entries for that particular backup to the client index and media index files. To the client index, it adds information about the specific Oracle data that was backed up. To the media index, it writes entries specifying the location of the backup volume and the Oracle data written to that volume.

The LSM Server is also preconfigured to perform the LSM Server *bootstrap* backup, every day at 3:33 a.m. *The bootstrap is a special backup set essential for disaster recovery procedures on the LSM Server.* The bootstrap contains the information needed to restore the following three components to the point just before the bootstrap was created:

- LSM Server index
- Media index
- Resource database

As mentioned in the section "[LSM Architecture](#)" on page 2-2, the LSM Server can only perform the Oracle backup operations after you have properly configured the required LSM resources. A *client* type of resource must exist identifying the Oracle Server as the LSM backup client.

You must configure a *server* resource, identifying the LSM Server and specifying the parallelism or maximum number of concurrent data streams. The server resource also specifies the users who belong to the LSM Administrator list--those users having sufficient privilege to modify the LSM configuration.

You must have a separate *device* type of resource configured for each Oracle backup device used by the LSM Server. And, you must have a storage volume labeled and mounted in each device to be used for backup. When labeling a volume, LSM assigns the volume to a volume pool, for which a *pool* type of resource must exist.

The section ["Configuring LSM Resources"](#) on page 2-16 provides more information about the preconfigured and recommended attribute settings of these required LSM resources.

Two important attributes of the client resource are the *browse policy* and *retention policy*. The LSM Server uses the browse policy and retention policy for managing the Oracle backup data life cycle. These policies specify how long the backed up Oracle data is available for recovery. After LSM installation, the LSM Server contains a preconfigured client resource for the Oracle Server that has the browse policy attribute set to a year and the retention policy set to ten years. *Legato recommends that you do not modify either of these policy attributes in the client resource.*

The *browse policy* determines how long the *client index* file on the LSM 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 remains in the client index. And, as long as there is an entry for the backup 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 LSM. Using the Oracle utility, you can restore individual Oracle data objects or an entire database and reconstruct an Oracle database during a recover session.

After the browse policy period for an Oracle backup set has been exceeded, LSM automatically *removes* the entry for that backup from the online client index. When the entry has been removed from the client index, you *cannot* restore the backup 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.

The *retention policy* determines the *minimum* period of time that the *media index* file maintains information about Oracle backup data. The media index tracks the Oracle backup sets on the storage volumes. 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 save set has been exceeded, LSM marks the status of the backup save set "recyclable," but retains its entry in the media index. When *all* the backup sets on a volume are marked "recyclable," LSM changes the volume's mode to "recyclable." The volume is then eligible for automatic relabeling by LSM. *LSM 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 LSM Administrator GUI.*

If a backup set has passed its browse policy and retention policy 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, LSM can automatically relabel the volume to satisfy a volume mount request. When LSM 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 the section "[Auto Media Management for Tape Devices](#)" on page 3-17.

Note: When LSM 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 LSM 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 save sets are also removed from the media index when you *manually* remove the volume from the LSM volume inventory. You can perform this type of manual removal within the Volumes window of the LSM Administrator GUI. For more information about using the Volumes window, see "[Using the Volumes Window](#)" on page 3-18.

Note that you can still use the `scanner` program to enable data recovery from a *manually* removed volume. The `scanner` program can retrieve the information needed to re-create entries in the client index and media index. When the `scanner` program has re-created the index entries, a user with the proper permissions can restore data using RMAN.

For more information about using the `scanner` program with LSM, refer to `scanner` in the *Legato Command Reference Guide* provided with LSM on Windows. For more information about using the *Legato Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.

For more information on `scanner`, see [Appendix A, "Scanner"](#).

In its system of tracking the status of Oracle storage volumes and the backup save sets on them, LSM assigns a "status" value to each backup save set (or "save set") and a "mode" value to each storage volume.

[Table 2-2](#) shows the possible values that LSM can assign for save set status.

Table 2-2 Save Set Status Values

| Status Value | Meaning | Description |
|--------------|-------------|---|
| abort | aborted | The backup for this save set was aborted manually, or a crash occurred during the operation. This save set is considered immediately eligible for recycling. |
| brows | browsable | The Browse policy for this save set has <i>not</i> expired. The files in this save set retain entries in the client index. You can restore all the files using Oracle's utility. |
| inpro | in progress | This save set is currently being backed up. |
| recov | recoverable | The Browse policy for this save set <i>has</i> expired but the Retention policy has <i>not</i> expired. The files in this save set no longer have entries in the client index but do have entries in the media index. You can only restore the files with the <code>scanner</code> program. |
| recyc | recyclable | The Retention policy for this save set <i>has</i> expired, but the files in this save set still have entries in the media index. You can only restore the files with the <code>scanner</code> program. |
| scann | scanned-in | The client index entry for this save set was restored with the <code>scanner</code> program. This entry remains in the client index and media index until you remove it <i>manually</i> . |
| susp | suspect | An attempt to restore this save set failed. The restore operation could not read all the blocks of the save set; for example, if there was a bad spot in the tape. |

As long as a save set remains in the client index, its status is "browsable." After LSM removes the save set from the client index, its status changes from "browsable" to "recoverable," and recovery of the save set cannot be performed directly with the available Oracle utility.

The status of a save set remains "recoverable" until its retention policy expires. Then, the save set's status changes from "recoverable" to "recyclable." When all the save sets on a volume change status to "recyclable," the mode of the storage volume itself changes to "recyclable." See [Table 2-3](#) for the meanings of storage volume modes.

Although the status of a save set is either "recoverable" or "recyclable," you can restore the save set from its storage volume by using the `scanner` program. Alternatively, you can use the `scanner` program to re-create a save set's entries in the client file index and enable file recovery using the Oracle utility.

[Table 2-3](#) lists the possible modes for a storage volume tracked by LSM and their definitions within LSM.

Table 2-3 Storage Volume Modes

| Mode Value | Meaning | Description |
|------------|----------------|---|
| appen | appendable | The volume contains empty space. Oracle data that meets the criteria for the pool to which the volume belongs can be backed up to the volume. |
| man | manual recycle | The volume is exempt from automatic recycling. You can only change the mode <i>manually</i> using the Volumes window of the LSM Administrator GUI. |
| (R) | read-only | The save sets on the volume are considered read-only. You can only change the mode <i>manually</i> using the Volumes window of the LSM Administrator GUI. |
| recyc | recyclable | The volume is eligible for automatic recycling. (LSM must relabel the volume before it can overwrite it.) |

When you run the LSM 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 LSM Administrator GUI, see the next section, ["Using the LSM Administrator GUI"](#). For

more information about using the Volumes window, see "[Using the Volumes Window](#)" on page 3-18.

[Chapter 3, "Media Management"](#) also contains more information about how LSM manages storage volumes for Oracle backups.

Note: *Legato recommends that you do not modify the existing Browse policy and Retention policy attributes of the client resource in the LSM Server from their default values of Year and Decade, respectively. The browse policy period of a year ensures that the save sets retain a "browsable" status in LSM and you can restore Oracle backup data using RMAN for at least a year. Furthermore, with the retention policy of a decade, the storage volumes do not become "recyclable" for at least ten years.*

Using the LSM Administrator GUI

As explained in the "[Overview of LSM Features](#)" on page 1-2, the LSM Administrator GUI is the graphical user interface for connecting to and configuring the LSM Server and its attached Oracle storage devices and volumes. You can also use the LSM 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 them.

In the installation process, the LSM Administrator GUI and LSM Server are installed on the Oracle Server. You can install and run the LSM Administrator GUI on a separate Windows 2000 or Windows NT platform on the same network as the Oracle Server.

Note: *Using the LSM Administrator GUI to administer a non-LSM (i.e., regular NetWorker) Server on the same network is not supported. You can only use the LSM Administrator GUI to configure and manage an LSM Server.*

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

- Add the LSM Server name to the local HOSTS file in `%SystemDrive%\system32\drivers\etc` or the Domain Name Server (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 LSM 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.
- We suggest that you use the same name for the LSM Server's TCP/IP hostname and the Windows computer name.

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

- From the taskbar, choose Start > Programs > NetWorker Group > NetWorker Administrator.
- If the LSM installation directory (`C:\win32app\nsr\bin` by default) is in your system path, run the `nwadmin` command at the command line prompt.
- If the LSM installation directory is *not* in your system path, use the complete pathname of the `nwadmin` command at the command line prompt, for example, `C:\win32app\nsr\bin\nwadmin`.

Note: If you installed LSM in a non-default directory, be sure to set the system path as described in "[Post-Installation Procedures](#)" on page 2-15.

The `nwadmin` entry in the *Legato Command Reference Guide* provides details on running the `nwadmin` program. For information on how to access the *Legato Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.

The `nwadmin` program is an X Window System application that provides a graphical user interface to administer and monitor LSM Servers. To start the `nwadmin` program, you can also enter the following command at the command line prompt:

```
nwadmin [ -s server-name ]
```

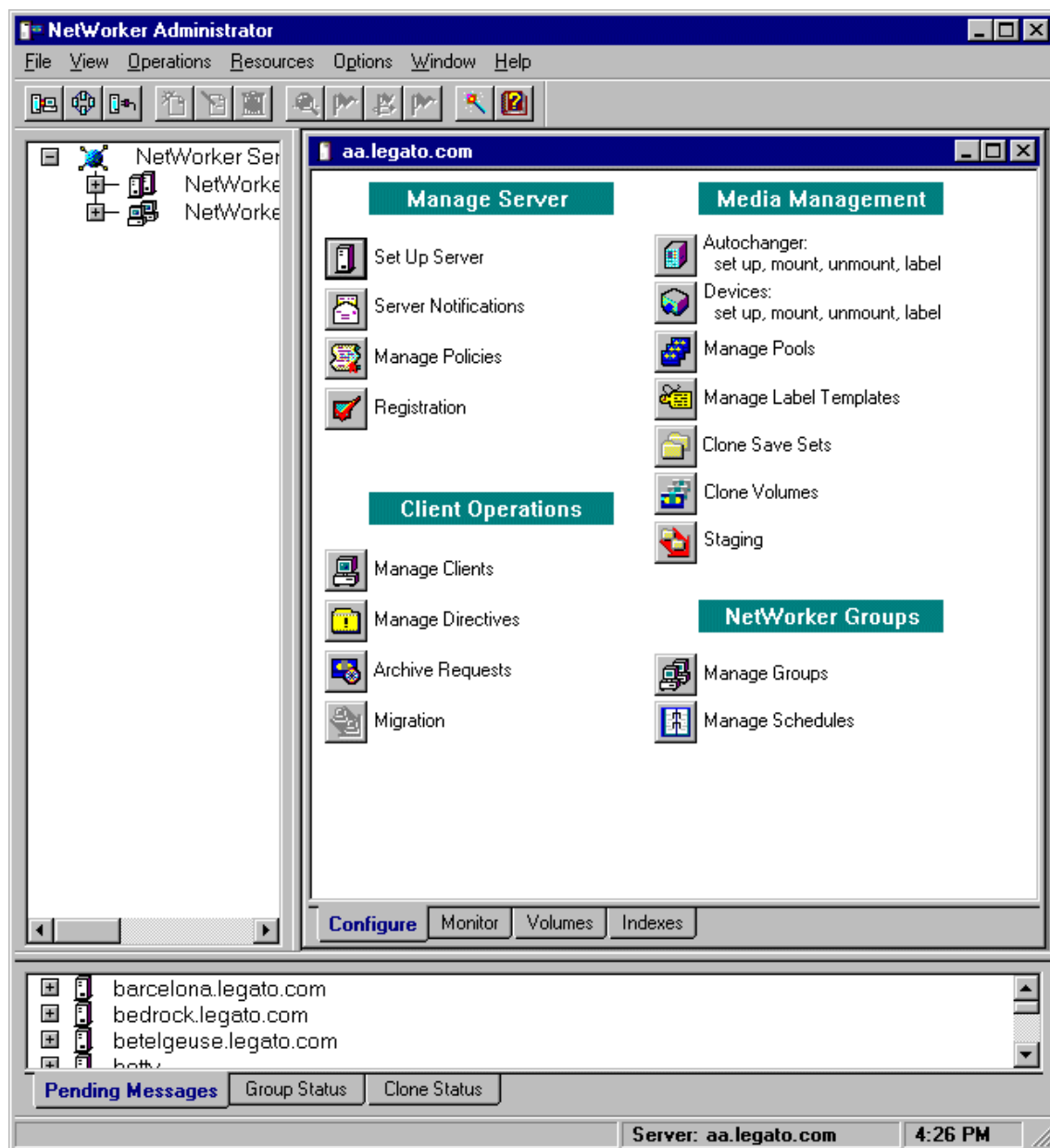
If you do not specify a `server-name` with the `-s` command option, the `nwadmin` command uses the server selection rules described in the `nsr` entry in the *Legato Command Reference Guide*. When multiple LSM Servers are accessible, you can select them from within the graphical user interface. Click the Change Servers speedbar button and enter the host ID of the server you want to access.

The main window of the `nwadmin` GUI display provides status information similar to that provided by the `nsrwatch` program for character-based displays.

Only users who have administrative privileges can create or apply configurations. Only `Administrators@server-name` have LSM Administrator privileges by default. You must be a member of the Administrators group on the LSM Server computer before you start any LSM administration programs or tasks. You can later add other users to the list of LSM Administrators using the procedure in "[Specifying LSM Administrators](#)" on page 2-21.

The main LSM Administrator window is displayed as shown in [Figure 2-3](#).

Figure 2-3 LSM Administrator Window



If the LSM Server is on a *different* platform from the Windows system running the LSM Administrator GUI, connect to the LSM Server by means of one of the following methods:

- Right-click a server icon in the Network or Messages window and select Connect to This Server from the pop-up menu.
- Click the Connect to Server toolbar button to open the Connect To Server dialog box, enter the server name in the Server text box, and click OK.

When the connection is successful, the LSM Administrator program displays a Server window for the LSM Server.

If you have any difficulty starting the LSM Administrator GUI on your Windows system, consider the following possibilities:

- LSM cannot resolve the LSM Server name into a network address.
- You are attempting to connect to a computer not currently running the LSM Server software.
- The LSM Server to which you are attempting to connect is unreachable or down.

If you have problems running the LSM Administrator GUI or establishing the connection to the remote LSM Server, see the troubleshooting information in [Appendix B, "Client Server Communications"](#).

For more information about using the LSM Administrator GUI, you can access its extensive online help component, as described in ["Online Help"](#) on page 1-9.

Now, proceed to ["Configuration Roadmap"](#).

Configuration Roadmap

Before performing LSM configuration procedures, be sure that you have properly installed LSM according to the instructions in the Oracle installation guide for your Windows system. You can install LSM during the process of installing your Oracle Server.

You must properly configure the LSM Server before you can use LSM for Oracle data storage management. To configure the LSM Server, perform the following steps:

1. Perform essential post-installation procedures, as outlined in ["Post-Installation Procedures"](#) on page 2-15.

2. Verify that the client resource in LSM is properly configured for your Oracle Server. For details, see "[Client Resource](#)" on page 2-16.
3. Customize the server resource in LSM as required. Ensure that the required users have administrative privileges on both the Windows computer running the LSM Server software and any Windows computer running the LSM Administrator GUI. For details, see "[Server Resource](#)" on page 2-19.
4. Configure an LSM device resource for each storage device attached to the LSM Server used for Oracle backup and restore operations. For details, see "[Configuring Storage Devices](#)" on page 3-2.
5. Customize any required volume pool resources and corresponding label template resources in the LSM Server. For details, see "[Using Volume Pools and Label Templates](#)" on page 3-11.
6. Label and mount your storage volumes in the required devices for Oracle backups. For details, see "[Labeling and Mounting Storage Volumes](#)" on page 3-13.
7. Verify that the LSM client and Default group resources are properly configured for the automatic daily LSM Server bootstrap backup. For details, see "[LSM Server Bootstrap Backups](#)" on page 4-10.

After you have finished installing LSM, see "[Post-Installation Procedures](#)" immediately below for important information on additional procedures required on your Windows system.

Post-Installation Procedures

After installing LSM, verify that the system path includes the correct LSM installation directory. If you installed LSM in a location other than the default directory `C:\win32app\nsr\bin`, you must set the system path to enable proper Oracle backup and restore operations.

After installing LSM in a non-default directory, add the LSM installation directory to the system search path by following these steps:

1. From the taskbar, select Start > Settings > Control Panel to open the Control Panel window.
2. Double-click System.
3. In the System Properties window, select Environment.
4. Select Path from the System Variables list box.

5. Add the complete pathname of the LSM installation directory to the path value. For example, if you installed LSM in the `\legato\nsr\bin` directory on the D: drive, add `D:\legato\nsr\bin` to the path value.
6. Select Set.
7. Select OK.
8. Reboot the Windows system.

After you have verified the correct setting of the system path, proceed to the section ["Configuring LSM Resources"](#) immediately below.

Configuring LSM Resources

The LSM Server contains a number of *preconfigured* resources after installation on the Oracle Server computer; the two main ones are the client resource and server resource. The section ["LSM Architecture"](#) on page 2-2 contains general information about how LSM uses its system of internal resources and attributes. The attribute values set in the client resource and server resource determine how the LSM Server and Oracle Server communicate during Oracle operations.

You can view and configure LSM resources and their attribute settings by means of the LSM Administrator GUI. For more information on running the GUI, see ["Using the LSM Administrator GUI"](#) on page 2-10. If the LSM Administrator GUI is on a Windows system separate from the Oracle Server, remember to connect to the LSM Server in the GUI by one of the methods outlined in ["Using the LSM Administrator GUI"](#) on page 2-10.

Use the information in the remainder of this chapter to properly configure your LSM Server for Oracle backup and restore operations.

Client Resource

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

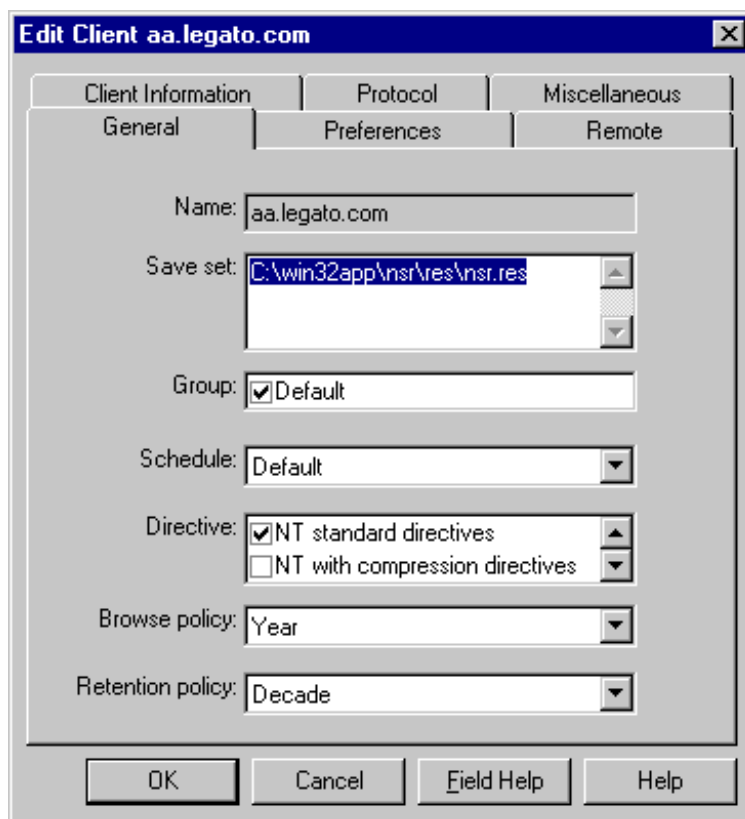
- The data to back up for the Oracle Server.
- How long to maintain entries for the data in the online index for recovery (browse policy).
- How long to keep the media containing the backed-up data (retention policy).

After initial installation of the LSM Server software, the LSM Server contains a preconfigured client resource for the Oracle Server. *You cannot modify any of the attribute settings for this preconfigured client resource.*

To view the client resource configuration in the LSM Administrator GUI on Windows, perform the following steps:

1. Clicking the Configure tab in the Server window (of the main Administrator window) to make the Configure window active.
2. Click the Manage Clients icon to open the Clients window. The Clients window lists only the one client resource having the name of the Oracle Server. On a Windows system, the Clients window does *not* automatically show the attribute settings of the client resource.
3. In the Clients window, right-click the icon of the LSM client, and select Edit from the pop-up menu to open the Edit Client dialog box, similar to the one shown in [Figure 2-4](#) on page 2-18.
4. In the Edit Client dialog box, the General (default) tab shows the client resource attributes used by the LSM Server for operations on the Oracle Server. Click Field Help to learn more about each attribute shown.

The Edit Client dialog box on a Windows system, listing all the attributes of the client resource, appears as shown in [Figure 2-4](#).

Figure 2–4 Edit Client Dialog Box

The Name field shows that the Name attribute is set to the hostname of the Oracle Server. The Browse policy attribute is set to a Year, and the Retention policy is set to a Decade. Use of these policies for management of the Oracle backup data is described in the ["Overview of LSM Operations"](#) on page 2-4.

The Group attribute must be set to Default for proper configuration of the automatic daily LSM Server bootstrap backup. For more information on the bootstrap backup configuration, see ["Automatic Bootstrap Backup"](#) on page 4-11.

As mentioned in the section ["LSM Architecture"](#), the LSM Server does not use all of the attributes represented by the fields in the Edit Client dialog box for the client resource.

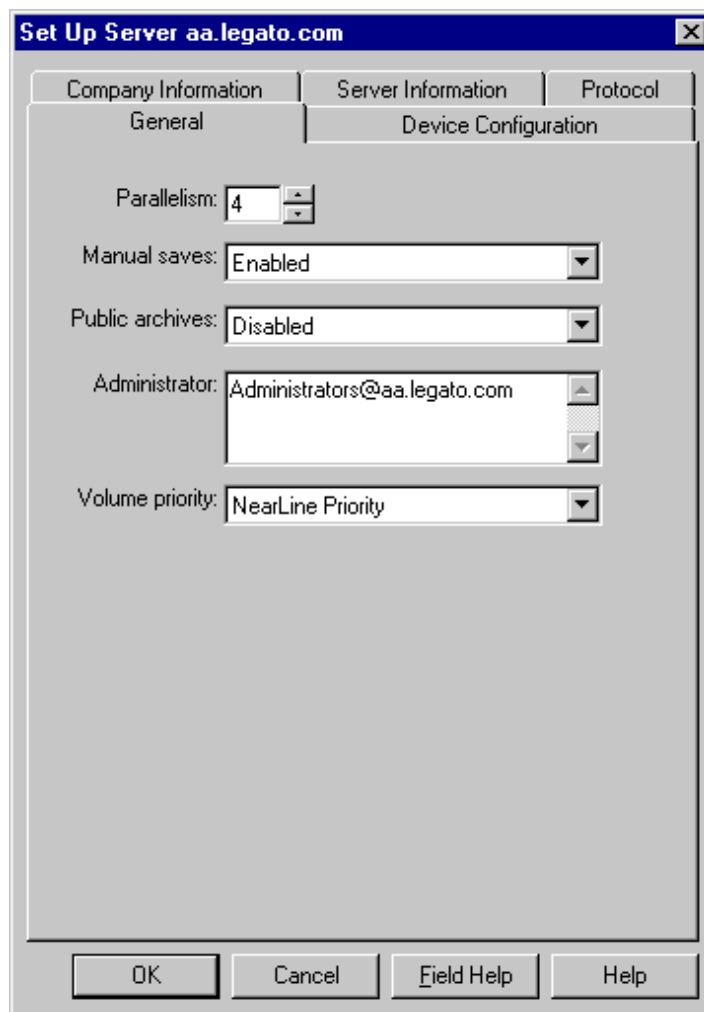
Server Resource

After initial installation of the LSM Server software, the LSM Server contains a preconfigured server resource with attribute settings that influence the performance and security of the Oracle backups. *Unlike the preconfigured client resource, you can modify some of the attribute settings of this server resource, including the Administrator attribute setting.*

To view the server resource configuration in the LSM Administrator GUI on Windows, perform the following steps:

1. Click the Configure tab in the Server window (of the main Administrator window) to make the Configure window active.
2. Click the Set Up Server icon to open the Set Up Server dialog box. The General (default) tab shows the server resource attributes for a basic configuration.

The Set Up Server dialog box on a Windows system appears as shown in [Figure 2-5](#) on page 2-20.

Figure 2–5 Set Up Server Dialog Box

The Set Up Server dialog box on Windows lists the attribute settings of the server resource. The basic attributes of the server resource are as follows:

- Name

This attribute (in the Server Information tab) lists the hostname of the LSM Server.

- **Parallelism**

This attribute (in the General tab) sets the maximum number of backup data streams that the LSM Server sends to the attached backup devices at any one time. The LSM Server can write up to four simultaneous data streams. Backing up multiple data streams simultaneously increases the efficiency of the storage device operations.

- **Administrator**

Although any user can view the LSM Server resource settings, only users specified in the Administrator attribute (in the General tab) have sufficient privilege to modify the LSM Server resource configurations. The initial default setting of this attribute is *Administrators@hostname* on Windows.

To customize the server resource attribute settings in the Set Up Server dialog box, see the appropriate sections below:

- To modify the list of users in the Administrator attribute, see ["Specifying LSM Administrators"](#) immediately below.
- To enable the device auto-detection feature *on Windows NT only*, modify the attribute settings in the Device Configuration tab of the Set Server dialog box using the instructions in ["Device Auto-Detection and Configuration on Windows NT"](#) on page 3-8.

Specifying LSM Administrators

The only users with sufficient privilege to modify the LSM Server resource configurations are LSM Administrators--those users specified in the Administrator attribute of the server resource. LSM on Windows initially sets the Administrator attribute to *Administrators@hostname*, where *hostname* is the LSM Server computer name. As a result, members of the Administrators group are set up as LSM Administrators by default.

If you receive the following error message while attempting to make LSM configuration changes, your user name is not included in the Administrator attribute:

`user user_name needs to be on administrator's list`

By definition, only an LSM Administrator can change the attributes of the LSM Server resources. Only an LSM Administrator can grant LSM Administrator privileges to other users or user groups on Windows and change or delete entries in the LSM Administrator list.

Table 2-4 lists the types of names that are acceptable in the Administrator attribute of the server resource. To grant LSM Administrator privileges to a user or user group, add one of the following types of names to the Administrator list using the procedure in "Modifying the LSM Administrator List" on page 2-23.

Table 2-4 LSM Administrator Names

| Acceptable Usage | Example |
|------------------------------|-------------------------------|
| <i>local_group@hostname</i> | <i>Administrators@mercury</i> |
| <i>global_group@hostname</i> | <i>Domain Admins@mercury</i> |
| <i>user@hostname</i> | <i>jsmith@mercury</i> |
| <i>hostname/user</i> | <i>mercury/jsmith</i> |
| <i>user@domainname</i> | <i>jsmith@legato.com</i> |
| <i>wildcard@hostname</i> | <i>*@mercury</i> |

Note that LSM recognizes domain names and Windows groups, both local and global, as acceptable entries in the Administrator attribute. If you are logged into an individual Windows computer, only the local group is recognized, since there is no "global" group. If you are logged into a domain, only the global group is recognized. You can find out the name of your group by running the Windows utility `findgrp.exe`, provided with the Windows Resource Kit.

If a *hostname* is used, LSM must be able to resolve the *hostname* to the right of the @ sign as a valid TCP/IP address.

Note: By using a wildcard (*, for example) to the *left* of the @ sign, you grant LSM Administrator privileges to any user logged onto that computer. *Avoid using a wildcard to the right of the @ sign.* If you do, you grant LSM Administrator privileges to any user or group to the left of the @ sign, regardless of their location.

If you need to restrict the LSM Administrator list so that it does *not* include *Administrators@hostname*, make sure that the list includes at least the user that starts the LSM services. Typically, this is the *system* user. For example, *system@hostname* allows the proper access to LSM resources and allows the services to start.

Modifying the LSM Administrator List

To modify the list of LSM Administrators in the Administrator attribute of the server resource on Windows, perform the following steps:

1. Run the LSM Administrator GUI as one of the users already in the LSM Administrator list.
2. Click the Configure tab in the Server window (of the main Administrator window) to make the Configure window active.
3. Click Set Up Server to open the Set Up Server dialog box. The General (default) tab displays the Administrator attribute.
4. Perform one or more of the following steps, as required:
 - To *add* a user or group name to the Administrator list, enter the name in the Administrator list box.
 - To *change* a name in the list, highlight the name in the Administrator list box and type the modified name.
 - To *remove* a name from the list, highlight the name in the Administrator list box and press [Delete]. Do not remove all names from the list, especially do not remove *system@hostname*.
5. Click OK to apply the changes to the LSM Server resource and exit the Set Up Server dialog box.

Other LSM Resources

Before you can use LSM for Oracle backup and restore operations, you need to create a device resource for each device to be used by the LSM Server. In addition, you must label and mount a storage volume in each backup device. You can also use the LSM Administrator GUI for these volume operations. For details about configuration and management tasks involving the Oracle backup devices and volumes, see [Chapter 3, "Media Management"](#).

Finally, you need to verify that the LSM client and Default group resources are properly configured for the automatic daily LSM Server bootstrap backup. For more information on configuring and running bootstrap backups, see ["LSM Server Bootstrap Backups"](#) on page 4-10.

Media Management

This chapter provides details about how to configure and manage the storage devices and volumes LSM uses for Oracle backup and restore operations. It explains how LSM sorts Oracle data onto volumes that are grouped into volume pools and how you can label and mount volumes in the storage devices in preparation for Oracle backups. It also reviews the procedures LSM uses to track Oracle storage volumes and manage the data on them.

Major Topics:

- [Configuring Storage Devices](#)
- [Using Volume Pools and Label Templates](#)
- [Labeling and Mounting Storage Volumes](#)
- [Auto Media Management for Tape Devices](#)
- [Using the Volumes Window](#)
- [Volume Operations](#)

Configuring Storage Devices

An Oracle storage device is the drive on the LSM Server that LSM uses to write data during an Oracle backup and to read data during an Oracle restore operation. Before LSM can recognize an attached storage device, you must configure a device resource for it in the LSM Server.

Keep the following LSM Server features in mind when you plan the configuration of the Oracle backup devices to be used by LSM:

- Support for backup to tape devices only
- Support for a maximum of four storage devices attached to the LSM Server
- Support for a maximum of four Oracle data streams backing up simultaneously to the storage devices
- Support for device auto-detection on Windows NT only
- *No* support for autochangers (jukeboxes) or silos
- *No* support for high-speed devices
- *No* support for cloning

Except for autochangers, silos, and high-speed devices, LSM supports all the same devices that the Legato NetWorker release 5.7 upgrade product supports. For more details on specific devices supported by the NetWorker server, refer to the *Legato Compatibility Guide for Hardware* at the web site:

<http://www.legato.com>

You can configure up to a maximum of four tape devices on the LSM Server for Oracle backup and restore operations. Note that LSM supports the feature of device auto-detection and configuration on Windows NT. For details on device auto-detection, see "[Device Auto-Detection and Configuration on Windows NT](#)" on page 3-8.

Preparing for Device Resource Configuration

The LSM installation process on Windows automatically configures an LSM device resource for a 4mm tape device. For details on the LSM installation procedures, refer to the Oracle installation guide for your Windows system.

The LSM Server configuration must include a device resource for each Oracle storage device to be used for backup and restore operations. You can configure up

to a maximum of four device resources on the LSM Server. In addition, each Oracle storage device to be used must contain a labeled and mounted volume.

Note: When you configure a tape device, you must specify a *no-rewind* device name. When backing up to a tape volume, the LSM Server writes a file mark on the volume at the end of each backup and uses the position of that file mark to append data onto the volume during the next backup. If the device rewinds the volume at the end of a backup, the file mark position is lost and the existing data on the volume is overwritten during the next backup.

On a Windows system, you need to use the Tape Devices program in the Windows Control Panel to install the device driver for a storage device *before* you configure the LSM resource for that device.

Only devices currently registered with the Windows Registry are available for use with LSM. To determine what devices are available, perform the following steps:

1. Open an MS-DOS window.
2. Change to the LSM directory (*C:\win32app\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.

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

If a tape device does not appear in the Windows 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.

Note: On Windows 2000, you must disable RSM for each stand-alone storage device to be used by LSM.

On Windows 2000, select Storage>Removable Storage>Physical Locations from the Computer Management console. Then, repeat the following steps for each device connected to your system to which LSM will have access:

1. Under Physical Locations, right-click the device for which you want to disable RSM. Select Properties.
2. In the General tab of the Properties dialog box, ensure that the Enable Library checkbox is not checked.

Now, proceed to ["Device Resource Configuration"](#).

Device Resource Configuration

You can view, create, modify, or remove LSM device resources using the LSM Administrator GUI. You must have a separate LSM device resource configured for each attached Oracle storage device, up to a maximum of four device resources.

For details on running the LSM Administrator GUI, see ["Using the LSM Administrator GUI"](#) on page 2-10. If the LSM Administrator GUI is on a Windows system separate from the Oracle Server, remember to connect to the LSM Server in the GUI using one of the methods outlined in ["Using the LSM Administrator GUI"](#).

Note: You must run the LSM Administrator GUI as one of the users listed in the Administrator attribute of the server resource to be able to create, modify, or remove an LSM device resource. To simply view LSM resources, you do *not* need to run the GUI as an LSM Administrator. For more information on LSM Administrator privileges, see ["Specifying LSM Administrators"](#) on page 2-21.

To view or modify the LSM device resources in the LSM Administrator GUI, perform the following steps to open the Devices window:

1. Click the Configure tab in the Server window (of the main Administrator window). The Configure window becomes active.
2. Click Devices to open the Devices window.

On a Windows system, the Devices window appears as shown in [Figure 3-1](#). The Devices window lists each configured device on the LSM Server, but the window itself does not show the attribute settings of the device resources.

Figure 3-1 *Devices Window*



To view the attribute settings for any specific device, right-click the icon of that device and select Edit from the pop-up menu. The Edit Device dialog box opens, displaying the attributes for the device.

To create, modify, or delete a device resource, perform the device resource configuration procedures in the following sections:

- To create a device resource for an Oracle backup device attached to the LSM Server, see ["Creating a Device Resource"](#) on page 3-6.
- To modify an existing LSM device resource, see ["Modifying a Device Resource"](#) on page 3-7.
- To remove an LSM device resource, see ["Removing a Device Resource"](#) on page 3-7.

After you have properly configured an Oracle storage device in the LSM Server, the device name is displayed 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).

Note: To enable the device auto-detection feature *on Windows NT only*, follow the instructions in ["Device Auto-Detection and Configuration on Windows NT"](#) on page 3-8.

After you have completed the required resource configuration tasks for your storage devices, see ["Using Volume Pools and Label Templates"](#) on page 3-11 for information on using volumes in the devices.

Creating a Device Resource

To create a new device resource using the LSM Administrator GUI on Windows, perform the following steps:

1. In the Devices window, right-click the main Devices icon and select Create from the pop-up menu to open the Create Device dialog box.
2. In the Name text box, enter the correct device pathname for the storage device.
3. Select the correct type of media from the Media type drop-down list.
4. Select Yes from the Read only drop-down list to specify that the device be used *only* for restoring Oracle data. Select No if the device is to be used for *both* backup and restore operations.
5. For the Target sessions field, select the number of sessions that LSM will allocate to the device before using the next device during a backup of multiple backup sets. For more information on how LSM uses the Target sessions

attribute during backups, see "[Multiplexing During RMAN Backups](#)" on page 4-10.

6. To enable auto media management for a tape device, click the Operation tab and then select Yes from the final drop-down list. For more information on auto media management, see "[Auto Media Management for Tape Devices](#)" on page 3-17.
7. Click OK to apply the device configuration settings.

Modifying a Device Resource

To modify an existing LSM device resource using the LSM Administrator GUI on Windows, perform the following steps:

1. In the Devices window, right-click the icon of the device that you want to edit and select Edit from the pop-up menu to open the Edit Device dialog box.
2. Make the required changes to any of the following text boxes in the Edit Device dialog box:
 - Media type
 - Read only
 - Target sessions
 - Auto media management

Note: Verify that the Enabled attribute is set to Yes to ensure that the device is enabled for Oracle operations.

3. Click OK to apply the changes to the device resource configuration.

Removing a Device Resource

To remove an LSM device resource using the LSM Administrator GUI on Windows, perform the following steps:

1. In the Devices window, right-click the icon of the device that you want to remove and select Delete from the pop-up menu.
2. In the dialog box that pops up asking whether you are sure that you want to delete the device, click Yes.

Device Auto-Detection and Configuration on Windows NT

On Windows NT *only*, you can configure the LSM Server to enable the device auto-detection and configuration feature. This feature allows LSM to automatically detect and configure SCSI (sequential access) tape devices attached to the LSM Server.

LSM device auto-detection does *not* support the following devices and features:

- Autochangers
- Non-SCSI devices
- Optical drives
- Silos
- Multiport devices
- Network attached storage (NAS) devices
- Storage area network (SAN) devices
- Windows 2000 Plug and Play

LSM starts an auto-detection session as a background process that automatically looks for *new* SCSI sequential access tape devices on the LSM Server. When auto-detection is complete, LSM creates an individual device resource for each supported device it detects. These individual device resources are listed in the Devices window of the LSM Administrator GUI. Like other LSM resources, you can modify the device attributes or delete the device resources altogether.

LSM device auto-detection also looks at devices with *existing* device resources. If an existing device resource's description has changed or if a device resource is listed but the device itself cannot be detected by the auto-detection process, LSM displays an error message and the device remains disabled.

Note: LSM supports a *maximum of four* configured storage devices. If device auto-detection is enabled and more than four devices are connected to the LSM Server, LSM will use only up to four of the detected and configured devices.

LSM device auto-detection does *not* automatically remove inactive or obsolete individual device resources listed in the Devices window. You must manually remove these resources. For details, see ["Removing a Device Resource"](#) on page 3-7.

Device Auto-Detection Enabling Options

When you first install LSM, the device auto-detection feature is *disabled*. You can *enable* the device auto-detection feature by changing the value of the Search New Devices attribute in the server resource, located in the Set Up Server dialog box.

You can select one of these values for the Search New Devices attribute:

- **Now** - Begins device detection immediately. This value reverts to the previous setting (either At Startup or Never) following the auto-detection. *You must reset the Search New Devices attribute to this choice each time you wish to perform an immediate auto-detection.*
- **At Startup** - Automatically looks for new devices each time the LSM Server is rebooted, or if the LSM services are restarted manually. *Be sure that your devices are LSM-compatible and that the latest device drivers are installed prior to starting LSM. Device and driver incompatibilities can degrade or prevent LSM from properly starting when this feature is enabled.*
- **Never** - Disables the device auto-detection feature. This is the *default* value of the Search New Devices attribute.

How to Set Device Auto-Detection

To set auto-detection and configuration of devices on Windows NT, perform the following steps:

1. Run the LSM Administrator GUI as one of the users listed in the Administrator attribute of the server resource. For details, see ["Using the LSM Administrator GUI"](#) on page 2-10.
2. Click the Configure tab in the Server window (of the main Administrator window) to make it active.
3. Click Set Up Server to open the Set Up Server dialog box.
4. Click the Device Configuration tab to make it active.
5. Select the appropriate choice from the Search New Devices drop-down list:
 - **Now** - Begins device detection immediately. (This value automatically reverts to its previous setting of either At Startup or Never following auto-detection.)
 - **At Startup** - Automatically looks for new devices each time the LSM Administrator GUI starts.
 - **Never (default)** - Disables the device auto-detection feature.

6. Select Yes from the Enable New Devices drop-down list if you want LSM to automatically enable all devices it detects. *Enable this attribute only if you know that all devices detected will serve your LSM Server--otherwise, you might inadvertently misuse or reconfigure another computer's devices.*
7. Enter the LSM Server name in the Device Host List list box.
8. Click OK to close the Set Up Server dialog box.

If you selected Now for the Search New Devices attribute, LSM now starts an auto-detection session. Otherwise, you must close and then restart LSM for auto-detection to take place.

Device Enabling and Configuration Following Auto-Detection

Some of the devices detected might be owned by other applications. LSM initially disables and only partially configures the device resources that it creates during auto-detection, by default.

Note: You can speed up and simplify auto-detected device configuration by specifying that LSM automatically enable all new devices. Setting the Enable New Devices attribute in the Set Up Server dialog box to Yes will instruct LSM to immediately enable any new device resources created during the auto-detection process. For details, see ["How to Set Device Auto-Detection"](#) on page 3-9.

You can enable each individual device resource *manually* by opening its Edit Device dialog box and selecting Yes from the drop-down list for the Enabled attribute. For details, see ["Modifying a Device Resource"](#) on page 3-7.

To assist you in identifying each device, the Edit Device dialog box contains the Description attribute describing the device. This is a read-only attribute displaying device information, including the vendor ID, product ID, and logical unit number (LUN).

After you enable a device, LSM will complete all the required configuration for the device. LSM gives *default* values to other attributes in the Edit Device dialog box. You can change any attribute value by opening the Edit Device dialog box and making the change. Once you enable the devices and their configuration is complete, LSM can use the devices for Oracle backup and restore operations.

Using Volume Pools and Label Templates

An LSM volume *pool* is a set of storage volumes that LSM groups together according to specific common characteristics. LSM uses pools of volumes to sort and store Oracle backup data. Before LSM can back up Oracle data to a storage device, there must be a properly labeled volume mounted in the device. When LSM labels a volume, it assigns the volume to a volume pool.

Each LSM volume pool is defined by its pool resource in the LSM Server. The attribute settings specified in a pool's resource act as a filter LSM uses to determine which data to write to the volumes in that pool. Each pool configuration contains a list of criteria that data must meet for the data to be written to the volumes belonging to that pool.

Every volume belongs to a pool. Every pool has a specific label template associated with it. When LSM labels a volume for a specific pool, it automatically creates the label according to the rules of the label template associated with the pool. Label templates provide a method for consistently naming and labeling volumes so you do not have to keep track of how many volumes you have used. LSM uses pools of volumes in conjunction with their label templates to maintain information about what data is on which volume.

For more information on how LSM uses label templates, see [Appendix C, "Using Label Templates"](#).

When an Oracle backup occurs, LSM tries to match the characteristics of the save stream to the resource attributes configured for a volume pool. If the save stream matches the criteria of a pool configuration, LSM directs the save stream to a labeled volume belonging to that pool. LSM then checks whether a correctly labeled volume is mounted on a configured device. If a correctly labeled volume is mounted on a device, LSM writes the backup data to the volume. If there is no correctly labeled volume mounted on a storage device, LSM's actions depend on whether there is a configured tape device with auto media management enabled:

- If auto media management is enabled for a tape device, LSM can automatically label and mount an unlabeled or recyclable volume that is loaded in the device and proceed with the backup. For more information about auto media management, see ["Auto Media Management for Tape Devices"](#) on page 3-17.
- If auto media management is not enabled for a tape device, LSM requests that a labeled volume be mounted and waits until an operator mounts an appropriate volume. It then continues with the backup to that volume.

Although LSM contains several preconfigured volume pools after installation, it only supports volume pools of the "Backup" type. Only one preconfigured volume pool of the "Backup" type is initially enabled for LSM use--the pool named "Default."

Legato recommends that you use the Default volume pool for all your Oracle backups to tape. See the next section, ["Default Volume Pool"](#), for more information about this preconfigured pool.

Default Volume Pool

The preconfigured resource for the Default volume pool has the following attributes:

Name: Default
Enabled: Yes
Pool type: Backup
Label template: Default
Store index entries: Yes
Auto media verify: No
Recycle to other pools: No
Recycle from other pools: No

You cannot modify the Default pool resource. To view the Default pool resource configuration, run the LSM Administrator GUI (see ["Using the LSM Administrator GUI"](#) on page 2-10) and perform the following steps:

1. Click the Configure tab in the Server window (of the main Administrator window). The Configure window becomes active.
2. Click Manage Pools to open the Pools window.
3. Right-click the Default icon and select Edit from the pop-up menu. The Edit Pool dialog box opens. The Default pool attributes are displayed.

If you do not enable or create another "Backup" type of volume pool, LSM routes all Oracle backup data to the Default pool.

The preconfigured label template associated with the Default pool is also named Default. The LSM resource for the Default label template has the following attributes:

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

LSM automatically uses this Default label template when it labels volumes for the Default pool. For example, if the hostname of the LSM Server is *jupiter*, LSM automatically labels the volumes for the Default pool as *jupiter.001*, *jupiter.002*, *jupiter.003*, and so on. Note that you can override this default labeling scheme when you manually label a backup volume. For more information about labeling volumes, see ["Labeling and Mounting Storage Volumes"](#) immediately below.

Labeling and Mounting Storage Volumes

Each configured Oracle backup device attached to the LSM Server must have a labeled storage volume mounted in it before the LSM Server can use it for backup and restore operations. Labeling a volume associates the volume with a particular volume pool. After a volume is labeled, it becomes eligible to be used for backup when LSM needs a volume from the volume pool. LSM must mount the volume in a configured storage device before it can back up Oracle data to it.

LSM uses unique volume labels to maintain a record of each volume in its online media index. For more information about how LSM uses the media index for tracking storage volumes and the data on them, see ["Overview of LSM Operations"](#) on page 2-4.

You can have LSM *automatically* label and mount volumes in a *tape* device by enabling the auto media management attribute in the tape device resource. For details, see ["Auto Media Management for Tape Devices"](#) on page 3-17.

LSM must label a volume and mount it into a storage device before LSM can back up data to it or restore data from it. A volume must also be unmounted from the device before you can replace the volume in the device with another volume.

To *manually* label, mount, or unmount a volume using the LSM Administrator GUI (see ["Using the LSM Administrator GUI"](#) on page 2-10), follow the procedures in the appropriate section below:

- To label a storage volume, and optionally mount the volume after labeling it, see ["Labeling a Volume"](#) immediately below.
- To mount a volume, see ["Mounting a Volume"](#) on page 3-15.
- To unmount a volume from a device, see ["Unmounting a Volume"](#) on page 3-16.

Labeling a Volume

To label a storage volume (and optionally mount it afterwards) using the LSM Administrator GUI on Windows, run the GUI as an administrative user and perform the following steps:

1. If you are using a tape device, load an unlabeled or recyclable volume into the device.
2. Click the Monitor tab in the Server window (of the main Administrator window) to make the Monitor window active. Highlight the device name in the Devices section of the Monitor window.
3. Click the Configure tab to make the Configure window active and click Devices to open the Devices window.
4. Right-click the icon for the specific storage device and select Operations from the pop-up menu to open the Device Operations dialog box.
5. Click Label to open the Label dialog box.
6. Select Default for the Pool for a tape volume.
7. If you want to override the Volume Label automatically displayed with an individual label name not associated with a template, edit the Volume Label and enter a unique label name.
8. To make the volume mode "manual recycle," select Manual Recycle. The volume becomes exempt from automatic recycling and does not change its mode to recyclable automatically according to the retention policy. In this case, only an LSM Administrator can change the volume's mode to recyclable. For more information about storage volume modes, see [Table 2-3](#).
9. If you want to have LSM automatically mount the volume after labeling it, select Mount after Labeling. To have LSM label the volume *without* mounting it, deselect Mount after Labeling.
10. Click OK to label (and optionally mount) the storage volume.

As the first step in the labeling process, LSM verifies that the volume is unlabeled. Then LSM labels the volume with the name specified in the Volume Label field, either the next sequential label from the label template associated with the chosen pool or an override volume name you entered.

Note: 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 LSM 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.

Both the Devices and Messages sections of the Monitor window (of the main Administrator window) display information confirming the success of the volume labeling (and optional mounting) operation.

After LSM labels and mounts a volume in a device, the volume is available to receive backup data. Because the LSM label is internal and machine readable, it is a good idea to put an adhesive label on a tape volume that matches the internal volume label.

Mounting a Volume

To mount a labeled volume in a specific storage device using the LSM Administrator GUI on Windows, run the GUI as an administrative user and perform the following steps:

1. If you are using a tape device, ensure that the labeled volume is loaded in the drive.
2. Click the Monitor tab in the Server window (of the main Administrator window) to make the Monitor window active. Highlight the device name in the Devices section of the Monitor window.
3. Click the Configure tab to make the Configure window active and click Devices to open the Devices window.
4. Right-click the icon for the specific storage device and select Operations from the pop-up menu to open the Device Operations dialog box.
5. Click Mount.

LSM mounts the volume into the selected storage device. When the mounting operation is complete, the Device Operations dialog box displays the following message:

```
mounted <media type and label name>
```

where it had previously displayed

```
unmounted <label name>
```

Also, the Devices and Messages sections of the Monitor window (of the main Administrator window) both display information confirming the success of the volume mounting operation.

Unmounting a Volume

To unmount a volume from a specific storage device using the LSM Administrator GUI on Windows, run the GUI as an administrative user and perform the following steps:

1. Click the Monitor tab in the Server window (of the main Administrator window) to make the Monitor window active. Highlight the device name in the Devices section of the Monitor window.
2. Click the Configure tab to make the Configure window active and click Devices to open the Devices window.
3. Right-click the icon for the specific storage device and select Operations from the pop-up menu to open the Device Operations dialog box.
4. Click Unmount.

LSM unmounts the volume from the selected storage device. When the unmounting operation is complete, the Device Operations dialog box displays the following message:

```
unmounted <label name>
```

where it had previously displayed

```
mounted <media type and label name>
```

Also, the Devices and Messages sections of the Monitor window (of the main Administrator window) both display information confirming that the volume has been unmounted from the device.

Auto Media Management for Tape Devices

LSM supports auto media management for tape devices. The auto media management feature gives LSM automatic control over a tape volume (which is manually) loaded in a configured tape device. If the auto media management feature is enabled in the tape device's resource, LSM can automatically label, mount, and overwrite a volume that it considers unlabeled, and automatically recycle a volume eligible for reuse when it is loaded in the device.

LSM 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 LSM label.
- The volume is labeled with an LSM label, but the density indicated on the internal label differs from the density of the device where the volume is mounted.

Note: Because the auto media management feature can relabel a tape volume with a different density, it is possible to inadvertently overwrite data that still has value. For this reason, be careful if tape volumes are shared between devices with different densities.

If the auto media management feature is *not* enabled for a tape device, LSM ignores an unlabeled tape in the device and does not consider it for backup.

If the auto media management feature is enabled for a tape device, LSM exhibits the following behavior when a volume becomes full during a backup:

1. LSM issues a notification that it is waiting for a writable volume. At the same time, LSM waits for the full, verified volume to be *unmounted*.
2. LSM monitors the device, and waits for the operator to insert another volume into the device.
3. After LSM detects a new volume, it checks that the volume is labeled. If so, LSM mounts the volume. LSM checks to see whether the volume is a candidate to which to write data. If so, the write operation continues. If not, LSM waits for a writable volume to continue the backup.
4. If the volume is recyclable and is a member of the required pool, LSM recycles it the next time a writable volume is needed--in this case, immediately.

5. If the volume is unlabeled, LSM labels it when the next writable volume is needed for a backup--in this case, immediately.

In general, if a *non-full* volume is unmounted from a tape drive and auto media management is enabled, LSM waits for 60 minutes before the volume is automatically remounted in the drive. This hour is considered a reasonable delay to give an administrator or operator time to unload the volume after unmounting it.

If you want to enable auto media management for a tape device, you can modify the device resource for the tape drive by means of the LSM Administrator GUI. Follow the procedure in ["Modifying a Device Resource"](#) on page 3-7. The value of Yes in the Auto media management attribute of the tape device resource enables the feature.

Using the Volumes Window

["Overview of LSM Operations"](#) on page 2-4 describes the process that LSM uses to track each Oracle backup volume and the backup sets (save sets) on it. That section also describes the "status" value that LSM assigns to each save set and the "mode" value given to each volume. See [Table 2-2](#) for details about the save set status values and [Table 2-3](#) for all the possible storage volume modes.

You can use the Volumes window in the LSM 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

To open the Volumes window, run the LSM Administrator GUI on Windows (see ["Using the LSM Administrator GUI"](#) on page 2-10) and select the Volumes tab in the Server window (of the main Administrator window).

On a Windows system, only volume-specific information is displayed in the Volumes window. For information about a volume's save sets, right-click the specific volume name in the list and select Show Save Sets from the pop-up menu to open the Volume Save Sets dialog box.

If you leave the Volumes window open for an extended period of time, you can occasionally refresh the information displayed in the Volumes window by right-clicking anywhere in the window and selecting Refresh from the pop-up menu.

Volume Operations

The system of volume labeling used by LSM provides unique names for tracking and recognizing the Oracle backup volumes. LSM refers to volume labels in the records that it stores in the online media index. LSM uses the records in the media index to determine which volumes are needed for backing up or restoring data.

If you place a new label on a storable volume or recycle a volume by relabeling it, any existing data stored on the volume becomes unavailable for recovery.

During a backup, LSM searches for a volume from the appropriate pool to accept the backup data. The storage volumes available for use are the ones mounted in configured devices and the volumes accessible to LSM through auto media management.

If you try to back up Oracle data when an appropriate volume is not mounted, LSM requests a writable volume by displaying a message similar to the following in the Pending Messages window:

```
media waiting: backup to pool 'Default' waiting for 1 writable backup tape or disk
```

You receive one of three messages suggesting that you mount a volume, relabel a volume, or label a new volume.

If you are restoring files, LSM requests the volume name you need to mount in the device by displaying a message similar to the following in the Pending Messages window:

```
media waiting: recover waiting for 8mm 5GB tape_volume_name
```

If you need more than one volume to restore the files, the Pending Messages window lists all the volumes in the order they are needed. During the restore process, LSM requests each volume it needs, one at a time.

If more than one volume is mounted in the configured devices, LSM uses the following hierarchy to select a volume on which to write data:

- An already mounted, appendable volume from the appropriate pool
- An already mounted, recyclable volume from the appropriate pool but not currently in use
- An already mounted, unlabeled volume not currently in use and in a device for which "Auto media management" is enabled
- An appendable volume not currently mounted in the device but from the appropriate pool
- A recyclable volume not currently mounted in the device but from the appropriate pool

Backup data is destined for a specific pool. When the data is ready to be written, LSM monitors the active devices to locate a volume from the appropriate pool.

If only one volume from the pool is mounted and appendable, the data is directed to that volume.

If two volumes from the same pool are mounted on devices, LSM factors in the following considerations to guide its volume selection:

- The expiration date of the volume

The volume expiration date is set by default at two years after the date on which the storage volume was labeled (or relabeled). To override this default setting, change the expiration date through the Devices dialog box. If the default setting has been overridden, LSM checks to ensure that the volume expiration date is farther in the future than the date on which the save set exceeds its retention policy. If it is, the save set is written to the volume. Otherwise, LSM does not write the save set to the volume. (This checking behavior does not occur under the default condition.)

- The volume mode

LSM first writes to a mounted appendable volume from the appropriate pool, if one is available. However, if the appendable volume is also recyclable, that is, if all the save sets on the appendable volume have the status recyclable, the volume is treated as recyclable. A mounted recyclable volume from the appropriate pool is the second choice. A mounted recyclable volume that belongs to a pool that is not the pool needed is not recycled. The choice is a new, unlabeled volume.

- Volume label time, which is the time when the volume was labeled.

Volumes with the oldest label time are selected before volumes that were labeled more recently.

- The number of sessions currently writing to the device

If LSM cannot find a mounted volume from the appropriate pool, it initiates a mount request. If Auto media management is not enabled, mount requests continue to be generated until a volume is mounted and writing begins.

Backup and Restore Operations

This chapter presents information about using LSM for Oracle backup and restore operations after you have configured the requisite LSM resources in the LSM Server. It provides details on how to set up and run Oracle backups and restores as well as details on LSM Server bootstrap backups. The methods for monitoring Oracle backups and restores by means of the LSM Administrator GUI and specific log files are also outlined.

Major Topics:

- [Roadmap for Oracle Backups and Restores](#)
- [LSM Environment Variables](#)
- [RMAN Commands](#)
- [Creating RMAN Scripts](#)
- [Running Oracle Backups or Restores](#)
- [Using OEM Backup Management Tools](#)
- [Multiplexing During RMAN Backups](#)
- [LSM Server Bootstrap Backups](#)
- [Monitoring Oracle Backups and Restores](#)

Roadmap for Oracle Backups and Restores

The preceding chapters of this guide outline the procedures for configuring LSM for Oracle backup and restore operations. After applying the information in the ["Configuration Roadmap"](#) on page 2-14, the LSM Server should have all the required client, server, device, and volume pool resources configured. There should also be a labeled volume mounted in each configured backup device--or, if auto media management is enabled for a tape device, a tape loaded in the tape device for LSM to use automatically.

Note: You will be able to use LSM to restore only Oracle data that has been backed up according to the instructions in this chapter.

As explained in ["Overview of LSM Features"](#) on page 1-2, you can perform the Oracle data backup or restore operation using either the RMAN command-line interface or OEM Backup Management Tools:

- To use the RMAN command-line interface for the backup or restore, perform the following steps:
 1. Review the LSM environment variables that you can set in the RMAN script for the Oracle data backup or restore. For details, see ["LSM Environment Variables"](#) on page 4-3.
 2. Review the RMAN commands in Oracle8i that are dependent on the LSM Media Management implementation. For details, see ["RMAN Commands"](#) on page 4-5.
 3. Create the RMAN script to be used for running the Oracle backup or restore. For details, see ["Creating RMAN Scripts"](#) on page 4-6.
 4. Run the Oracle backup or restore using the RMAN command line interface. For details, see ["Running Oracle Backups or Restores"](#) on page 4-8.
- To use OEM Backup Management Tools for the backup or restore, see ["Using OEM Backup Management Tools"](#) on page 4-9.

For important additional considerations for RMAN backups, see ["Multiplexing During RMAN Backups"](#) on page 4-10.

Note: The **LSM** bootstrap is a special backup set essential for disaster recovery procedures. The **LSM** Server is preconfigured to perform an automatic daily bootstrap backup. After running a number of Oracle backups, a *manual* bootstrap backup is also recommended. For more information, see "[LSM Server Bootstrap Backups](#)" on page 4-10.:

You can use the information in "[Monitoring Oracle Backups and Restores](#)" on page 4-14 to keep track of the status of your Oracle backup and restore operations.

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*.

LSM Environment Variables

LSM provides several environment variables that you can set for your particular type of Oracle backup or restore. See [Table 4-1](#) for a description of the environment variables. LSM environment variables are all *optional*.

For LSM environment variables to be in effect during the Oracle backup or restore operation, you must set the variables in the RMAN backup or restore script itself. Setting the variables in the environment using the Windows command `set` has *no effect*.

Contrary to statements in the Oracle documentation, you must set an LSM variable using the `parms` argument in each `allocate channel` command in your RMAN script. Be sure to set the LSM variable for *each* channel. Also, specify the variable name in uppercase, for example, `NSR_DEBUG_FILE` instead of `Nsr_Debug_File`. Setting an LSM variable in the `backup` command in the RMAN script has *no effect*. For more information on setting the LSM variables in the RMAN script, see "[RMAN Commands](#)" on page 4-5.

[Table 4-1](#) describes all the available LSM environment variables, which 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 4–1 *LSM 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 LSM perform checksumming on the data Value of FALSE specifies no checksumming | <ul style="list-style-type: none"> FALSE (default) TRUE |
| NSR_COMPRESSION | <ul style="list-style-type: none"> Value of TRUE specifies that LSM perform compression on the backup data Value of FALSE specifies no compression | <ul style="list-style-type: none"> FALSE (default) TRUE |
| 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 LSM perform encryption on the backup data Value of FALSE specifies no encryption | <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 |

RMAN Commands

The Oracle8i RMAN commands described below are dependent on the LSM Media Management implementation. Be sure to review the following information before you use any of these RMAN commands.

Proxy Copy

LSM does *not* support proxy copy. The `proxy only` option of the RMAN `backup` command will cause the Oracle backup to fail.

Contrary to statements in the Oracle *Backup and Recovery Guide*, the `proxy` option of the RMAN `backup` command will also cause backup failure. This option will *not* default to a regular backup. To perform a regular backup, you must *not* specify the `proxy` or `proxy only` option.

Send Command

LSM 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.

The output of `trace` is written to the Windows file named `%SystemDrive%\win32app\nsr\applogs\dmo.messages`.

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

Table 4–2 Trace Option Values and Conditions Traced (Page 1 of 2)

| 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) |

Table 4–2 Trace Option Values and Conditions Traced (Page 2 of 2)

| Trace Value | Conditions Traced |
|-------------|--|
| 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 |

Pool Option of the Backup Command

LSM does *not* support the `pool` option of the RMAN `backup` command, with the exception of `pool=0`.

If you specify any non-zero value for the `pool` option of the RMAN `backup` command, the RMAN session will terminate and LSM will return the following error message:

```
Oracle pool is not supported
```

Duplex Option of the Set Command

LSM does *not* support the use of the `set duplex` command.

Creating RMAN Scripts

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

You can store your RMAN scripts as flat ASCII files. Alternatively, if you are using a Recovery Catalog, you can store your scripts in the Recovery Catalog database. For more information on storing RMAN scripts in the Recovery Catalog database, refer to the Oracle *Backup and Recovery Guide*.

For example, the following RMAN script performs an Oracle8 or Oracle8i backup of the entire database and specifies that RMAN-specific debugging information be written to the file `C:\win32app\nsr\applogs\backup.log`.

```
run {
  allocate channel t1 type 'SBT_TAPE'
  parms 'ENV=(NSR_DEBUG_FILE=C:\win32app\nsr\applogs\backup.log)';
  allocate channel t2 type 'SBT_TAPE'
  parms 'ENV=(NSR_DEBUG_FILE=C:\win32app\nsr\applogs\backup.log)';
  backup full filesperset 4
```

```

format 'FULL_%d_%u'
(database);
release channel t1;
release channel t2;
}

```

You must set the `type` argument in the RMAN command `allocate channel` to `SBT_TAPE`. This value specifies an LSM Media Management device.¹

Note: To ensure that a specific LSM environment variable is set during your Oracle backup or restore, set that variable in the RMAN script.

As another example, the following RMAN script performs an Oracle8 or Oracle8i restore of an Oracle tablespace and specifies that RMAN-specific debugging information be written to the file `C:\win32app\nsr\applogs\restore.log`.

```

run {
  allocate channel t1 type 'SBT_TAPE'
  parms 'ENV=(NSR_DEBUG_FILE=C:\win32app\nsr\applogs\restore.log)';
  allocate channel t2 type 'SBT_TAPE'
  parms 'ENV=(NSR_DEBUG_FILE=C:\win32app\nsr\applogs\restore.log)';
  sql 'alter tablespace users offline immediate';
  restore (tablespace users);
  sql 'alter tablespace users online';
  release channel t1;
  release channel t2;
}

```

To use any of the optional LSM environment variables described in "[LSM Environment Variables](#)" on page 4-3, you must set them in the RMAN script.

Contrary to statements in the Oracle *Backup and Recovery Guide*, *each* LSM environment variable you set in the RMAN script must be included in the `parms` option for *each* allocated channel. You *cannot* set the LSM variables at the system command line, for example, using a `set` command.

¹ If you allocate a device using the command `allocate channel t1 type disk` (with Oracle correctly configured and LSM uninstalled), you can back up to disk files using the Oracle backup implementation. In this case, the `parms` option has no effect.

Note: When you set an LSM environment variable in the RMAN script, as shown in the script example above, the value of that LSM variable remains in effect for all subsequent allocated channels and for all subsequent RMAN scripts until either:

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

```
run {  
    allocate channel t1 type 'SBT_TAPE'  
    parms 'ENV=(NSR_DEBUG_FILE=)';  
    :  
    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 LSM Server*. You can use substitution variables such as `%d` and `%u` to guarantee unique names. Note that 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 LSM Server.

For more details on how to write RMAN scripts, refer to the *Oracle Backup and Recovery Guide*. For details on how to use the OEM Backup Wizard to generate RMAN scripts, refer to your Oracle Enterprise Manager documentation. Also, see ["RMAN Commands"](#) on page 4-5 for important Legato-specific information about RMAN commands in Oracle8i.

Running Oracle Backups or Restores

Chapters 2 and 3 explain how to configure LSM for backup and restore operations.

After applying the information in the ["Configuration Roadmap"](#) on page 2-14, the LSM Server should have all the required client, server, device, and volume pool resources configured. There should also be a labeled volume mounted in each configured backup device--or, if auto media management is enabled for a tape device, a tape loaded in the tape device for LSM 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 script created as described in ["Creating RMAN Scripts"](#) on page 4-6, you can start an Oracle backup or restore using the RMAN command line interface on the Oracle Server.

For example, if the RMAN backup script on page 4-6 is stored in the file `C:\disk1\scripts\full_backup.txt` on an Oracle Server and the TSN Listener has been configured to connect to the databases *payroll* and *rcvcatdb*, you can run the Oracle backup using the following command:

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

As another example, if the RMAN restore script on page 4-7 is stored in the file `C:\disk1\scripts\restore.txt` on an Oracle Server and the TSN 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  
C:\disk1\scripts\restore.txt
```

Note that the Windows command to run RMAN is `rman80` for Oracle8 and `rman` for Oracle8i. For more information on the command line options available with the `rman` or `rman80` command, refer to the Oracle *Backup and Recovery Guide*.

Using OEM Backup Management Tools

You can use Oracle Enterprise Manager (OEM) Backup Management Tools instead of the RMAN command-line interface to start an Oracle backup or restore. 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.

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

For information on how to use OEM Backup Management Tools, refer to the *Oracle Enterprise Manager Administrator's Guide* and the other Oracle Enterprise Manager documentation included with your product kit.

Multiplexing During RMAN Backups

To prevent LSM from multiplexing multiple RMAN backup sets to one tape drive, only allocate as many RMAN "channels" as there are physical tape drives available to LSM.

Allocating more channels than physical tape drives will typically result in multiplexed RMAN backup sets to one drive, which might significantly add to the time required to restore from those backups. To clarify, the multiplexing performed by LSM (when allocating more channels than physical devices) would be in addition to the multiplexing automatically performed by RMAN.

The Target sessions attribute of a device resource configured in the LSM Server is described in "[Creating a Device Resource](#)" on page 3-6. The Target sessions value is *not a hard limit* on the number of sessions that will run concurrently on the device. It defines the number of sessions that LSM allocates to a device before using the next device. The Target sessions attribute value defaults to 1 for devices created during the initial installation of LSM as well as for devices created afterwards.

If more concurrent backup sets are created than the number of available devices, LSM will multiplex those backup sets onto the available devices, up to the maximum number of sessions specified in the parallelism value of the server resource.

Note that the "client parallelism" attribute does *not* apply to LSM sessions initiated by RMAN.

LSM Server Bootstrap Backups

As mentioned in "[Overview of LSM Operations](#)" on page 2-4, the LSM Server is preconfigured to perform a special automatic backup--the LSM Server *bootstrap* backup--every day at 3:33 a.m. The bootstrap contains the information needed to restore the following three components to the point just before the bootstrap was created:

- LSM Server index
- Media index
- Resource database

From these three components, the complete LSM Server environment can be recreated.

The bootstrap is a special backup set essential for disaster recovery procedures on the LSM Server. LSM writes the bootstrap file to the backup media and generates a report

about the success of the bootstrap backup. LSM sends an automatic notification to the administrator about the bootstrap backup and displays the same information in the LSM Administrator GUI. Also, bootstrap information is sent to a printer on the LSM Server.

Note: Note that if the LSM system is down at the time that the automatic bootstrap backup is scheduled to run, the backup will run when the system comes back up.

You can also run the bootstrap backup *manually*. For example, after finishing the last of many Oracle backups performed during a day, it would be advisable to manually run a bootstrap backup, to ensure that you have an up-to-date bootstrap. An up-to-date bootstrap is essential for a complete disaster recovery on the LSM Server.

The next section, "[Automatic Bootstrap Backup](#)", contains instructions on how to verify that the LSM Server is properly configured for the automatic bootstrap backup. For information on how to run the bootstrap backup *manually*, see "[Manual Bootstrap Backup](#)" on page 4-13. "[Maintaining Bootstrap Information](#)" on page 4-14 has details on the critical bootstrap information you need to keep for future disaster recovery procedures.

[Chapter 5, "Disaster Recovery"](#) contains complete details on how to use the LSM Server bootstrap during a disaster recovery.

Automatic Bootstrap Backup

To verify that the LSM Server configuration is properly set up for the automatic bootstrap backup, you need to run the LSM Administrator GUI. See "[Using the LSM Administrator GUI](#)" on page 2-10 for details about running the GUI on Windows.

Then, you need to verify that the client resource and Default group resource are both configured correctly. For information about accessing the client resource, see "[Client Resource](#)" on page 2-16. In the client resource, be sure that the Group attribute is set to Default.

Finally, check the Default group resource configuration. To open the Groups window, perform the following steps:

1. Run the LSM Administrator GUI.
2. Click the Configure tab in the Server window (of the main Administrator window) to make it active.

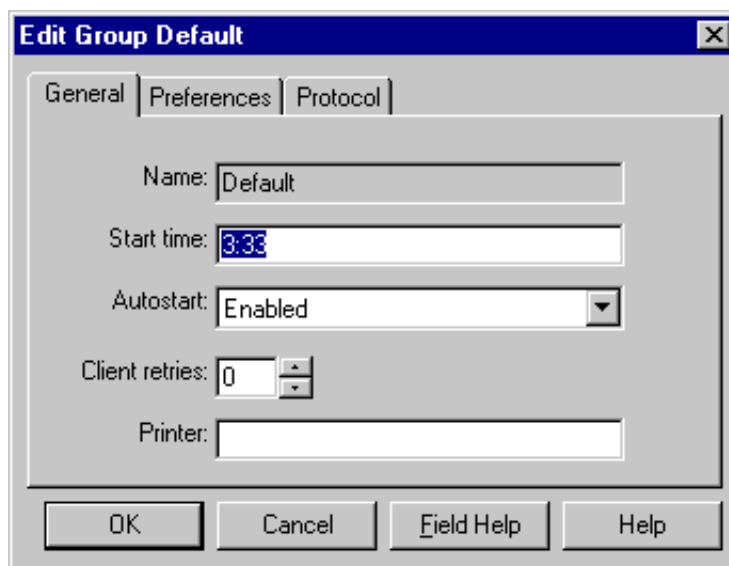
3. Click Manage Groups to open the Groups window. The Groups window lists the single group resource named Default.

On Windows, the Groups window does not automatically show the attribute settings of the group resource, so you must perform the following additional steps to see the group's attributes:

1. In the Groups window, right-click the icon of the Default group and select Edit from the pop-up menu to open the Edit Group dialog box.
2. In the Edit Group dialog box, the General (default) tab shows the attributes of the Default group resource. Click Field Help to learn more about each attribute.

The Edit Group dialog box on Windows lists all the attributes of the group resource, as shown in [Figure 4-1](#).

Figure 4-1 Edit Group Dialog Box



The Start time attribute specifies when the bootstrap backup is configured to begin--3:33 a.m. by default. To have the bootstrap information sent to a specific printer, set the Printer attribute to the name of that printer.

Note: Be sure that the Autostart attribute is set to Enabled to enable the automatic bootstrap backup. If Autostart is set to Disabled, the bootstrap backup does *not* run.

Information confirming the completion of the automatic bootstrap backup is displayed in the Messages section of the Monitor window in the LSM Administrator GUI.

Manual Bootstrap Backup

If you want to *manually* run the bootstrap backup on a Windows system, you must be logged in as Administrator. Then, enter this `savegrp` command at the system prompt:

```
savegrp -O -l full -P printer_name -c server_name
```

Here, *printer_name* is the name of the printer where the bootstrap information is printed at the end of the bootstrap backup. Also, *server_name* is the hostname of the LSM Server.

Note: Be sure to have a writable media device available *before* you start a manual bootstrap backup. If you attempt to run the `savegrp` command for a manual bootstrap backup *without* an available device, the backup will fail. In that case, you must provide the writable media device and then rerun the `savegrp` command, to restart the manual bootstrap backup.

Refer to `savegrp` in the *Legato Command Reference Guide* provided with LSM on Windows. For details on how to access the *Legato Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.

Note that information confirming the completion of the manual bootstrap backup is displayed in the Messages section of the Monitor window in the LSM Administrator GUI.

Maintaining Bootstrap Information

At the end of the *automatic* daily bootstrap backup, LSM prints the bootstrap information to the printer specified in the Printer attribute of the Default group resource; or, if that Printer attribute is blank, to the default printer.

At the end of a *manual* bootstrap backup run with the `savegrp` command, as described in "[Manual Bootstrap Backup](#)" above, the bootstrap information is sent to the printer specified in that `savegrp` command.

Be sure to 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 LSM Server indexes and resource database files during a disaster recovery.

An example of a bootstrap printout is as follows:

```
August 20 03:30 1999 LSM bootstrap information Page 1
date      time      level  ssid          file  record  volume
8/19/99   2:29:08   9      1148868949   56    0        jupiter.005
8/20/99   2:52:25   9      1148868985   77    0        jupiter.001
```

Monitoring Oracle Backups and Restores

You can use the LSM Administrator GUI to monitor the status of Oracle backup and restore operations. In the GUI on Windows, the messages appear in the Monitor window.

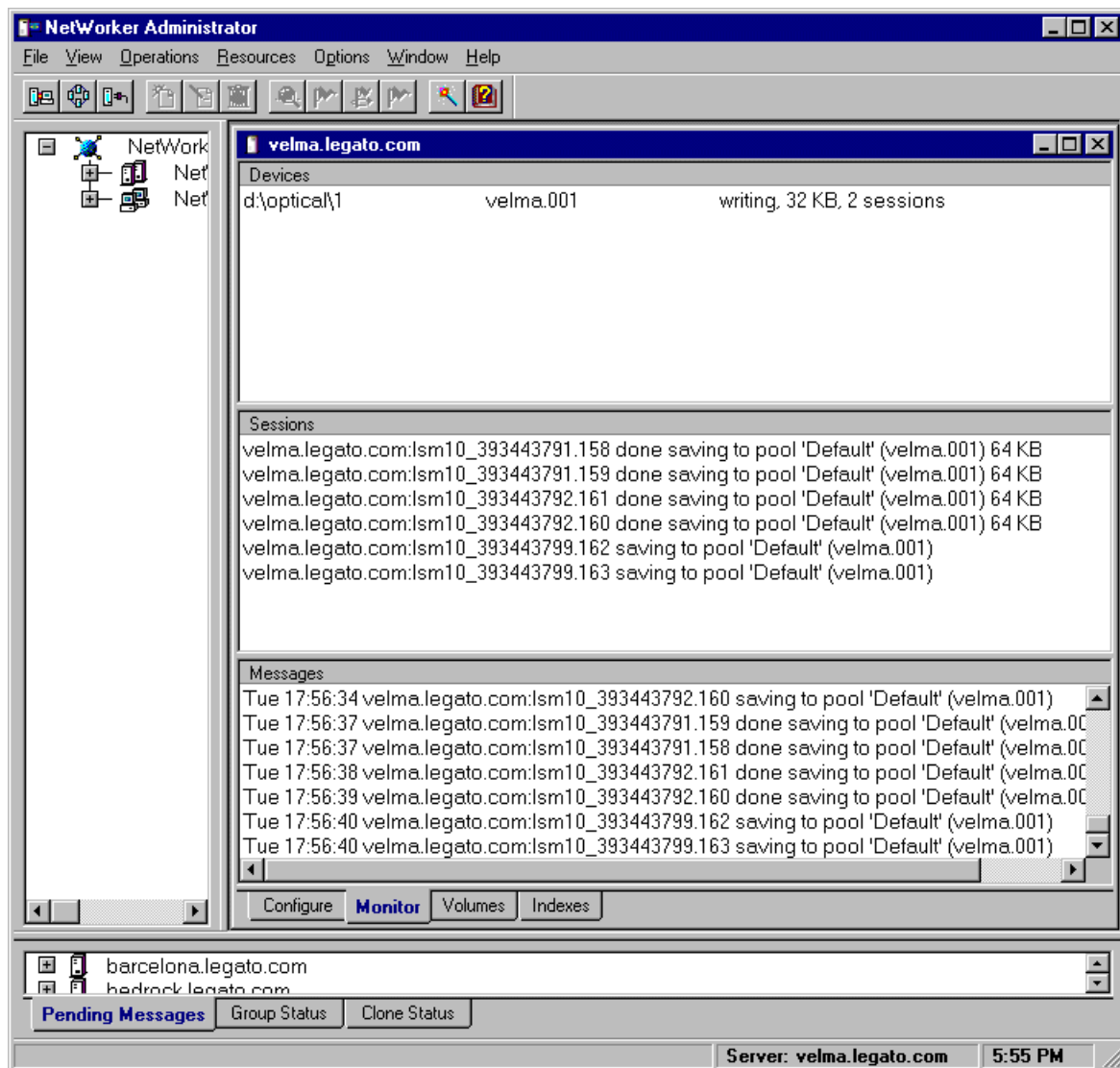
You can view progress messages that appear during the backup or restore and completion messages that advise when the backup or restore is complete. You can also view the messages in specific online system files.

- For progress messages, watch the Sessions display in the LSM Administrator GUI. The Sessions display information is also written to a *daemon.log* file in the directory `%SystemDrive%\win32app\nsr\logs` on Windows.
- For completion messages, watch the Messages display in the LSM Administrator GUI. The Messages display information is also written to a *messages* file in the directory `%SystemDrive%\win32app\nsr\logs` on Windows.
- For information about why a backup cannot progress, view the messages in the Pending display. The Pending display shows requests to mount tapes and other conditions that require operator intervention. See "[Volume Operations](#)" on page 3-19 for examples of the messages that LSM displays when requesting a volume for Oracle backup or restore.

- LSM also writes error messages to a specific system file. On Windows, LSM writes error messages to the file `%SystemDrive%\win32app\nsr\applogs\dmo.messages`.
- For additional RMAN-specific debugging information, set the LSM environment variable `NSR_DEBUG_FILE` to a valid file pathname in the RMAN backup script. LSM will write debugging information to the specified file. For details on the variable `NSR_DEBUG_FILE`, see [LSM Environment Variables](#) on page 4-3.
- To obtain RMAN-specific error messages, be sure to specify the `msglog` parameter in the RMAN command, as in the following example:

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

The following example shows the types of messages displayed in the Sessions and Messages sections of the Monitor tab in the main LSM Administrator window during Oracle backups.

Figure 4–2 Oracle Backup Messages

Disaster Recovery

This chapter provides information on how to recover from different types of system disasters on your LSM Server computer. It stresses the importance of preparing for a disaster. If you back up your Oracle data regularly and implement the planning procedures outlined in this chapter, you will be well prepared to recover from a disaster.

Major Topics:

- [Types of Disaster](#)
- [Disaster Preparation](#)
- [Disaster Recovery](#)

Types of Disaster

For the purpose of this guide, a *disaster* is any situation in which the day-to-day access to data (for example, working files, software programs, or system files) is disrupted. A disaster can also damage network components such as data, devices, hardware, media, and software.

A disaster can be the result of any one or a combination of the following:

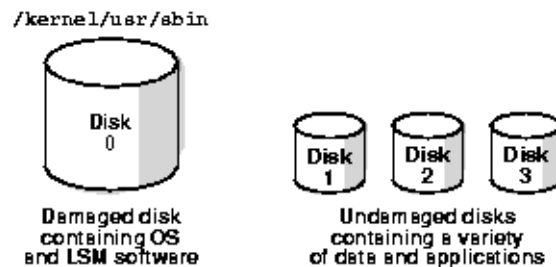
- Computer viruses that can corrupt data
- Hardware and software failures
- Infrastructure interruptions, inconsistencies, or loss of services such as communication or network connections

The degree of 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 might need to perform to recover data on your computer.

In your disaster recovery plan, you should consider how to recover from the following types of disasters on your LSM Server:

- [Figure 5-1](#) illustrates how the operating system and LSM software can be damaged or destroyed. In this example, the LSM Server computer has several physical disks. A power outage has corrupted the filesystem on Disk 0, and the operating system and LSM software residing on Disk 0 has been lost. To recover from the disaster, you need to replace the disk, reinstall the operating system and LSM software, and use LSM to recover the lost server configuration and any data that was lost when the filesystem was corrupted.

Figure 5-1 Damaged Disk Containing OS and LSM Software

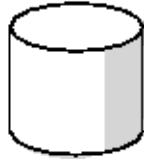


Note: In a situation where the primary disk containing both the operating system and the LSM binaries has been destroyed, you must always reinstall the operating system, reinstall LSM, and then use LSM to recover the remainder of your data. You cannot recover data backed up by LSM without reinstalling the operating system and LSM software first.

- **Figure 5–2** shows how the directory containing the LSM online indexes and resource configuration files can be damaged or destroyed. In this example, a disaster has corrupted the disk on the LSM Server computer that contains the LSM indexes and configuration files. To recover from a disaster of this type, you need to recover the contents of the bootstrap save set.

Figure 5–2 *Damaged Disk Containing LSM Indexes*

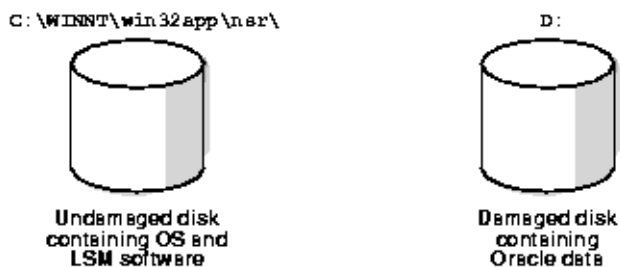
```
C:\win32app\nsr\res
C:\win32app\nsr\index
C:\win32app\nsr\mm
```



Damaged disk
containing server
indexes and
configuration files

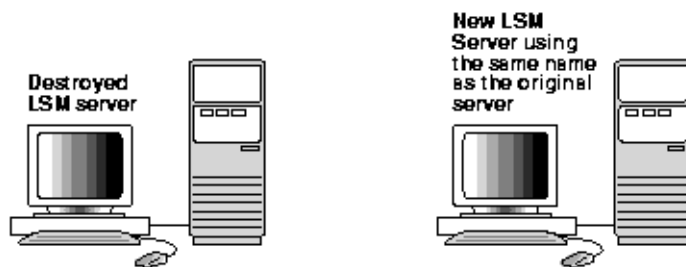
- **Figure 5–3** illustrates how Oracle data can be damaged or destroyed. In this example, an LSM Server computer has two disks. The second disk containing the Oracle data has been destroyed by a disk crash. However, the disk containing the operating system and LSM software is still operational. To recover from this situation, you can use the Oracle backup/restore utility, RMAN.

Figure 5–3 Damaged Disk Containing Oracle Data



- In the example in **Figure 5–4**, the LSM Server computer is destroyed. To recover from this disaster, you need to recover all the data to a new system *by the same name*.

Figure 5–4 Destroyed LSM Server



Disaster Preparation

It is important to develop a plan for recovering from different types of disasters on the LSM Server computer. You need to back up important data on the LSM Server computer on a regular 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 developing and testing your backup strategy and disaster recovery plan, the better prepared you will be in the event of a disaster.

Note: Be sure to back up the Oracle data on the LSM Server computer regularly using LSM. Also, be sure to back up the *other* data on the LSM Server computer regularly using a suitable backup method.

The section "[LSM Server Bootstrap Backups](#)" on page 4-10 describes how the LSM Server is preconfigured to perform an automatic daily *bootstrap* backup. The bootstrap is a special backup save set that includes the LSM Server index, media index, and resource database. You can also perform a manual bootstrap backup by using the procedure in "[Manual Bootstrap Backup](#)" on page 4-13.

The bootstrap information printed at the end of every bootstrap backup is essential for recovering LSM Server indexes and resource configuration files. As explained in "[Maintaining Bootstrap Information](#)" on page 4-14, you should keep the bootstrap printout in a safe place, ready for use during a disaster recovery.

If you do not keep the bootstrap printout, you will need to determine the save set ID of the most recent bootstrap. For more information on determining the bootstrap save set ID and using the bootstrap information, see "[How to Recover an LSM Server](#)" on page 5-13.

To prepare for disaster recovery, it is important to provide suitable access to the key information about the LSM Server computer. You should maintain this key information in an onsite location that is the least resistant to disaster. The information should be easily accessible by those assigned to perform disaster recovery. You should also enact strict guidelines regarding the access, maintenance, and usage of this key information.

Gathering the Key Information

You should maintain accurate records for each hardware, software, network, device, and media component related to the LSM Server computer.

Computer Hardware Information

The following information regarding computer hardware must be maintained and kept up-to-date:

- Filesystem configuration
- Fully qualified Domain Names, IP addresses, and hostnames
- For Domain Name Service (DNS) clients, maintain the DNS host's internet address and its hostname
- Hard drive configuration information
- Media device names
- Hardware vendor contact information and contract number
- Configuration information for each piece of hardware, both active and inactive

Computer Software Information

The following information regarding computer software must be maintained and kept up-to-date:

- Copies of the original operating system and software media and patches, including the original LSM software media (and where they are located)
- Software enabler and authorization codes
- Software vendor contact information and contract number
- The operating system version and patches installed
- Operating system configuration information
- Emergency media that can be used to restore the computer in the event of a disaster
- LSM Server bootstrap information
- Kernel configuration and location information
- Device drivers

Disaster Recovery

This section describes how to perform a disaster recovery on an LSM Server computer running Windows. The information provided is designed to give you *general principles* on how to recover critical data and to help you understand the disaster recovery procedures. Refer to the list of disaster recovery scenarios below to determine which set of instructions apply to your situation.

Note: To recover data *other than Oracle data* on the LSM Server computer, use the recovery method that corresponds to the method used to back up that data. Note that you can use LSM to restore only Oracle data that was backed up by LSM.

Table 5–1 Sections Containing Disaster Recovery Information

| If you are recovering... | See the following sections... |
|--------------------------|---|
| Hard drive | "How to Replace a Hard Drive" on page 5-7 |
| Operating system | "How to Recover the Operating System" on page 5-9 |
| LSM Server | "How to Recover an LSM Server" on page 5-13 |
| Oracle data | "How to Restore Oracle Data" on page 5-20 |

How to Replace a Hard Drive

To replace a hard drive:

- Obtain the hard drive information.
- Replace the hard drive.

Obtaining the Hard Drive Information

On Windows 2000, go to Start>Programs>Administrative Tools>Computer Management>Storage>Disk Management. On Windows NT, use the Windows NT Disk Administrator. Obtain the following information about each drive:

- Size of the drive
- Size, filesystem type, and volume label assigned to each disk partition

Note: Though it will not affect LSM operation, you may also want to note any use of mirroring, RAID/stripping, compression, and volume sets.

After you obtain the hard drive information, you can replace the hard drive.

Replacing a Hard Drive

To replace a hard drive, follow these steps:

1. Install a new drive that is the same size or larger. This will ensure that you can recover all of the drive's data.
2. Use the BIOS Setup program to:
 - Configure the drive.
 - Set the boot sequence.

Refer to the vendor documentation for instructions on how to use the BIOS Setup program.

If you have a SCSI, RAID, or other controller type, refer to the corresponding documentation to complete the configuration of the drive.

3. If the operating system was on the failed drive that you are replacing, install the operating system on the new drive. For example, on Windows NT, load the Windows NT system disk into drive A and reboot the computer.

If the operating system is still intact, reboot the computer and open Disk Administrator.

4. Depending on whether the operating system is functional, use SETUP or Disk Administrator to partition the drive.

Partition the new drive exactly like the old drive, using the same:

- Volume name(s).
 - Partition size(s) or larger.
 - Filesystem type for each partition, for example NTFS, FAT.
5. Format the drive.
 6. If the original drive was compressed, compress the new hard drive or ensure that the new partition is large enough to store uncompressed data.
 7. Verify the drive partition information.
 8. Verify the integrity of the hard drive, using the `chkdsk` command on Windows 2000 or the `scandisk` command on Windows NT.

The drive should now be ready for recovery.

To begin the recovery process, recover:

- The operating system, if necessary. For details, see ["How to Recover the Operating System"](#) immediately below.
- The LSM Server software, if necessary. For details, see ["How to Recover an LSM Server"](#) on page 5-13.
- Oracle data that was backed up by LSM. For details, see ["How to Restore Oracle Data"](#) on page 5-20.
- Other filesystem data as necessary, using a suitable recovery method.

How to Recover the Operating System

To recover the operating system:

- Meet the operating system recovery requirements.
- Recover the operating system.

Operating System Recovery Requirements

To recover the operating system, you need the following information:

- Version, service pack, and patch level of the operating system
- Location of the operating system
- TCP/IP properties:
 - Adapter type
 - IP address
 - Default gateway
 - Subnet mask
 - DNS server
- Windows server/workstation properties:
 - Computer name
 - Fully qualified domain name (also called the *hostname*)
 - Administrator name and password
- Date/time properties
- Virtual memory settings

- Protocols installed
- See ["DHCP and WINS Databases"](#) on page 5-19 for more information about requirements on Windows NT.

Once you have met these requirements, you can recover the operating system.

Recovering the Windows Operating System

This section describes how to recover the Windows 2000 or Windows NT operating system. You can use this process to recover the Windows operating system back to the original computer or to a different computer.

You can recover the operating system by performing either:

- A complete installation. In this case, you perform a complete installation and configuration of the operating system.
— or —
- A partial installation. In this case, you install and configure only those files that enable the computer to communicate over the network. Then, you recover the remaining operating system and configuration files using a suitable recovery method.

To recover the operating system, follow these steps:

1. Install the operating system.
2. Test the operating system and configure the devices.

Step 1: Install the Operating System

To install the operating system:

1. Install the same version, service pack, and patch level of the Windows operating system into its original location. Refer to the documentation accompanying the operating system for details.

If you want to upgrade the operating system, first recover the operating system as it was previous to the disaster, and then perform the upgrade.

2. For Windows NT, install the computer as a workstation or server, not as a BDC (Backup Domain Controller) or PDC (Primary Domain Controller).
3. Install the computer into a workgroup, not into a domain.
4. Configure the TCP/IP properties as they were configured before, with the same hostname (domain name), IP address, default gateway, subnet mask, and DNS

server. For example, in the *hosts* file on Windows 2000 (%SystemRoot%system32\drivers\etc\hosts), the computer name should appear directly after the fully qualified domain name, on the same line, as in the following example:

```
123.56.890.474    kingdome.seattle.washington.com    kingdome
```

Note: If you are recovering the operating system to a different computer, you must:

- Use the same *hostname* for the new computer. If you do not use the same *hostname*, you will not be able to recover the LSM indexes associated with the original computer.
 - Assign the same TCP/IP address for the new computer; otherwise, the computer will be assigned a new host ID by LSM. If this computer does not have the same TCP/IP address as the original computer, you must reinstall and configure the LSM software on it. For details, see ["How to Recover an LSM Server"](#) on page 5-13.
-
-

5. Configure the Windows server/workstation properties as they were configured before the disaster. Be sure to use the same computer name, fully qualified domain name, administrator name, and password. (The fully qualified domain name for a computer named *kingdome*, for example, might be *kingdome.seattle.washington.com*.)

For example, on Windows 2000, perform the following steps:

1. On the Desktop, right-click My Computer and select Properties on the context menu. The System Properties dialog box appears. (Another way to reach the System Properties dialog box is to select Start>Settings>Control Panel and click the System icon.)
2. In the System Properties dialog box, select the Network Identification tab.
3. In the Network Identification dialog box, click the Properties button.
4. In the Identification Changes dialog box, click the More button.
5. In the DNS Suffix and NetBIOS Computer Name dialog box, ensure that the field labeled "Primary DNS suffix of this computer" contains your domain name. If not, enter your domain name in this field.

6. Configure the Localization Properties or Date/Time Properties as they were configured before the disaster.
7. Restart the computer after installing the Windows operating system.
8. Reset the Virtual Memory Settings as they were configured before, by selecting the appropriate options in the Control Panel:
 - Windows 2000: Control Panel>System>Advanced>Performance options>Virtual Memory>Change
 - Windows NT: System>Performance>Change

Note: On Windows NT, do not upgrade OEM drivers for NIC cards with the OEM Service Pack version of the NIC card.

9. If you had any additional Windows components installed previously, install them before recovering the computer data.
10. Restart the computer after the Service Pack is installed, to apply the new settings.

Step 2: Test the Operating System and Configure the Devices

To test the operating system and configure the devices:

1. Configure any devices required by LSM.

Note: On Windows 2000, you must disable RSM for each stand-alone storage device to be used by LSM.

2. On Windows 2000, select Storage>Removable Storage>Physical Locations from the Computer Management console, then repeat the following steps for each device connected to your system to which LSM will have access:
 1. Under Physical Locations, right-click the device for which you want to disable RSM. Select Properties.
 2. In the General tab of the Properties dialog box, ensure that the Enable Library checkbox is not checked.

3. Verify that the:

- Operating system is functioning properly.
- Network protocols are functioning properly. Test by running `ping`.
- “Name to Address” resolution is correct. Test by running `nslookup` using the fully qualified domain name of the LSM Server.
- Required devices are recognized by the operating system. If the devices are not recognized by the operating system, you might need to:
 - Load the SCSI driver.
 - Install the device driver software.

To complete the recovery process, recover:

- The LSM Server software, if necessary. For details, see ["How to Recover an LSM Server"](#) on page 5-13.
- Oracle data that was backed up by LSM. For details, see ["How to Restore Oracle Data"](#) on page 5-20.
- Other filesystem data as necessary, using a suitable recovery method.

After you have recovered the computer’s data and rebooted the computer:

- If you want to use Active Desktop, install it.
- On Windows NT, if the computer is a Backup Domain Controller, synchronize it with the Primary Domain Controller.
- On Windows NT, if the computer is a Primary Domain Controller, synchronize it with the domain.

How to Recover an LSM Server

To recover an LSM server:

- Meet the LSM server requirements.
- Recover the LSM server.

LSM Server Requirements

To recover the LSM server, you need the following:

- Version and patch level of LSM
- Location of LSM

- LSM Server for Windows installation media
- Backup volumes containing the server bootstrap, which includes the following three items:
 - LSM Server index
 - LSM media database
 - LSM configuration files

Note: Before recovering the LSM Server on Windows NT, follow the instructions in "[DHCP and WINS Databases](#)" on page 5-19 to ensure that the Windows NT DHCP databases and WINS databases are properly restored.

Once you have met these requirements, you can recover the LSM Server.

Recovering an LSM Server

This section describes how to recover an LSM Server. You can use the following process to recover the LSM Server back to the original computer or to a different computer.

To recover an LSM server, follow these steps:

1. Install LSM.
2. Configure LSM.
3. Locate the LSM Server bootstrap save set ID.
4. Recover the LSM Server bootstrap.
5. Rename the LSM Server configuration files.
6. Verify the LSM Server recovery.

Step 1: Install LSM

To install LSM:

1. Install the same release of LSM into its original location. Refer to the *Oracle Installation Guide* for LSM installation instructions.

If you want to upgrade the LSM Server, first recover the server to its original state, and then perform the upgrade.

Note: By default, the configuration files are located in the directory `C:\win32app\nsr\res`. You should only attempt to reuse these LSM configuration files if the LSM Server's hard drive had not crashed and you are upgrading or reinstalling LSM.

2. Install any LSM patches that were installed prior to the disaster.

Step 2: Configure LSM

To configure the LSM Server:

1. From the LSM Administrator GUI, check the settings in the Preferences tab of the LSM client resource. Verify that the computer's aliases are entered correctly. The settings might look something like the following:

```
aliases:kingdome  
kingdome.seattle.washington.com
```

2. Configure the LSM device resource for each device to be used in ["Step 3: Locate the Server's Bootstrap Save Set ID"](#) immediately below. For details on the device configuration, see ["Configuring Storage Devices"](#) on page 3-2.
3. The server's current file index path must be the same as when the disaster occurred. If you have relocated the server's file index path to a new location, reset it to the original path using the following procedure:
 1. Edit the Index Path attribute in the server's associated Client resource to the original path.
 2. Restart the LSM services. This will enable LSM to recognize that the index path has changed. For information on how to restart the LSM services, refer to ["Step 5: Rename the LSM Server Configuration Files"](#) on page 5-18.
 3. Run `nsrck -c server-name` from the directory containing the LSM binaries to create an empty file index into which the records can be recovered. By default, the LSM binaries are located in the directory `C:\win32app\nsr\bin`.

Step 3: Locate the Server's Bootstrap Save Set ID

This section describes how to locate the save set ID for the LSM Server's latest bootstrap. The bootstrap contains the server's online file index, media index, and resource configuration files.

Use the following steps to locate the save set ID of the most recent bootstrap if you do not have this information:

1. Insert the most recent backup tape used for the automatic daily bootstrap backups or for manual bootstrap backups into the appropriate device.
2. At the command prompt, switch to the directory where the LSM binaries and executables are located. By default, these files are located in the directory *C:\win32app\nsr\bin*.
3. Use the `scanner -B` command to determine the save set ID of the most recent bootstrap on the tape. For example:

```
scanner -B \\.\Tape0
```

The `scanner -B` command displays the latest bootstrap save set information found on the backup volume, as in the following example:

```
scanner: scanning 8mm tape mars.006 on \\.\Tape0
scanner: Bootstrap 1148869870 12/11/99 6:29:58 mars.006, file 88
```

Step 4: Recover the LSM Server Bootstrap

This section describes how to recover the LSM bootstrap. By default, these files reside in the *C:\win32app\nsr* and *C:\win32app\nsr\res* directories, and can be recovered using the `mmrecov` command.

To recover the LSM bootstrap:

1. Use the `mmrecov` command to recover the LSM Server's bootstrap (online file index, media index, and configuration files).

The following output appears:

```
mmrecov: Using madrid.spain.com as server
```

Note: The `mmrecov` command will overwrite the LSM Server's existing online file and media indexes.

2. When the following message appears, enter the name of the device you are using for the recovery (this message only appears if the server has multiple devices configured and enabled):

```
What is the name of the device you plan on using [\\.\Tape1]? \\.\Tape0
```

3. When the following message appears, enter the save set ID for the latest bootstrap.

Enter the latest bootstrap save set ID: **20076**

4. When the following message appears, enter the file number to begin the recovery. If unknown, enter zero.

Enter starting file number (if known) [0]: **130**

5. When the following message appears, enter the first record number to begin the recovery. If unknown, enter zero.

Enter starting record number (if known) [0]: **0**

6. When the following message appears, insert the volume containing the associated save set ID into the backup device, for example:

Please insert the volume on which save set ID 20076 started into \\.\Tape0.
When you have done this, press <RETURN>:

7. Once you have loaded the appropriate volume, the following message appears:

Scanning \\.\Tape0 for save set 20076; this may take a while...

LSM then scans the volume for the appropriate save set. Once the save set has been located, LSM recovers it.

8. Use the `nwadmin` program to monitor the recovery of the server indexes and configuration files.

Note: The server index might not be on the same volume as the media database and resource configuration files. If this is the case, LSM will prompt you if additional media is required.

Once the media database and resource configuration files have been recovered, `mmrecov` recovers the LSM Server index.

If you routinely move your LSM backup media to an offsite location for safekeeping and a subsequent file recover operation generates a mount request, the recover will wait until an operator satisfies the mount request. To avoid delays when recovering

files, use the `mminfo -mv` command to list the media that is associated with the file you want to recover and retrieve the media from the offsite storage before starting the recover.

The LSM Server index is recovered when the following message appears:

The bootstrap entry in the online index for *server_name* has been recovered.

Step 5: Rename the LSM Server Configuration Files

Because the configuration files cannot be reliably overwritten while LSM is running, `mmrecov` recovered the `C:\win32app\nsr\res` directory as `C:\win32app\nsr\res.R` by default. In addition, `mmrecov` may have recovered another server's configuration file in this directory, so stopping and restarting the Legato services is recommended.

To rename the configuration files:

1. In the Windows Control Panel, select the Services window. For each Legato service listed in the window, select and shut down the service, in the following order:
 - NetWorker Power Monitor (*on Windows 2000 only*)
 - NetWorker Backup and Recover Server
 - NetWorker Remote Exec
2. Rename the existing `C:\win32app\nsr\res` directory to `C:\win32app\nsr\res.orig`.
3. Rename the recovered `C:\win32app\nsr\res.R` directory to `C:\win32app\nsr\res`.
4. In the Windows Control Panel, select the Services window. For each Legato service listed in the window, select and start the service, in the following order:
 - NetWorker Remote Exec
 - NetWorker Backup and Recover Server
 - NetWorker Power Monitor (*on Windows 2000 only*)
5. After you verify that the LSM configurations are correct in the LSM Administrator GUI, remove the *res.orig* directory.

Step 6: Verify the LSM Server Recovery

To verify the LSM Server recovery:

1. Perform a test Oracle backup or restore to make sure the LSM Server is fully recovered.
2. Perform a test LSM Server bootstrap backup manually using the instructions in ["Manual Bootstrap Backup"](#) on page 4-13.

DHCP and WINS Databases

If you are using Dynamic Host Configuration Protocol (DHCP) or Windows Internet Naming Service (WINS), it is recommended that you regularly dump these databases and back up the dumps using a suitable backup method.

Windows NT does not provide a programming interface for backup and restore of the DHCP database or the WINS database, but you can configure DHCP and WINS database dumps using DHCP Manager and WINS Manager. You can back up these database dumps as part of your routine filesystem backup operations and then restore the dumps if it ever becomes necessary. After restoring the dumps you can import them, again using DHCP Manager or WINS Manager.

To dump, back up, restore, and import the WINS and DHCP databases:

1. To open the DHCP administrative interface, go to Start>Programs>Administrative Tools>DHCP Manager.
2. To run DHCP dumps as necessary, configure the dumps from DHCP Manager. A default dump location is provided, but you can specify a different location. Make a note of the database dump location you choose.
3. To open the WINS administrative interface, go to Start>Programs>Administrative Tools>WINS Manager.
4. To run WINS dumps as necessary, configure the dumps from WINS Manager. A default dump location is provided, but you can specify a different location. Make a note of the database dump location you choose.
5. As part of your routine filesystem backups, specify the backup set(s) including the filesystem locations you specified for the DHCP and WINS databases dumps. You can then restore a dump whenever it becomes necessary.
6. To recover a DHCP or WINS database, open DHCP Manager or WINS manager and import the database that was backed up and restored.

How to Restore Oracle Data

This section describes how to recover from a crash in which one or more files of an Oracle database were damaged on your LSM Server computer.

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 swap in a spare disk than it is to rename database files and update the control file accordingly.

After you have determined the Oracle data that needs to be recovered, you must first restore the relevant files.

You can restore and recover the Oracle database files by using one of these programs:

- RMAN command-line interface
- OEM Backup Management Tools

For complete details on how to restore Oracle database files using LSM, see Chapter4, "[Backup and Restore Operations](#)".

To recover an Oracle8 or Oracle8i database using Recovery Manager, please see Oracle's *Backup and Recovery Guide*.

You can use the `scanner` program to recreate the LSM client index entries or recreate media database entries, if no entries for the volume exist in the media database. The `scanner` program can read a storage volume directly, without assistance from LSM.

To find the volume that contains a specific file, use the `mminfo` program if the volume is still in the media database or the `scanner` program if the volume is no longer in the media database. The `mminfo` and `scanner` programs provide detailed information on the contents of the volume. This information includes:

- The name of the backup volume
- The name of the save set that contains the file you want
- The name of the client to which the file belongs
- The date and time the file was backed up

Using the Scanner Program

The `scanner` program reads a storage volume directly, without accessing information that may be available in the LSM media database. If no entries exist in the media database, you must make an educated guess as to which volume contains the specific data.

Mount the volume and execute the `scanner` command with any of its options. The most commonly used `scanner` options are as follows:

- Rebuild the media database entries for everything on the storage volume by executing `scanner -m device`.
- Rebuild the media database and client index entries for everything on the storage volume by executing `scanner -i device`.

- Rebuild the media database entries for a specific save set on the storage volume by executing `scanner -S save-set-id -i device`.
- Rebuild the media database and client index entries for a specific save set on the storage volume by executing `scanner -S save-set-id -m device`.
- Execute `scanner` with `-c client-name` and `-N save-set-name` options, along with any other of the options previously described to further specify the save sets by client or name.

Detailed information about `scanner` program syntax and examples of how `scanner` options can be customized to meet the needs of a particular recovery situation are available in the `scanner` entry in the *LSM Command Reference Guide*. For details on how to access the *LSM Command Reference Guide*, see ["Legato Command Reference Guide"](#) on page 1-11.

The entries placed in the client index receive a status of "scanned-in" to protect them from being automatically deleted the next time the index management service checks the index for entries that have surpassed their browse policy. The entries placed in the media database also receive a status of "scanned-in" and the volume mode is listed as "read-only." These entries will need to be manually deleted.

Scanner Program Options

The `scanner` program directly reads LSM media (backup tapes) to confirm the contents of a volume or to rebuild the LSM online indexes. You can only run this command as Administrator or equivalent. You must specify a device, which is usually one of the device names used by the LSM Server. If the device is a tape drive, it must be a non-rewinding type.

If the `scanner` program is invoked without options (or with only the `-v` option), the volume on the specified device is scanned and a table of contents is generated. The table of contents contains information about each save set found on the volume. By default, one line of information is written to standard output for each save set found on the volume. The information provides the client name, save set name, save time, level, size, files, save set ID, and a flag.

The following example describes the format and options available for the `scanner` program:

```
scanner [ -Bimnpqv ] [ -s server ] [ -S ssid ]  
[ -c client ] [ -N name ] [ -f file ] [ -r record ]  
[ -t type ] [ -b pool ] device [ -x command argument-list ]
```

- Use the `-b pool` option to specify the pool that the volume should belong to. This option only applies to volumes backed up by versions of LSM that did not store pool information on the media.
- Use the `-B` option, without the `-S` option, to quickly scan the tape to the location of the start of the bootstrap save sets. When the entire tape has been scanned, the save set ID and tape file location of the most recent bootstrap save set is printed to standard output.
- Use the `-c client` option to instruct `scanner` to only process save sets that came from the computer specified by `client`. You can specify more than one client name in the same command line. The `-c` option can also be used in conjunction with the `-N` option, but only if the `-i` or `-x` option is also specified.
- Use the `-f file` option to start the scan at a specific media file number. Refer to the `mminfo` entry in the *LSM Command Reference Guide* for information on how to determine the media file number. For details on how to access the *LSM Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.
- Use the `-i` option to instruct `scanner` to rebuild both the client index and media database from the volumes that are read. If you specify a single save set with the `-S ssid` option, only the entries from the specified save set are made to the client index.
- Use the `-m` option to instruct `scanner` to rebuild only the media database for the volumes that are read.
- Use the `-n` option to run `scanner` without rebuilding the client index or media database. This option provides a way to check the media without modifying the client index or media database.
- Use the `-N name` option to process only save sets that match the specified name. The value of `name` should be a literal string. You can specify multiple names when this option is used in conjunction with the `-c client` option, but only if the `-i` or `-x` option is also specified.
- Use the `-p` option to print out information about each save set as it is processed.
- Use the `-q` option to only display error messages or messages of significance.
- Use the `-r record` option to start the scan at a specific media record number, to avoid a scan of potentially unused information. Refer to the `mminfo` entry in the *LSM Command Reference Guide* for information on how to determine the

media record number. For details on how to access the *LSM Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.

- Use the `-s server` option to specify the controlling LSM Server.
- Use the `-S ssid` option to extract the save set specified by `ssid`. When this option is used in conjunction with the `-i` or `-x` option, you can specify multiple `ssid` values. The save sets selected are in addition to any selected by the use of the `-c` and `-N` options. If the `-B` option is also specified, the value of `ssid` is assumed to be that of the bootstrap save set; only one `ssid` can be specified in this case.
- Use the `-x command` option, with an optional list of command arguments, to specify a command to execute on each save set scanned. This option can only be specified once per `scanner` command line, after the device specification.

Refer to the `scanner` entry in the *LSM Command Reference Guide* for examples of `scanner` command usage and a list of common error messages.

Rebuilding Save Set Entries in LSM Online Indexes

If a file is not browsable (which means that the save set's browse policy has expired), but its save set is still tracked by LSM in the media database (which means that the save set's retention policy has not expired), follow these steps to recover the save set's entry back into the client index:

1. Run the `mminfo` program:

```
mminfo -a -v volume-name
```

2. From the `mminfo` output, find the save set ID that you believe contains the file you want. *Make sure it is not the bootstrap save set ID.*
3. Once you have the proper save set ID, replace the save set entry in the file index with the `scanner` program:

```
scanner -i -S save-set-id device-name
```

Note: If the save set spans volume boundaries, use the `scanner` program to read from all the volumes. Otherwise, the client index will not be fully rebuilt, making it impossible to perform an online recovery of the files in this save set.

If the save set that contains the file is not browsable, and the save set is not represented in the media database, both the browse and retention policies have expired. Follow these steps to rebuild the save set's entry in both the client index and the media database:

1. Run the `scanner` program on the backup volume that you believe contains the file you want (make a guess based on the adhesive label on the volume).

```
scanner device-name
```

2. Use the output from the `scanner` program to decide whether to reintroduce the contents of this volume into the client index and whether the save set you want to rebuild is on this volume. You must locate *all* of the volumes that contain this save set ID.

3. Once you have determined which volumes to reintroduce into the online indexes, run the `scanner` command below:

```
scanner -i device-name
```

The `scanner` command asks for a new volume until you terminate it. To rebuild the indexes completely, you must scan in *all* of the volumes that contain the save set ID.

Scanner Requests an Entry for Record Size

If you use the `scanner` program with the `-s` option but without an `-i` or `-m` option, and you receive the following message:

```
please enter record size for this volume ('q' to quit) [xx]
```

the number in the bracket [xx] is the entry from the last query.

The `scanner` command always rewinds the tape and reads the volume label to determine the block size. If the volume label is corrupted or unreadable, you will see a message asking you to enter the block size (in kilobytes).

Type in the block size; it must be an integer equal to or greater than 32. If you enter an integer that is less than 32, you receive the following message:

```
illegal record size (must be an integer >=32)
```

Scanner Marks a Volume Read-Only

When you use the `scanner` program to rebuild the index of a backup volume, the `scanner` program marks the volume read-only. This is a safety feature that prevents the last save set on the backup volume from being overwritten. To write to the media without marking it read-only, use the `nsrmm -o` command:

```
# nsrmm -o notreadonly volume-name
```

For more information on the `nsrmm` command, refer to the `nsrmm` entry in the *LSM Command Reference Guide*. For details on how to access the *LSM Command Reference Guide*, see "[Legato Command Reference Guide](#)" on page 1-11.

Client Server Communications

Many of the problems that LSM users report when they set up and configure LSM are actually problems with the communications in their networks. This section contains a procedure for testing the communications in a network.

How to Troubleshoot IP Errors

1. Read this section. Document the steps you take and the results, especially error messages, in case you need to contact Oracle Worldwide Customer Support.
2. Set up host tables for LSM clients and the LSM Server. See ["How to Set Up Host Tables"](#) immediately below.
3. Use `ping` to establish basic connectivity. See ["How to Use ping to Verify Network Connections"](#) on page B-2.

How to Set Up Host Tables

Legato recommends that you troubleshoot IP problems using only host tables. Troubleshooting using only host tables does not mean you cannot use your name service (for example, DNS) with LSM. Test using only host tables to determine whether you have LSM installed correctly. After you know LSM works with host tables, you can enable whatever name server you are using.

To configure host tables on a server or client:

1. On the LSM client, list the client and the LSM Server to which it connects, for example:

```
127.0.0.1 localhost localhost
123.456.789.111 client client.domain.com
123.456.789.222 server server.domain.com
```

-
2. On the LSM Server, list the LSM Server itself and all of its clients, for example:

```
127.0.0.1 localhost localhost
123.456.789.111 server server.domain.com
123.456.789.222 client client.domain.com
```

3. Use the guidelines in "[How to Use ping to Verify Network Connections](#)" immediately below to ensure the highest success rate for host table parsing within any operating system.

Notes for host table configuration:

- Do not use blank lines in the body of your host tables.
- The end of the host table should always contain a blank line.
- The first unremarked entry should always be the loopback line in the exact order and format shown above.
- The last character of each unremarked line should be a space, not a carriage return.

On Windows, the host tables reside in *C:\system32\drivers\etc\hosts*.

Host tables can be used in addition to DNS where necessary, but it is simplest to temporarily disable DNS for troubleshooting purposes.

How to Use ping to Verify Network Connections

After you have created the host tables, test with `ping`. Use just the steps marked with an asterisk (*) if the server is the only client.

On the LSM client:

- `ping` the client short name (host name) from the client
- `ping` the client long name (host name plus domain information) from the client
- `ping` the client IP address from the client
- `ping` the server short name from the client
- `ping` the server long name from the client
- `ping` the server IP address from the client

The following example shows pinging the client short name and client long name from a LSM client called *mars* in the *oak* domain:

```
ping mars
ping mars.oak.com
```

On the LSM Server:

- ping the server short name from the server *
- ping the server long name from the server *
- ping the server IP address from the server *
- ping the client short name from the server
- ping the client long name from the server
- ping the client IP address from the server

How to Verify Firmware for Switches and Routers

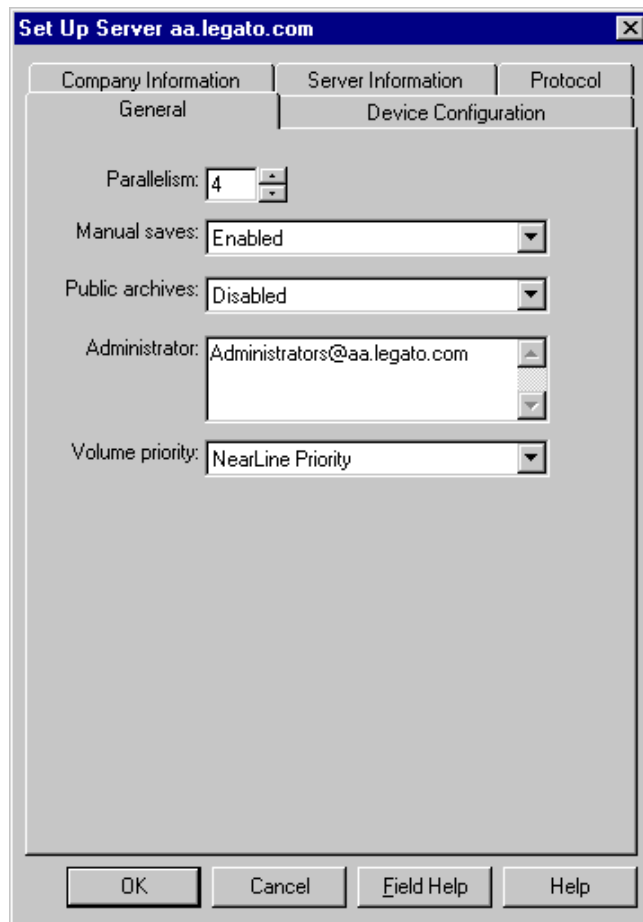
If you are using switches or routers from any vendor, make sure that the switch or router firmware is dated after August 1995 (wherever they exist on your network) to ensure that RPC traffic is handled properly. Most of the switch and router vendors with whom we have worked have significantly improved their handling of RPC traffic since August 1995.

Configuring Server Communications

You establish communication between the LSM Server and the Oracle Server (as an LSM client) by assigning values in both the Set Up Server dialog box and the Client dialog box in the LSM Administrator GUI. To help you understand how these values work together, this section discusses communication issues internal to LSM. LSM relies on full and accurate configuration of the network to implement features that protect data and ensure security.

Configure your server by using the Set Up Server dialog box ([Figure B-1](#)). Here you make choices that affect the performance and security of your backups, such as setting the server parallelism, enabling concurrent devices, and adding or changing LSM administrators.

Figure B-1 Set Up Server Dialog Box



The image shows a Windows-style dialog box titled "Set Up Server aa.legato.com". It features three overlapping tabs: "Company Information", "Server Information", and "Protocol". The "Server Information" tab is active and contains two sub-sections: "General" and "Device Configuration". The "General" sub-section is selected and displays the following settings:

- Parallelism:** A numeric spinner box set to 4.
- Manual saves:** A dropdown menu set to "Enabled".
- Public archives:** A dropdown menu set to "Disabled".
- Administrator:** A text box containing "Administrators@aa.legato.com" with up and down arrow buttons on the right.
- Volume priority:** A dropdown menu set to "NearLine Priority".

At the bottom of the dialog box are four buttons: "OK", "Cancel", "Field Help", and "Help".

Click Set Up Server in the Server window of the LSM Administrator GUI to open the Set Up Server dialog box. The Set Up Server dialog box contains overlapping tabs containing resource attributes to configure your LSM server. Many of these attributes are determined when you initially install your LSM Server software.

Some attributes are read-only, or contain information more advanced and detailed than most LSM users need, particularly if Hidden Attributes is enabled. Technical support engineers might request that you provide information displayed in these

attributes to understand your system configuration. Click Field Help to learn more about each attribute.

The following sections address various client-server communication issues using LSM.

Host Name Determination

Your Windows LSM server gets its host name from its TCP/IP setup. You can access both the server and domain name through the Windows control panel. This name is not necessarily the computer name that is common to other Windows applications.

To access your server and domain names, follow these steps:

1. From the taskbar, select Start > Settings > Control Panel to open the Control Panel window.
2. Double-click the Network icon to open the Network dialog box. Note that your computer and domain names are displayed in the Identification tab. However, this display is read-only.
3. Select the Protocols tab to make it active.
4. Double-click the TCP/IP Protocol from the Network Protocols list to open the TCP/IP Properties dialog box.
5. Select the DNS tab to make it active. Your server's host name and domain names are located here and can be modified.

Name Resolution

In a pure Windows environment, you may find using WINS or LMHOSTS is adequate for using LSM. However, using LSM with other types of clients requires using a local host file or DNS name resolution.

You must add the LSM server name to either the local *HOSTS* file located in *C:\system32\drivers\etc* or the Domain Name Server (DNS) which contains the names of all the servers on your network.

Backup Operators Group

The Backup Operators local group provides its members the rights necessary to backup and recover data from a Windows system. A user requesting a backup must be in the Backup Operators or Administrators group of the domain into which they are logged. The Backup Operators group is assigned on a machine-by-machine

basis. It is not assigned globally by the domain. If you are having trouble performing tasks on one LSM Server but not another, check the problematic machine's Backup Operators group to ensure you are properly assigned.

DHCP Clients

Typically, addresses for Dynamic Host Configuration Protocol (DHCP) clients change because they use dynamic addressing. If your LSM Server is a DHCP client, you must reserve a static TCP/IP address on your DHCP server. If the address changes, the authorization code for that LSM Server becomes invalid.

Backup and Recover Service

In the Windows operating system, the service named NetWorker Backup and Recover Server is normally started by the Windows System account. This allows the LSM services to be running even if no one is logged onto that system.

Using Label Templates

LSM labels (initializes) each storage volume with a unique internal label that corresponds to a pool. During backup, restore, and other operations, LSM can identify the pool to which a volume belongs by its label. LSM applies a label template to create a unique internal label for each volume.

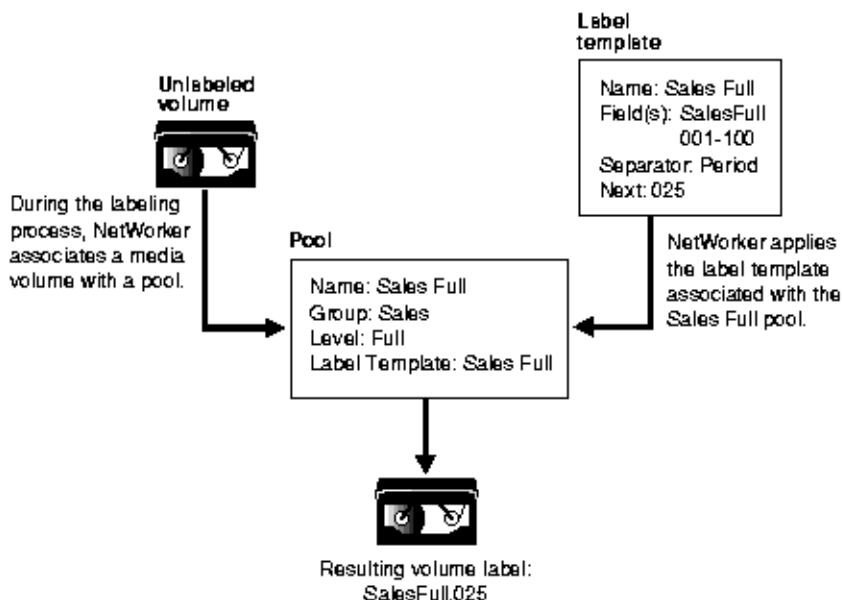
LSM uses label templates and pool configuration settings to sort, store, and track data on media volumes. If you need to recover data, LSM prompts you for the specific volume(s) containing the required data by volume name and sequence number.

How LSM Uses Label Templates

LSM writes a given set of data to a specific pool of volumes. For LSM to recognize that a particular volume belongs to the correct pool of volumes, the volume must have an internal identification label that associates it with the correct pool. The contents of the volume label follow rules defined in a specific label template that you create in the Label Templates resource. You then associate a label template with a specific pool in the Pools resource. If you do not associate data with a specific pool, LSM uses the preconfigured Default pool and corresponding Default label template.

[Figure C-1](#) illustrates how a pool configuration uses its associated label template to label a volume. You must configure a label template before you configure the associated pool in order for your label template name to be available in the Pools resource.

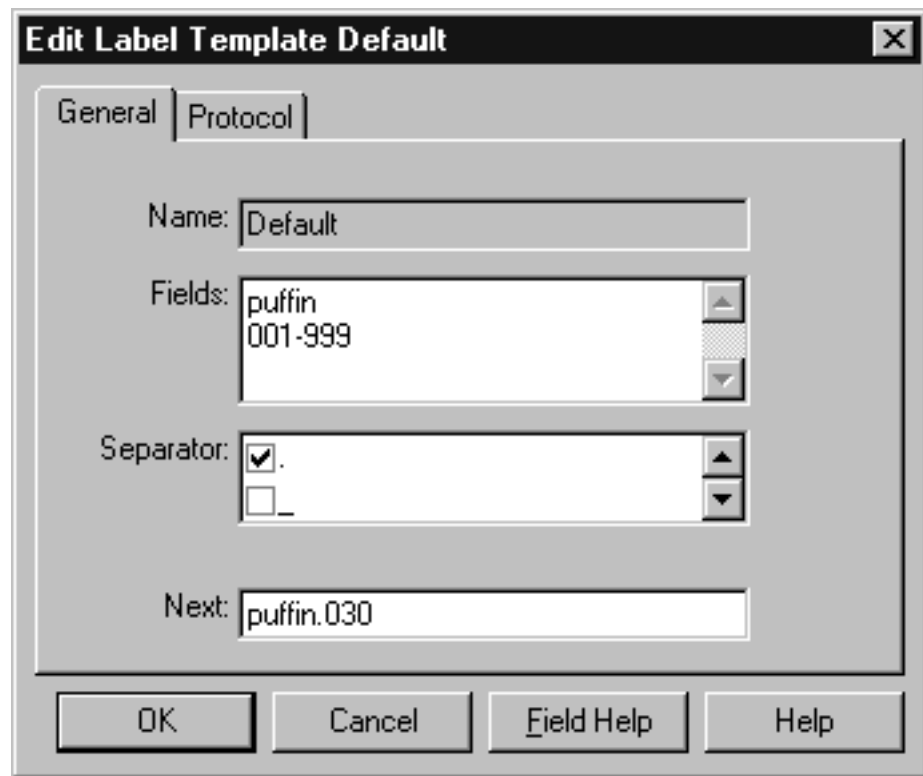
Figure C–1 Labeling a Volume Using a Label Template



Label Template Dialog Box

The Label Template dialog box is where you enter or change configuration information for label templates. The Label Template dialog box opens whenever you select the Create or Edit commands for label templates. [Figure C-2](#) shows the Edit Label Template dialog box as a sample. There may be differences in contents between the Create and Edit Label Template dialog boxes.

The Label Template dialog box consists of overlapping tabs containing resource attributes. The General (default) tab contains most of the attributes required for creating a label template. Some attributes are read-only, or contain information more advanced and detailed than most LSM users need, particularly if Hidden Attributes is enabled. Legato technical support engineers may request that you provide attribute information to understand your system configuration. Click Field Help to learn more about each attribute.

Figure C-2 Edit Label Template Dialog Box

The following sections describe the main attributes of the Label Template resource.

Name

The Name you choose will appear in the Pools dialog box as a label template choice. Consistent naming is the most important aspect for defining label templates. Keep the label Name consistent with the pool Name so users and administrators can easily see how the data is organized. You can use the same or similar names for the pool Name and label template Name. For example, you could create a label template called "AcctFull" for volumes that belong to a pool called "Accounting Full."

Use only alphanumeric characters in the Name text box when you create label templates. LSM does not allow the following characters in label template names:

/ \ * [] () \$! ^ ' ; ' ~ < > & | { }

In addition, you cannot use the following characters in the Name text box because they are used as separators in label templates:

colon (:), dash (-), period (.), underscore (_)

Fields

A label template is made up of one or more components that you enter in the Fields text box. Each component provides a layer of specificity to your organizational structure. You can have as many components as you want, but it is best to keep the template simple, with few components. The total length of the label cannot exceed 64 characters.

There are four types of components you can use:

- Range of numbers – for example, *001-999*
- Range of lowercase letters – for example, *aa-zz*
- Range of uppercase letters – for example, *AA-ZZ*
- Character string – for example, *Accounting*

Each range includes a starting value, a dash (-), and an ending value. The starting value and the ending value must have the same number of characters. For example, use "01-99" not "1-99" or "aaa-zzz," not "aa-zzz." This rule does not apply to a list of character strings or words; character strings are separated by a blank space.

You can have as many components as you want, but it is best to keep the template simple, with few components. The total length of the label must be less than 64 characters.

The order in which you enter each component of the template is important. LSM applies each component in a left-to-right order, starting with the first one you enter. [Table C-1](#) illustrates how label templates use components to create a numbering sequence for volume labels.

Your label template should allow for expansion of your backup media storage system. For example, it is better to create a template for 100 tapes and not use all of them, than to create a template for only 10 tapes and run out of labels. When LSM

reaches the end of the template numbering sequence, LSM wraps around to the starting value. For example, after zz.99, the 67,600th label in the following example, the next label LSM uses is aa.00 for label 67,601.

Table C–1 Examples of Numbering Sequences for Volume Labels

| Type of Component(s) | Fields | Resulting Numbering Sequence | Total Number of Labels |
|----------------------------|-----------|--|---|
| Range of Numbers | 001-100 | 001, 002, ...100 | 100 |
| Character String | SalesFull | SalesFull.001, SalesFull.002, ...SalesFull.100 | 100 |
| Range of Numbers | 001-100 | | |
| Range of Lowercase Letters | aa-zz | aa.00, aa.01, aa.02 ...aa.98,aa.99, | 67,600 (26 ² times 10 ²) |
| Range of Numbers | 00-99 | ab.00, ab.01, ab.02, ...ab.98, ab.99, | |
| | | ac.00, ac.01, ac.02, ...ac.98, ac.99, | |
| | | : | |
| | | az.00, az.01, az.02, ...az.98, az.99, | |
| | | ba.00, ba.01, ba.02, ...ba.98, ba.99 | |
| | | : | |
| | | zz.00, zz.01, zz.02, ...zz.98, zz.99 | |

Separator

The Separator text box allows you to choose what character symbol you want to appear between component entries. You can use the period, dash, colon, or underscore to separate each component of the label template. If you do not select a separator, the label components will not have separators (for example, AA00aa), which makes the labels difficult to read.

Next

The Next text box allows you choose the next sequence number that LSM will place on a volume label (according to the template). If you want to force a label to start the labeling scheme at a particular point, enter the desired starting label in the Next text box. LSM continues to generate labels from that point on, according to the rules of the template. If you want LSM to generate the first label for you, leave the Next text box blank.

Note: When LSM recycles a storage volume, the volume label does not change if the volume remains in the same pool. That is, if a storage volume labeled "Dev.006" is recycled, it will retain the volume label "Dev.006" and will not receive a new label with the next sequence number. The original data on the volume, however, will be overwritten by new data.

Using Label Template Components

LSM ships with preconfigured label templates that correspond to the preconfigured pools. If you choose to create your own templates, you can include as many components in the Fields text box as necessary to suit your organizational structure. For clarity’s sake, however, it is a good idea to keep the template simple, with few components. For example, if you created a label template for your Accounting Department, you could customize your label template in several ways depending on the size of your storage system and media device capabilities. [Table C–2](#) illustrates several ways you could use components to organize your labels.

Table C–2 *Using Label Template Components*

| Type of Organizational Structure | Fields (Components) | Separator | Resulting Volume Label(s) |
|---|----------------------------|------------|---|
| Sequential | AcctFull 001-100 | period | AcctFull.001 (100 total labels) |
| Storage Oriented (for example, 3 storage racks with 5 shelves each, each shelf holding 100 tapes) | 1-3 1-5 001-100 | dash | 1-1-001 This label is for the first tape in rack 1 on shelf 1. (1,500 total labels) |
| Two-sided Media (for example, optical device) | AcctFull 000-999 a-b | underscore | AcctFull_000_a (side 1) AcctFull_000_b (side 2) (2,000 total labels) |

Creating Label Templates

Resource dialog box contents vary depending on the server. Use these steps as a general guideline to follow. However, additional attributes may be present (particularly if Hidden Attributes is enabled), or attributes mentioned here may be absent. Use Field Help for guidance in completing these additional attributes as necessary.

To create a label template, perform the following steps:

1. Select the Configure tab in the Server window to make the Configure window active.
2. Click Manage Label Templates to open the Label Templates window.
3. Right-click on the main Label Templates icon, and select Create from the pop-up menu to open the Create Label Template dialog box.
4. Enter the name of the label template in the Name text box.
5. Enter the components for your label template in the Fields list box. Press [Return] after entering each component. You can use any or all of the following four components for your label template:

Range of number – for example, *001-999*

Range of lowercase letters – for example, *aa-zz*

Range of uppercase letters – for example, *AA-ZZ*

Character string – for example, *Accounting*

If you enter a range of numbers of characters, they change incrementally with each new label. For example:

First label Engineering.001

Second label Engineering.002

Third label Engineering.003

6. Select a separator symbol in the Separator list box and click OK. If no symbol is selected, the components will have no separators (for example, AA00aa).
7. Complete the other attributes as necessary and click OK.

Editing Label Templates

To edit a label template, perform the following steps:

1. Select the Configure tab in the Server window to make the Configure window active.
2. Click Manage Label Templates to open the Label Templates window.
3. Right-click on the icon of the label template you want to edit, and select Edit from the pop-up menu to open the Edit Label Template dialog box.
4. Edit the attributes and click OK. Click Field Help to learn more about each attribute.

You cannot change the name of a label template. However, if you want to change an individual label name, delete the existing name in the Next text box, and enter a new name.

Glossary

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

8mm

Choice in the Devices window; represents eight-millimeter magnetic tape.

Administrators group

Members of this Windows user group 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.

Application Specific Module (ASM)

A program, that when used in a directive, specifies the way that a set of files or directories is to be backed up and recovered.

ASM

See Application Specific Module.

autochanger

A mechanism which 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.

Backup Operators group

Members of this Windows group have the capability to log onto a domain from a workstation or a server, back it up, and restore the data. Backup Operators also can shut down servers or workstations.

backup set

See save set.

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 LSM after a disk crash.

browse policy

The policy that determines how long entries for your files remain in the online file index.

client

A machine that accesses the LSM Server to back up or recover files. Clients may be workstations, PCs, or file servers.

client index

A database of information maintained by LSM which tracks every file or filesystem backed up.

command line

The shell prompt, where you enter commands.

device

The backup device (tape drive) connected to the LSM Server; used for backing up and recovering client files.

directive

An instruction directing LSM to take special actions on a given set of files.

fileserver

A machine with disks that provides services to other machines on the network.

filesystem

1. A file tree which is on a specific disk partition or other mount point. 2. The entire set of all files. 3. A method of storing files.

heterogeneous

Heterogeneous networks are networks with systems of different platforms that interact meaningfully across the network.

interoperability

The ability of software and hardware on multiple machines from multiple vendors to communicate meaningfully.

machine

Any computer, including file or compute servers, diskfull workstations, or diskless workstations.

media

Magnetic tape or optical disks used to back up files.

media index

A database of information maintained by LSM which tracks every backup volume.

media manager

The LSM component that tracks save sets to backup volumes.

LSM

A Legato network-based software product to back up and recover Oracle7, Oracle8, or Oracle8i databases.

LSM client

The Oracle Server machine that can access the backup and recover services from the LSM Server.

LSM Server

The machine on a network running the LSM software, containing the online indexes, and providing backup and recover services to the Oracle Server.

notice

A response to a LSM event.

nsrhost

The logical *hostname* of the machine that is the LSM Server.

online indexes

The databases located on the LSM Server that contain all the information pertaining to the Oracle 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 LSM.

pathname

Instructions for accessing a file. An *absolute pathname* tells you how to find a file beginning at the root directory and working down the directory tree. A *relative pathname* tells you how to find the file starting where you are now.

preconfigured

Existing selections or configurations for different LSM features.

print

Send data to a printer.

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.

retention policy

This policy determines how long entries will be retained in the media index and thus be recoverable.

save

The LSM 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 LSM.

save set ID

An internal identification number assigned to a save set by LSM.

scanner

The LSM command used to read a backup volume when the online indexes are no longer available.

server

The machine on a network running the LSM software, which contains the online indexes, and provides 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.

system administrator

The person normally responsible for installing, configuring, and maintaining LSM.

user

The person who can use LSM 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 LSM.

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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