

Dynamic Storage Technology Administration Guide

Open Enterprise Server 11

August 6, 2012

Novell.

Legal Notices

Novell, Inc., makes no representations or warranties with respect to the contents or use of this documentation, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, Novell, Inc., reserves the right to revise this publication and to make changes to its content, at any time, without obligation to notify any person or entity of such revisions or changes.

Further, Novell, Inc., makes no representations or warranties with respect to any software, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, Novell, Inc., reserves the right to make changes to any and all parts of Novell software, at any time, without any obligation to notify any person or entity of such changes.

Any products or technical information provided under this Agreement may be subject to U.S. export controls and the trade laws of other countries. You agree to comply with all export control regulations and to obtain any required licenses or classification to export, re-export or import deliverables. You agree not to export or re-export to entities on the current U.S. export exclusion lists or to any embargoed or terrorist countries as specified in the U.S. export laws. You agree to not use deliverables for prohibited nuclear, missile, or chemical biological weaponry end uses. See the [Novell International Trade Services Web page \(http://www.novell.com/info/exports/\)](http://www.novell.com/info/exports/) for more information on exporting Novell software. Novell assumes no responsibility for your failure to obtain any necessary export approvals.

Copyright © 2007–2012 Novell, Inc. All rights reserved. No part of this publication may be reproduced, photocopied, stored on a retrieval system, or transmitted without the express written consent of the publisher.

Novell, Inc.
1800 South Novell Place
Provo, UT 84606
U.S.A.
www.novell.com

Online Documentation: To access the latest online documentation for this and other Novell products, see [the Novell Documentation Web page \(http://www.novell.com/documentation\)](http://www.novell.com/documentation).

Novell Trademarks

For Novell trademarks, see [the Novell Trademark and Service Mark list \(http://www.novell.com/company/legal/trademarks/tmlist.html\)](http://www.novell.com/company/legal/trademarks/tmlist.html).

Third-Party Materials

All third-party trademarks are the property of their respective owners.

Contents

About This Guide	11
1 Overview of Dynamic Storage Technology	13
1.1 Understanding Dynamic Storage Technology	13
1.1.1 Merged View of the File Tree	14
1.1.2 Merged View for User File Access	15
1.1.3 Local File Access	15
1.1.4 File Systems	15
1.2 Benefits of Dynamic Storage Technology	16
1.2.1 Transparent File Access to End Users	16
1.2.2 Policy-Based Migration between Primary and Secondary Storage Areas	16
1.2.3 Faster and Smaller Backups of Important Data	16
1.2.4 Faster Disaster Recovery	17
1.2.5 More Efficient Use of Expensive Storage	17
1.2.6 Fast Storage for Active Data and Slower, Less Expensive Storage for Old Data	17
1.2.7 Moving Files from an Existing Secondary Volume	17
1.2.8 Access to the Secondary Storage Area without the Performance Penalties of HSM Solutions	18
1.3 Shadowing Scenarios	18
1.3.1 Existing Volume as Primary with an Empty Volume as Secondary	18
1.3.2 Empty Volume as Primary with an Existing Volume as Secondary	18
1.4 DST Policy Scenarios	19
1.4.1 Move Files Based on the Last Time Accessed or Modified	19
1.4.2 Move Files Based on File Size	19
1.4.3 Move Files Based on File Extensions	20
1.4.4 Move Selected Files	20
1.5 DST Components	20
1.5.1 NCP Engine	20
1.5.2 Shadow Volume	20
1.5.3 ShadowFS	20
1.5.4 Policy Engine	21
1.6 Management Tools	21
1.7 What's Next	21
2 What's New or Changed in Dynamic Storage Technology	23
2.1 What's New (July 2012 Patches)	23
2.2 What's New (May 2012 Patches)	23
2.3 What's New (OES 11)	24
3 Installing Dynamic Storage Technology	25
3.1 Installation Requirements for Dynamic Storage Technology	25
3.1.1 Novell Open Enterprise Server 11	25
3.1.2 NCP Server and Dynamic Storage Technology	26
3.1.3 Novell Storage Services	26
3.1.4 Novell eDirectory 8.8.2 or Later	26
3.1.5 Novell CIFS	26
3.1.6 Novell Samba with ShadowFS, FUSE, and LUM	26
3.1.7 Linux User Management	27

3.1.8	Novell Cluster Services for Linux	27
3.1.9	Novell Remote Manager for Linux	27
3.1.10	Novell iManager 2.7.4 for Linux	27
3.1.11	SFCB and CIMOM	28
3.1.12	Other OES Services	28
3.2	Installing NCP Server and Dynamic Storage Technology	29
3.2.1	Installing on a New OES 11 Server	29
3.2.2	Installing on an Existing OES 11 Server	30
3.3	Configuring Global Policies for DST	31
3.4	Installing DST on Nodes in a Novell Cluster Services for Linux Cluster	31

4 Using DST in a Virtual Environment 33

5 Installing and Configuring ShadowFS for Novell Samba Users 35

5.1	Understanding ShadowFS	35
5.2	Prerequisites for Using ShadowFS	36
5.3	Preparing Your System for Using ShadowFS	36
5.4	Installing ShadowFS and FUSE	37
5.5	Setting Rights to ShadowFS Shares	38
5.6	Creating a Samba Share	39
5.7	Adding a User to Samba	40
5.8	Connecting Users to the Share	40
5.9	Testing Shadow Volume Policies	41
5.10	Enabling or Disabling ShadowFS	41
5.10.1	Loading ShadowFS and FUSE	41
5.10.2	Verifying ShadowFS Commands in the init.d Script	41
5.11	Starting and Stopping ShadowFS Manually	42
5.11.1	Starting FUSE and ShadowFS	42
5.11.2	Starting FUSE and ShadowFS with novell-shadowfs	42
5.11.3	Stopping Shadowfs	42
5.12	Configuring Trustee Rights for Novell Samba Users	43

6 Planning for DST Shadow Volumes and Policies 45

6.1	Planning to Create DST Shadow Volumes	45
6.1.1	Storage Devices	45
6.1.2	iSCSI Block Storage Devices	46
6.1.3	File Systems	47
6.2	Providing a Merged View for Users	47
6.2.1	User Access and Authentication	47
6.2.2	File Access Protocols	48
6.2.3	ShadowFS and FUSE	50
6.3	Using DST Shadow Volumes	51
6.3.1	Number of Shadow Volumes per Server	51
6.3.2	Data Volumes	51
6.3.3	Files and Folders	51
6.3.4	File System Trustees and Rights	52
6.3.5	File System Management Utilities	52
6.4	Using NSS Volumes in DST Shadow Volumes	52
6.4.1	DST Support for NSS Volume Attributes	53
6.4.2	DST Support for NSS Features and Actions	54
6.5	Using NSS File System Trustees, Rights, and Attributes on DST Shadow Volumes	56
6.6	Using NSS Encrypted Volumes in a DST Shadow Volume	56
6.7	Using NSS Quotas on DST Shadow Volumes	56
6.7.1	NSS Volume Quotas	57

6.7.2	NSS Directory Quotas	57
6.7.3	NSS User Quotas	57
6.8	Using DST Shadow Volumes with Novell Cluster Services	57
6.9	Using Novell Distributed File Services with DST Shadow Volumes	58
6.10	Using Virus Checking Utilities with DST Shadow Volumes	59
6.11	Using Backup Utilities with DST Shadow Volumes	60
7	Management Tools for DST	61
7.1	Dynamic Storage Technology Plug-In for Novell Remote Manager for Linux	61
7.1.1	Accessing Novell Remote Manager	61
7.1.2	Starting, Stopping, or Restarting Novell Remote Manager on Linux	62
7.1.3	Quick Reference for Dynamic Storage Technology Options	63
7.1.4	Quick Reference for NCP Server Options	65
7.1.5	Quick Reference for DST Global Policy Settings	65
7.1.6	Shadow Volume Inventory and Trustee Reports	66
7.2	NCP Console (NCPCON) Commands	66
7.3	Management Tools for NSS Volumes	66
7.3.1	Storage Plug-In for Novell iManager 2.7x	66
7.3.2	Files and Folders Plug-In for Novell iManager 2.7x	67
7.3.3	NSS Management Utility (NSSMU)	67
7.4	Management Tools for Clustering	67
8	Managing Services for DST	69
8.1	Restarting the Novell NCP/NSS IPC (ncp2nss) Daemon	69
8.2	Restarting the Novell eDirectory (ndsd) Daemon	69
8.3	Starting and Stopping ShadowFS	70
9	Configuring DST Global Policies	71
9.1	Replicating Branches of the Primary File Tree in the Secondary File Tree	71
9.2	Shifting Files from the Secondary File Tree to the Primary File Tree	72
9.2.1	Understanding Shift Parameters	72
9.2.2	Configuring a Global Policy for Shifting Modified Shadow Files	75
9.2.3	Configuring a Global Policy for Shifting Accessed Shadow Files	76
9.2.4	Configuring a Global Policy for the Days Since Last Access	76
9.2.5	Using the SET Command to Set Global Policies	76
9.3	Resolving Instances of Duplicate Files	76
9.3.1	Understanding Conflict Resolution for Duplicate Files	77
9.3.2	Configuring a Global Policy for Actions to Resolve Duplicate Files Conflicts	79
9.3.3	Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts	80
9.3.4	Resolving Instances of Duplicate Files in the /_DUPLICATE_FILES Directory	81
9.4	Automatically Loading ShadowFS	81
9.4.1	Using Novell Remote Manager to Set the Autostart	82
9.4.2	Using the Command Line to Set the Autostart	82
9.4.3	Manually Starting and Stopping ShadowFS	82
10	Creating and Managing DST Shadow Volumes for NSS Volumes	85
10.1	Understanding DST Shadow Volumes	85
10.1.1	Primary Volume	86
10.1.2	Secondary Volume	86
10.1.3	Merged View	86
10.1.4	How Directories Are Created in the Shadow Volume	86
10.1.5	Global Policies	86
10.1.6	Shadow Volume Policies	87

10.1.7	File Inventory for the Shadow Volume	87
10.1.8	Moving Specified Files between Volumes	87
10.2	Creating a DST Shadow Volume with NSS Volumes.	87
10.2.1	Preparing the NSS Volumes for Use in the Shadow Volume	88
10.2.2	Disabling the NCP/NSS Bindings for the Secondary Volume	89
10.2.3	Adding a Shadow to the Primary NSS Volume	90
10.2.4	Moving Data between the Two Volumes	91
10.3	Giving Users a Merged View of the Shadow Volume	92
10.3.1	NCP	92
10.3.2	Novell CIFS	92
10.3.3	Novell Samba with ShadowFS and FUSE	92
10.4	Configuring the NCP/NSS Bindings for an NSS Volume	92
10.4.1	Disabling the NCP/NSS Bindings for an NSS Volume	93
10.4.2	Enabling the NCP/NSS Bindings for an NSS Volume	93
10.4.3	Enabling or Disabling NCP/NSS Bindings by Editing the /etc/opt/novell/ncp2nss.conf File	94
10.5	Copying a Trustee Database to the Primary NSS Volume.	95
10.6	Viewing a List of NCP Shares	96
10.7	Mounting and Dismounting DST Shadow Volumes	96
10.8	Viewing the Name and Path Information for a Shadow Volume	97
10.9	Viewing Information about a Shadow Volume	97
10.9.1	Accessing the Volume Information Report	98
10.9.2	Viewing the Shadow Status of a Volume.	98
10.9.3	Viewing the Share Information for a Shadow Volume	99
10.10	Auditing File Move Events for the Shadow Volume	100
10.11	Backing Up DST Shadow Volumes	101
10.11.1	Planning Your Backup Solution	101
10.11.2	Planning Your Restore Solution.	102
10.11.3	Using the /etc/NCPVolumes XML File for Backup.	103
10.11.4	Configuring the Backup Attribute for NSS Volumes	104
10.11.5	Configuring a Backup for Trustee Information on NSS Volumes on Linux	104
10.12	Removing the Shadow Relationship for a Non-Clustered DST Shadow Volume.	104
10.12.1	Preparing to Remove a Shadow Volume.	105
10.12.2	Removing the Shadow Volume Relationship by Using Novell Remote Manager for Linux	105
10.12.3	Removing a Shadow Volume by Editing Configuration Files.	107

11 Creating and Managing Policies for Shadow Volumes

109

11.1	Understanding Shadow Volume Policy Options.	109
11.1.1	Last Executed	110
11.1.2	Description.	110
11.1.3	Start Time	110
11.1.4	End Time	110
11.1.5	Start Day	110
11.1.6	Frequency	111
11.1.7	Command Status.	111
11.1.8	Volume Selection.	112
11.1.9	Volume Operations	112
11.1.10	Subdirectory Restrictions.	113
11.1.11	Search Criteria.	114
11.1.12	Stop	116
11.2	Creating a Shadow Volume Policy.	116
11.2.1	Prerequisite	116
11.2.2	Guidelines for Shadow Volume Policies	117
11.2.3	Creating a Shadow Volume Policy	117
11.3	Modifying a Shadow Volume Policy	119
11.4	Running a Policy On Demand	119

11.5	Viewing DST Policies and Policy Status	120
11.6	Viewing Information about the Files Moved During a Policy Run.	121
11.7	Stopping a Running Policy	121
11.7.1	Stopping All Running Shadow Volume Policies.	122
11.7.2	Stopping a Running Individual Shadow Volume Policy	122
11.8	Deleting a Shadow Volume Policy	122

12 Generating a File Inventory for DST Shadow Volumes 125

12.1	Understanding the File Inventory for a Shadow Volume	125
12.1.1	Inventory Summary	125
12.1.2	Available Space Trends.	127
12.1.3	Graphical Profiles	127
12.1.4	Tabular Profiles	131
12.1.5	Inventory Detail Reports	132
12.1.6	Custom Shadow Volume Options	132
12.2	Creating the Shadow Volume Inventory.	134
12.3	Viewing a Saved NCP Volume Report.	134
12.4	Emailing a Saved NCP Volume Report	134
12.5	Viewing Statistics for the Shadow Volume.	134
12.6	Using Inventory Detail Reports to Move, Copy, or Delete Files on the Shadow Volume.	135
12.7	Generating a Custom Inventory Report	136

13 Configuring DST Shadow Volumes with Novell Cluster Services 139

13.1	Planning for Using Shadow Volumes in a Cluster	139
13.1.1	Requirements for Using DST in a Cluster	140
13.1.2	DST Shadow Volume Cluster Resource	142
13.1.3	Shadow Volume NCPCON Commands for Scripts	142
13.1.4	Shadow Volume Configuration Information	143
13.1.5	DST Global Policies in a Cluster	144
13.1.6	DST Shadow Volume Policies in a Cluster	144
13.1.7	Monitor Script for the DST Shadow Volume Cluster Resource	144
13.1.8	Additional Volumes in the Primary Pool.	145
13.2	Preparing the Nodes to Support DST in a Cluster Environment	145
13.3	Sample Load Script for a DST Shadow Volume	146
13.4	Sample Unload Script for a DST Shadow Volume.	146
13.5	Configuring the DST Shadow Volume Cluster Resource with Two Cluster-Enabled Pools.	147
13.5.1	Overview of the Cluster Resource Setup.	147
13.5.2	Disable the NCP/NSS Bindings for the Secondary Volume	148
13.5.3	Viewing the Load and Unload Scripts for the Two Pool Cluster Resources	148
13.5.4	Configuring the Load and Unload Scripts for the Shadow Volume Cluster Resource.	151
13.6	Configuring the DST Shadow Volume Cluster Resource with a Cluster-Enabled Pool and a Shared Pool	154
13.6.1	Overview of Cluster Resource Setup.	155
13.6.2	Creating a Shared Pool That Is Not Cluster-Enabled	156
13.6.3	Disabling the NCP/NSS Bindings for the Secondary Volume	157
13.6.4	Viewing or Modifying the Cluster Load and Unload Scripts.	157
13.6.5	Configuring the Load and Unload Scripts for a Shadow Volume.	159
13.7	Removing the Local Definition for a Cluster-Enabled Shadow Volume	162
13.8	Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes.	163
13.9	Configuring Shadow Volume Policies for the Clustered Shadow Volume	164
13.10	Removing the Shadow Relationship for a Clustered DST Shadow Volume	164
13.10.1	Preparing to Remove a Shadow Volume.	164
13.10.2	Removing the Shadow Volume Relationship in the Cluster Resource	165

14 Troubleshooting for DST	169
14.1 My NCP server information is set to: LOCAL_CODE_PAGE CP437. Why is it not using UTF-8?	169
14.2 A File is listed twice in a directory	169
14.3 Users cannot see some files and directories	170
14.4 Cross-protocol locking stops working.	170
14.5 Novell Remote Manager connection error when you are working on the DST Options page	170
15 Security Considerations	171
15.1 Client Access	171
15.2 Linux-Enabled eDirectory Users	171
15.3 Using File System Trustees and Rights	172
15.4 Server-to-Server Access	172
15.5 Hidden Directories and Files	172
15.5.1 Trustee Database	172
15.5.2 Available Space Trends.	172
15.6 Shadow Volumes Audit Logs	173
15.7 Shadow File System Audit Logs	173
15.8 NCP Server Auditing and Log Files	173
15.9 Using Secure Remote Connections	173
A Commands and Utilities for Dynamic Storage Technology	175
A.1 Using NCPCON for DST Commands.	175
A.1.1 Interactive Mode	175
A.1.2 Command Line Mode	176
A.1.3 Scripting Mode.	176
A.2 DST Commands for NCPCON.	176
A.3 DST Commands for NCPCON for Use with Novell Cluster Services for Linux Clusters	180
A.3.1 Scenario 1: Primary NSS and Shadow NSS	180
A.3.2 Scenario 2: Primary Non-NSS and Shadow Non-NSS (Not supported)	181
A.3.3 Scenario 3: Primary Non-NSS and Shadow NSS (Not supported)	181
A.3.4 Scenario 4: Primary NSS and Shadow Non-NSS (Supported for the Remote Secondary NSS Volume in the Technology Preview)	181
A.4 Configuring Global DST Policies by Using the SET Command	182
A.4.1 Understanding DST Parameters for the SET Command.	183
A.4.2 Using Novell Remote Manager to Configure DST Parameters for the SET Command.	184
A.4.3 Using the ncpcon set Command to Configure DST Parameters	185
A.5 DST Commands for /etc/opt/novell/ncpserv.conf.	185
A.6 DST Commands for /etc/opt/novell/shadowfs.conf	187
A.7 DST EXCLUDE_VOLUME Command for /etc/opt/novell/ncp2nss.conf.	187
A.8 DST Shadow Volume Information in /etc/NCPVolumes.	188
A.9 DST ShadowFS Volume Information in /etc/mtab.shadowfs	188
B RPM Files for Dynamic Storage Technology	189
C Documentation Updates	191
C.1 August 6, 2012.	191
C.1.1 Creating and Managing Policies for Shadow Volumes	191
C.1.2 What's New	191
C.2 July 20, 2012	192
C.2.1 Commands and Utilities for Dynamic Storage Technology	192
C.2.2 Configuring DST Shadow Volumes with Novell Cluster Services	192

C.3	May 30, 2012	192
C.3.1	Installing and Configuring ShadowFS for Novell Samba Users.	192
C.4	April 30, 2012	193
C.4.1	Creating and Managing Policies for Shadow Volumes	193
C.5	January 18, 2012	193

About This Guide

This guide describes how to install, configure, and manage the Dynamic Storage Technology for Novell Open Enterprise Server (OES) 11. It is divided into the following sections:

- ♦ [Chapter 1, “Overview of Dynamic Storage Technology,” on page 13](#)
- ♦ [Chapter 2, “What’s New or Changed in Dynamic Storage Technology,” on page 23](#)
- ♦ [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#)
- ♦ [Chapter 4, “Using DST in a Virtual Environment,” on page 33](#)
- ♦ [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 35](#)
- ♦ [Chapter 6, “Planning for DST Shadow Volumes and Policies,” on page 45](#)
- ♦ [Chapter 7, “Management Tools for DST,” on page 61](#)
- ♦ [Chapter 8, “Managing Services for DST,” on page 69](#)
- ♦ [Chapter 9, “Configuring DST Global Policies,” on page 71](#)
- ♦ [Chapter 10, “Creating and Managing DST Shadow Volumes for NSS Volumes,” on page 85](#)
- ♦ [Chapter 11, “Creating and Managing Policies for Shadow Volumes,” on page 109](#)
- ♦ [Chapter 12, “Generating a File Inventory for DST Shadow Volumes,” on page 125](#)
- ♦ [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,” on page 139](#)
- ♦ [Chapter 14, “Troubleshooting for DST,” on page 169](#)
- ♦ [Chapter 15, “Security Considerations,” on page 171](#)
- ♦ [Appendix A, “Commands and Utilities for Dynamic Storage Technology,” on page 175](#)
- ♦ [Appendix B, “RPM Files for Dynamic Storage Technology,” on page 189](#)
- ♦ [Appendix C, “Documentation Updates,” on page 191](#)

Audience

This guide is intended for storage services administrators. Security administrators can find a summary of security information for Dynamic Storage Technology in [Chapter 15, “Security Considerations,” on page 171](#).

It is assumed that the reader has some understanding of the OES Services components that are used with Dynamic Storage Technology, including the OES 11 operating system, the NSS file system, the file access services (NCP (NetWare Core Protocol), Novell CIFS (Common Information File System), and CIFS/Samba), and Novell Cluster Services.

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation

Documentation Updates

For the most recent version of the *Dynamic Storage Technology Administration Guide*, see the [Novell Open Enterprise Server 11 documentation Web site](http://www.novell.com/documentation/oes11/) (<http://www.novell.com/documentation/oes11/>).

Additional Documentation

For documentation on Novell Storage Services (NSS) volumes, see the *OES 11: NSS File System Administration Guide for Linux*.

For documentation on NCP Server and NCP file access, see the *OES 11: NCP Server for Linux Administration Guide*.

For documentation on other OES 11 products, see the [Novell Open Enterprise Server 11 documentation Web site](http://www.novell.com/documentation/oes11/) (<http://www.novell.com/documentation/oes11/>).

1 Overview of Dynamic Storage Technology

Dynamic Storage Technology (DST) for Novell Open Enterprise Server (OES) 11 is an information life-cycle management technology that uses a policy-based approach for relocating data between two Novell Storage Services (NSS) volumes located on different devices. It transparently provides a merged view of the file tree to users. An administrator can specify policies that classify data to be moved by its frequency of use, file extension, and file size. Policy enforcement is automated with scheduled and on-demand runs of the policies.

Dynamic Storage Technology allows you to seamlessly tier storage between high-performance and lower-performance devices. For example, you can establish policies that keep frequently used, mission-critical data on high-performance devices, and move rarely accessed, less-essential data to lower-performance devices. Backup can be performed separately on the two volumes, which allows for different backup schedules.

Dynamic Storage Technology enables you to manage data more efficiently for the enterprise. In doing so, the enterprise can potentially realize significant cost savings in storage management.

This section provides an overview of Dynamic Storage Technology and its components.

- ♦ [Section 1.1, “Understanding Dynamic Storage Technology,” on page 13](#)
- ♦ [Section 1.2, “Benefits of Dynamic Storage Technology,” on page 16](#)
- ♦ [Section 1.3, “Shadowing Scenarios,” on page 18](#)
- ♦ [Section 1.4, “DST Policy Scenarios,” on page 19](#)
- ♦ [Section 1.5, “DST Components,” on page 20](#)
- ♦ [Section 1.6, “Management Tools,” on page 21](#)
- ♦ [Section 1.7, “What’s Next,” on page 21](#)

1.1 Understanding Dynamic Storage Technology

Dynamic Storage Technology (DST) for OES 11 is a feature of NCP Server that allows you to specify a shadow relationship between two volumes that form a *shadow volume pair*. The secondary directory tree structure, or *secondary file tree*, shadows the primary file tree.

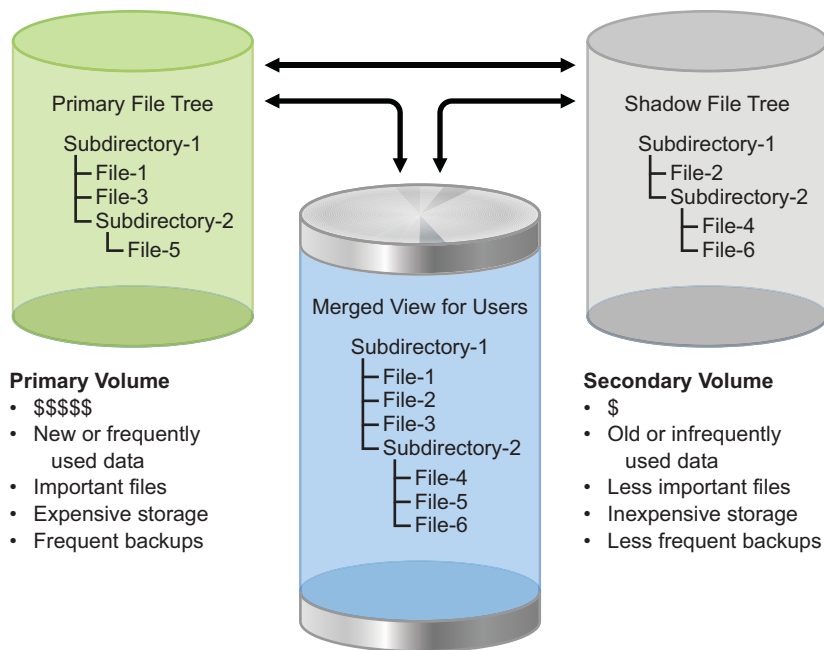
IMPORTANT: Only NSS volumes are supported to be used for DST shadow volume pairs.

- ♦ [Section 1.1.1, “Merged View of the File Tree,” on page 14](#)
- ♦ [Section 1.1.2, “Merged View for User File Access,” on page 15](#)
- ♦ [Section 1.1.3, “Local File Access,” on page 15](#)
- ♦ [Section 1.1.4, “File Systems,” on page 15](#)

1.1.1 Merged View of the File Tree

Dynamic Storage Technology presents the directory trees on each volume in a merged view, as illustrated in [Figure 1-1](#). The primary file tree and shadow file tree have the same directory structure, so that each directory appears in both locations as data is moved between the two volumes. The primary tree and the secondary tree are overlaid to create one virtual volume tree that is transparently presented to the users. When accessing files through the merged view, users are not aware of the actual physical location of the files. If the shadow relationship is removed, the secondary volume can once again function independently and normally.

Figure 1-1 User View of the File System Directory



An example of the merged view of the shadow volume is shown in [Figure 1-1](#). When an NCP client lists files for Subdirectory-1, the user sees File-1, File-2, and File-3. File-1 and File-3 are stored in the primary file tree. File-2 is stored in the shadow file tree.

When a client creates new files, the files are automatically stored in the primary file tree. When files in the shadow file tree are modified, a configurable option allows the files to be moved to the primary file tree (default), or left in the shadow file tree.

For example, if your policy is to place newer files in the primary file tree and to place older files in the shadow file tree, you want an older file in the secondary file tree to move to primary file tree if the file's content is modified. On the other hand, if you are placing files of one type (such as .doc and .ppt) in the primary area and files of a different type (such as .mp3 and .jpg) in the secondary area, you want files to stay where they are whenever they are modified.

When a new directory is created, it is created in the primary file tree. A configurable option allows the necessary branches of the tree to be created in the shadow file tree in one of two ways:

- The new directory path is created as needed when policies are enforced to move files to the directory in the secondary location (the default)
- The new directory path is created immediately in the secondary location, and files are moved to the directory as policies are enforced.

Performance is better when the directory branches are created only as needed.

When a directory is deleted, it is deleted in both areas. When a directory is renamed, it is renamed in both areas. The coordination of the file and directory management happens automatically so that the areas remain synchronized and have the same directory structure.

1.1.2 Merged View for User File Access

Dynamic Storage Technology supports a merged view via NCP for user file access. You can also install and configure one of the following OES Services on the DST host server to provide a merged view for CIFS user access:

- ♦ Novell CIFS

Use Novell CIFS with the primary NSS volume in the DST shadow volume pair, just as you would with a regular NSS volume.

- ♦ Novell Samba

This CIFS/Samba solution requires FUSE and ShadowFS as described in [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,”](#) on page 35. Configure CIFS/Samba shares on the primary NSS volume. The Samba service and users must be enabled with Linux User Management (LUM).

Users access files by connecting to the primary volume. All file operations (such as read, write, rename, delete, and so on) can be performed whether a file resides on the primary or secondary location. Dynamic Storage Technology executes the transaction transparently for the user.

In general, transactions are executed wherever the file resides. Any file that requires a normal user-level action (copy, delete, and so on) is moved back to the primary for the action to take place, which simplifies the auditing requirements. Some transactions, such as a directory rename, occur in both file trees in order to keep the paths synchronized.

1.1.3 Local File Access

After you create the shadow relationship, the secondary volume is hidden to everyone but those users or applications that are authorized to view the local Linux file system, such as the `root` user. The only operations that are intended to take place directly on the secondary volume are backup, or “remove and archive.”

For example, backup administrators and system administrators with `root` user privileges on the server can see the primary file tree and the shadow file tree as separate and independent directories. Thus, backup tools can apply one backup policy to the primary volume location and apply a different backup policy to the secondary volume location.

1.1.4 File Systems

The primary area and the secondary area can each be located anywhere in the logical Linux directory tree that is available to the server. For example, the default location for NSS volumes is in the `/media/nss/` directory, but DST can handle any mount point that you specify for your NSS volumes.

The primary volume and secondary volume must use the same file system. Only the NSS file system is supported at this time.

The primary and secondary volumes can be located on a local SCSI devices, Fibre Channel SAN devices, and iSCSI SAN devices. The device types and performance can differ between the primary and secondary devices, with the secondary volume typically being on the device with lower performance.

Clustering is supported with Novell Cluster Services.

1.2 Benefits of Dynamic Storage Technology

Shadow volumes have many benefits:

- ♦ [Section 1.2.1, “Transparent File Access to End Users,” on page 16](#)
- ♦ [Section 1.2.2, “Policy-Based Migration between Primary and Secondary Storage Areas,” on page 16](#)
- ♦ [Section 1.2.3, “Faster and Smaller Backups of Important Data,” on page 16](#)
- ♦ [Section 1.2.4, “Faster Disaster Recovery,” on page 17](#)
- ♦ [Section 1.2.5, “More Efficient Use of Expensive Storage,” on page 17](#)
- ♦ [Section 1.2.6, “Fast Storage for Active Data and Slower, Less Expensive Storage for Old Data,” on page 17](#)
- ♦ [Section 1.2.7, “Moving Files from an Existing Secondary Volume,” on page 17](#)
- ♦ [Section 1.2.8, “Access to the Secondary Storage Area without the Performance Penalties of HSM Solutions,” on page 18](#)

1.2.1 Transparent File Access to End Users

Because shadow volumes present a merged view of the file trees, the end user’s files appear to be in the same logical place regardless of their physical location. This allows the administrator to manage the data without disrupting the end user’s view of the files.

1.2.2 Policy-Based Migration between Primary and Secondary Storage Areas

DST provides policy-based control of the files to move and the direction that you want to move data between devices. You can set up policies that migrate data by file extension, file size, and the date last accessed or modified. You can also specify a list of files to move in either direction for a one-time move. Policies can be scheduled to run and run on demand. You can set policies so that data stored on the secondary storage volume can be accessed without de-migrating it.

1.2.3 Faster and Smaller Backups of Important Data

Backup policies can differ for the primary storage volume and the secondary storage volume. For example, the DST administrator can allocate the data between the two volumes in a way that supports separate backup schedules:

- ♦ Important or active data that needs to be maintained on quality storage and backed up frequently
- ♦ Less important or stale data that can be stored on less expensive storage and backed up less frequently

Analyzing the inventory of a volume’s data shows that a large portion of its data is seldom used. Having a shadow volume allows the administrator to spend more on the most important data and spend less on the less important data. The important data, which is stored on the primary area, can be backed up nightly. The less important data, which is stored in the secondary area, can be backed up

weekly or even monthly. Getting the less important data out of the way enables the backups of your important data to run more quickly and efficiently. Allocating data in this way can significantly lower the cost of backups by reducing both labor and tape requirements.

For information about backing up data on DST volumes, see:

- [Section 6.11, “Using Backup Utilities with DST Shadow Volumes,” on page 60](#)
- [Section 10.11, “Backing Up DST Shadow Volumes,” on page 101](#)

1.2.4 Faster Disaster Recovery

Start by locating your most important files on the primary area. Then, during a disaster recovery, the server administrator can restore the primary area first. This restores the critical files first, and leaves the recovery of the less important secondary area until later. The users can continue working while files they probably do not need immediately are being restored. Also, other fault-tolerant replication solutions like snapshots can be used for the primary area without wasting money on files that do not require the same level of fault tolerance.

1.2.5 More Efficient Use of Expensive Storage

Policies can be used to partition files based on file age, owner, type, size, and so on. You can move the less important files to from a higher quality storage array to a lower quality storage, thus reserving the higher-cost storage for your most important files. For example, you can configure the primary area on block-based SCSI storage devices in a Fibre Channel SAN-based hardware RAID array or storage array, and configure the secondary area on a lower quality storage array using slower devices like SATA. This allows you to get more use out of your Fibre Channel storage solution, and keep it from filling up with unimportant files. You can store more data on your server with a lower overall cost per gigabyte.

1.2.6 Fast Storage for Active Data and Slower, Less Expensive Storage for Old Data

Storage media can differ for the primary storage volume and the secondary storage volume. Storage costs can be reduced by allowing data that is used infrequently to be stored on lower-cost storage. Locate the primary area on storage drives that are faster and higher quality. Then locate the secondary area on less expensive storage drives. Files that the users are currently working on can be located on the high-performance drives. The files that have not been modified for a long time can be moved to the lower-performance drives to free up space on the high-performance drives. In this way, you can locate a large amount of your data on less expensive, lower-performance storage drives, while your users still get high-quality performance because their active files are located on the high-performance storage drives.

1.2.7 Moving Files from an Existing Secondary Volume

You can start with an empty primary NSS volume, and have the shadow area be an existing volume. The combined view initially presented by the NCP Engine is equivalent to the secondary volume. You can define a policy to move files to the primary as they are modified or accessed. As users access their data through the new primary volume, the files they use are automatically migrated to the new server. This migration-on-demand approach migrates the data gradually, freeing the IT department from spending off-hours time migrating the data with the server offline.

1.2.8 Access to the Secondary Storage Area without the Performance Penalties of HSM Solutions

With HSM (hierarchical storage management) solutions, files are migrated from the primary storage to a secondary storage device, and a copy of the file's metadata (stub file) is left behind in the volume's directory tree. If the file is ever accessed again, it needs to be migrated back to the primary storage before it is available.

In contrast, DST shadow volumes can access files directly regardless of which area (primary or secondary) they are in, and without de-migrating them. If a user searches through all the files on a shadow volume, the files are searched without needing to move them to the primary area. Also, shadow volume backups are faster because there are no HSM metadata stub files for the backup software to scan. The backup software does not need to be HSM aware.

1.3 Shadowing Scenarios

The flow of data between the primary storage area and the secondary storage area can take place two ways:

- [Section 1.3.1, "Existing Volume as Primary with an Empty Volume as Secondary," on page 18](#)
- [Section 1.3.2, "Empty Volume as Primary with an Existing Volume as Secondary," on page 18](#)

1.3.1 Existing Volume as Primary with an Empty Volume as Secondary

In this scenario, all data currently exists on an NSS volume that you want to make the primary volume. You create a new volume to use as the secondary storage, then define a shadow volume for the two NSS volumes.

The volume contains information that is seldom used and rarely changes, and you want to move the seldom-used data to a location where it can be accessed but backed up less frequently. This decreases the time it takes to back up or restore the data you use the most.

Then, you can configure a policy that governs what data moves to the secondary storage area. Data is returned to the primary area based on a policy of usage or file type. For example, if the user simply views the data in a file, then the data does not move. If the user modifies the file, then the file is moved back to the primary volume. Users are not aware of where the data are physically stored because they see a merged view of both volumes.

1.3.2 Empty Volume as Primary with an Existing Volume as Secondary

You have an existing volume on older storage and want to move the data to new storage arrays. You create a new volume on a storage device in a Fibre Channel SAN solution. You define a shadow volume that uses the empty device as the primary area, and the existing volume as the secondary area.

You can configure a policy so that the data moves to the primary volume based upon usage. Data gradually flows to the primary volume as it is used. In this way, there is a natural background migration of data from the existing volume to the new volume. The new volume gradually grows, and the relationship between the primary and shadow volume is as if the primary had been populated first.

For example, suppose you have an existing pool that spans multiple LUNs, and contains multiple volumes. The current best practice is to use a separate LUN for each pool, and a single volume per pool. You create a new pool on a new larger LUN (or fewer larger LUNs), then create a single NSS volume in the pool. You might need to rename the old and new NSS volumes if users need to access the data via known paths, because after the shadow volume is created, users access data via the new volume. Repeat this process so that you have one new empty volume for each of the old volumes on the pool. As the new and old volumes are ready, you create a DST shadow volume with the new volume as the primary storage area and an existing volume from the old pool as the secondary storage area.

To begin de-migrating the data, configure the global policies to shift data from the secondary storage area to the primary storage area whenever they are accessed or modified. You can also configure individual shadow volume policies or use inventory reports to shift data on schedule or on-demand based on age, file names, file types, or file size. De-migration occurs with the storage online and accessible to end users; they are not aware of where the data is actually stored. When you have moved all the data from the old NSS volume to the new one, you can remove the shadow volume, then delete the empty old NSS volume from the old pool. When the old pool has had all its volumes deleted, you can delete the old pool, which frees that storage for use in other volumes. Users are not aware that the volumes are on a new pool. They see only the volume by its name.

1.4 DST Policy Scenarios

DST policies control how data flows between the primary storage area and the secondary storage.

- [Section 1.4.1, “Move Files Based on the Last Time Accessed or Modified,” on page 19](#)
- [Section 1.4.2, “Move Files Based on File Size,” on page 19](#)
- [Section 1.4.3, “Move Files Based on File Extensions,” on page 20](#)
- [Section 1.4.4, “Move Selected Files,” on page 20](#)

1.4.1 Move Files Based on the Last Time Accessed or Modified

You can create a DST policy that moves files to the secondary volume that have not been modified or accessed for a period of time, such as 6 months or 1 year.

1.4.2 Move Files Based on File Size

You can create a DST policy that moves files to the secondary volume that have are greater than or less than a specified file size.

By default, files in the secondary area are moved back to the primary area if they are modified. You should disable the `SHIFT_MODIFIED_SHADOW_FILES` parameter to turn off this auto-move feature. The `SHIFT_ACCESSED_SHADOW_FILES` parameter is disabled by default so that files are not moved when accessed. These settings are global settings that apply to all shadow volumes on a given server. In this way, the desired file types stay in the secondary area after they are moved there.

1.4.3 Move Files Based on File Extensions

You can create a DST policy that moves non-essential types of files based on file extensions, such as *.jpg, *.mp3, *.wma, *.mpeg, *.iso, *.zip, *.cab, and so on.

By default, files in the secondary area are moved back to the primary area if they are modified. You should disable the SHIFT_MODIFIED_SHADOW_FILES parameter to turn off this auto-move feature. The SHIFT_ACCESSED_SHADOW_FILES parameter is disabled by default so that files are not moved when accessed. These settings are global settings that apply to all shadow volumes on a given server. In this way, the desired file types stay in the secondary area after they are moved there.

1.4.4 Move Selected Files

You can use the Shadow Volume Inventory page in Novell Remote Manager for Linux to view statistics on files and usage for the DST shadow volume. At the bottom of the page, use the form to move selected files between the two volumes. This one-time move is not policy based.

1.5 DST Components

There are four main components for Dynamic Storage Technology.

- ♦ [Section 1.5.1, “NCP Engine,” on page 20](#)
- ♦ [Section 1.5.2, “Shadow Volume,” on page 20](#)
- ♦ [Section 1.5.3, “ShadowFS,” on page 20](#)
- ♦ [Section 1.5.4, “Policy Engine,” on page 21](#)

1.5.1 NCP Engine

The NCP Engine provides support for NCP clients and the main file copy engine for Dynamic Storage Technology. It provides the merged view for NCP users and Novell CIFS users. It supports the ShadowFS access for CIFS/Samba users.

1.5.2 Shadow Volume

Shadow Volume allows NCP users and Novell CIFS users to see a merged file-tree view of the primary file tree and shadow file tree.

1.5.3 ShadowFS

The Shadow File System (ShadowFS) works with Novell Samba and FUSE (File Systems in Userspace) to provide a merged view for CIFS/Samba users. It also allows Linux applications (such as Samba Server, PureFTPd, and SSH) to see the merged view of the shadow volume.

IMPORTANT: If you need only NSS access, Novell CIFS can be used instead Novell Samba. Novell CIFS does not require ShadowFS and FUSE. For information, see [“Novell CIFS” on page 49](#).

ShadowFS uses FUSE to create a local mount point for each DST shadow volume in `/media/shadowfs/shadow_volume_name`. FUSE is an open source software package included in OES 11 that is installed automatically when you install DST.

1.5.4 Policy Engine

The DST policy engine allows you to create, manage, and enforce policies for a shadow. There are two types of policies:

- ♦ **Global:** The policy applies to every mounted shadow volume on the server. If global policies are set for a server where volumes are in a clustered pool, these policies must be set on every node in the cluster. For information about setting global policies, see [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#).
- ♦ **Volume:** The policy applies only to a specified volume. Volume policies can be used for local or shared volumes. They should be used when volumes are in a clustered pool so that the policy easily follows the volume when the cluster resource fails over. For information, see [Chapter 11, “Creating and Managing Policies for Shadow Volumes,” on page 109](#).

1.6 Management Tools

Dynamic Storage Technology shadow volumes, global policies, and shadow volume policies can be managed in Novell Remote Manager for Linux. For information about using Novell Remote Manager, see [Chapter 7, “Management Tools for DST,” on page 61](#).

DST shadow volumes can be created and removed with commands by using the NCP Console (NCPCON, `ncpcon(8)`) utility. For information, see [Appendix A, “Commands and Utilities for Dynamic Storage Technology,” on page 175](#).

1.7 What’s Next

For information about installing NCP Server, Dynamic Storage Technology, and NSS, see [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#).

For information about planning your DST solution, see [Chapter 6, “Planning for DST Shadow Volumes and Policies,” on page 45](#).

2 What's New or Changed in Dynamic Storage Technology

This section describes the changes made to Dynamic Storage Technology since the Novell Open Enterprise Server (OES) 11 release.

- ♦ [Section 2.1, “What’s New \(July 2012 Patches\),” on page 23](#)
- ♦ [Section 2.2, “What’s New \(May 2012 Patches\),” on page 23](#)
- ♦ [Section 2.3, “What’s New \(OES 11\),” on page 24](#)

2.1 What's New (July 2012 Patches)

In addition to bug fixes, the following enhancements are available:

- ♦ **Subdirectory Restrictions:** The Subdirectory Restrictions filter has been modified as follows:
 - ♦ Precede subdirectory paths with a forward slash (/), such as
`/subdir1/subdir2`
 - ♦ In addition to subdirectory paths, the Exclude Subdirectory option allows you to specify a directory name that might exist in multiple places on a volume. You indicate this intended action by specifying only a directory name with no forward slashes, and the directory name must contain at least one wildcard (such as ? or *). All instances of directories that match the specified directory name are excluded from the policy run.

For example, to exclude all GroupWise archive subdirectories, specify the following directory name with wildcards:

`of???arc`

For information, see “Subdirectory Restrictions” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bb8ubn2.html#bb8udwu) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).

2.2 What's New (May 2012 Patches)

In addition to bug fixes, the following enhancements are available:

- ♦ **Search Pattern:** You can specify file names with spaces in them.
- ♦ **ShadowFS:** The *Load ShadowFS now and at boot time* option has been renamed as *Load ShadowFS (enable only if using Samba)*. The option starts ShadowFS by issuing the `/etc/init.d/novell-shadowfs start` command when you click the button, and configures the server to load ShadowFS at system restart. Only one instance should be running at a time. ShadowFS should be enabled only when Novell Samba or Linux file access protocols are used.

2.3 What's New (OES 11)

Novell Dynamic Storage Technology was modified to support Novell Open Enterprise Server 11. In addition, the following enhancements were added since the OES 2 release:

- ♦ **Include/Exclude Folders:** The Subdirectory Restrictions filter allows you to specify multiple paths to include or exclude in a policy when it runs. You can specify either included paths or excluded paths in a given policy, but not both. For information, see “[Subdirectory Restrictions](http://www.novell.com/documentation/oes11/stor_dst_lx/data/bb8ubn2.html#bb8udwu)” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bb8ubn2.html#bb8udwu) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).
- ♦ **Search Pattern:** The Search Pattern filter allows you to specify multiple file extensions for a given policy. For information, see “[Search Pattern](http://www.novell.com/documentation/oes11/stor_dst_lx/data/bb8ubn2.html#bb8udkh)” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bb8ubn2.html#bb8udkh) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).
- ♦ **Novell CIFS:** Novell CIFS supports the merged view of Dynamic Storage Technology volumes that are configured with NSS volumes. See “[Novell CIFS](http://www.novell.com/documentation/oes11/stor_dst_lx/data/bsrzg7.html#bss0cs9)” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bsrzg7.html#bss0cs9) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).
- ♦ **Encrypted NSS Volumes:** You can use encrypted NSS volumes in a DST shadow volume. See “[Using NSS Encrypted Volumes in a DST Shadow Volume](http://www.novell.com/documentation/oes11/stor_dst_lx/data/bsrky2b.html)” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bsrky2b.html) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).
- ♦ **Stop a Running Policy:** The Stop a Running Policy option allows you to stop all currently running policies, or to stop an individual running policy. See “[Stopping a Running Policy](http://www.novell.com/documentation/oes11/stor_dst_lx/data/bovhz4x.html)” (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bovhz4x.html) in the *OES 11: Dynamic Storage Technology Administration Guide* (http://www.novell.com/documentation/oes11/stor_dst_lx/data/bookinfo.html).

3 Installing Dynamic Storage Technology

This section describes installation requirements and how to install Dynamic Storage Technology on a Novell Open Enterprise Server (OES) 11 server.

- ♦ [Section 3.1, “Installation Requirements for Dynamic Storage Technology,” on page 25](#)
- ♦ [Section 3.2, “Installing NCP Server and Dynamic Storage Technology,” on page 29](#)
- ♦ [Section 3.3, “Configuring Global Policies for DST,” on page 31](#)
- ♦ [Section 3.4, “Installing DST on Nodes in a Novell Cluster Services for Linux Cluster,” on page 31](#)

3.1 Installation Requirements for Dynamic Storage Technology

Ensure that your system satisfies the required software and configuration settings that are specified in this section.

- ♦ [Section 3.1.1, “Novell Open Enterprise Server 11,” on page 25](#)
- ♦ [Section 3.1.2, “NCP Server and Dynamic Storage Technology,” on page 26](#)
- ♦ [Section 3.1.3, “Novell Storage Services,” on page 26](#)
- ♦ [Section 3.1.4, “Novell eDirectory 8.8.2 or Later,” on page 26](#)
- ♦ [Section 3.1.5, “Novell CIFS,” on page 26](#)
- ♦ [Section 3.1.6, “Novell Samba with ShadowFS, FUSE, and LUM,” on page 26](#)
- ♦ [Section 3.1.7, “Linux User Management,” on page 27](#)
- ♦ [Section 3.1.8, “Novell Cluster Services for Linux,” on page 27](#)
- ♦ [Section 3.1.9, “Novell Remote Manager for Linux,” on page 27](#)
- ♦ [Section 3.1.10, “Novell iManager 2.7.4 for Linux,” on page 27](#)
- ♦ [Section 3.1.11, “SFCB and CIMOM,” on page 28](#)
- ♦ [Section 3.1.12, “Other OES Services,” on page 28](#)

3.1.1 Novell Open Enterprise Server 11

Dynamic Storage Technology runs on OES 11 servers with 64-bit processors. For information about installing and configuring OES 11, see the [OES 11: Installation Guide](#).

3.1.2 NCP Server and Dynamic Storage Technology

Dynamic Storage Technology is a component of the NetWare Core Protocol (NCP) Server. NCP Server for Linux provides the NCP services for the shadow volume. NCP Server must be installed and running in order for DST to work. NCP Server also provides a merged view of the data for NCP users and applications.

DST is automatically enabled when NCP Server is running and enabled, even if there are no shadow volume pairs currently defined. There is no way to separately turn DST on or off in Novell Remote Manager for Linux or in the YaST Runlevel Editor.

For information about managing NCP Server for Linux, see the [OES 11: NCP Server for Linux Administration Guide](#).

3.1.3 Novell Storage Services

Dynamic Storage Technology supports only Novell Storage Services (NSS) volumes in shadow volumes. You must install Novell Storage Services and any other OES Services that it requires. For information, see “[Installing and Configuring Novell Storage Services](#)” in the [OES 11: NSS File System Administration Guide for Linux](#).

IMPORTANT: Some restrictions apply when using NSS volumes in a DST shadow volume. For information, see [Section 6.4, “Using NSS Volumes in DST Shadow Volumes,”](#) on page 52.

3.1.4 Novell eDirectory 8.8.2 or Later

Dynamic Storage Technology requires that access to data be restricted to users with User objects defined in Novell eDirectory 8.8.2 or later. For information about configuring eDirectory and users, see the [Novell eDirectory 8.8 Administration Guide](#).

IMPORTANT: All users of data on the shadow volume pair must be eDirectory users. The server’s root user is the only local user who can access data without authenticating in eDirectory.

3.1.5 Novell CIFS

Novell CIFS is supported to give CIFS users access to the data on DST volumes that are built with NSS volumes. CIFS users see a merged view of the data by accessing a CIFS share on the primary volume. For information about configuring and managing Novell CIFS, see the [OES 11: Novell CIFS for Linux Administration Guide](#). For planning information, see “[Novell CIFS](#)” on page 49.

Novell CIFS is supported as an alternative to the Novell Samba solution. Novell CIFS does not require ShadowFS, FUSE, or LUM.

3.1.6 Novell Samba with ShadowFS, FUSE, and LUM

Novell Samba is supported as an alternative to Novell CIFS to give CIFS/Samba users access to the data on DST volumes.

The CIFS/Samba users and the Linux Samba service must be enabled with Linux User Management (LUM).

The merged view for CIFS/Samba is provided by the Shadow File System (ShadowFS) and FUSE (File System in Userspace). These components are installed automatically when you install NCP Server and Dynamic Storage Technology. For information, see [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,”](#) on page 35.

3.1.7 Linux User Management

Linux User Management is selected and installed automatically when you install NCP Server and Dynamic Storage Technology. LUM is required if you use Novell Samba with DST volumes. For information about how to configure users and services for LUM, see the [OES 11: Novell Linux User Management Administration Guide](#).

3.1.8 Novell Cluster Services for Linux

NCP Server and Dynamic Storage Technology support the sharing of shadow volumes in clusters with Novell Cluster Services for OES 11.

NCP Server and DST are not cluster-aware. They must be installed and configured on each node in the cluster where you plan to fail over DST shadow volumes. Each node should run the same release version of OES.

For information about installing Novell Cluster Services, see “[Planning for Novell Cluster Services](#)” in the [OES 11: Novell Cluster Services 2.0 for Linux Administration Guide](#).

For information about managing cluster resources, see “[Configuring and Managing Cluster Resources](#)” the [OES 11: Novell Cluster Services 2.0 for Linux Administration Guide](#).

For information about configuring shadow volumes in cluster resources, see [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,”](#) on page 139.

3.1.9 Novell Remote Manager for Linux

Novell Remote Manager for Linux is required for managing NCP Server services and Dynamic Storage Technology. It is selected and installed by default when you install NCP Server and Dynamic Storage Technology.

For information about managing Novell Remote Manager and using its other features, see the [OES 11: Novell Remote Manager Administration Guide](#). For information about management options for DST, see [Section 7.1, “Dynamic Storage Technology Plug-In for Novell Remote Manager for Linux,”](#) on page 61.

3.1.10 Novell iManager 2.7.4 for Linux

Novell iManager 2.7.4 for Linux is required for managing eDirectory users, Samba services, Novell CIFS services, Linux User Management, Novell Storage Services, and Novell Cluster Services for Linux. It is not necessary to install iManager on every server, but it must be installed somewhere in the same eDirectory tree. For information about installing and using Novell iManager, see the [Novell iManager 2.7.4 Administration Guide](#).

You use the Storage plug-in to share devices and to create and manage NSS pools and volumes. For information, see “[Storage Plug-In Quick Reference](#)” in the [OES 11: NSS File System Administration Guide for Linux](#).

You use the Clusters plug-in for Novell iManager to manage the DST shadow volume cluster resource, load script, and unload script. For information, see [“Configuring and Managing Cluster Resources”](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

3.1.11 SFCB and CIMOM

The Small Footprint CIM Broker (SFCB) replaces OpenWBEM for CIMOM activities in OES 11. For information, see [“Small Footprint CIM Broker \(SFCB\)”](#) in the *OES 11: Planning and Implementation Guide*.

IMPORTANT: SFCB must be running and working properly whenever you modify the settings for the cluster or the cluster resources.

Port 5989 is the default setting for secure HTTP (HTTPS) communications. If you are using a firewall, the port must be opened for CIMOM communications.

The storage-related plug-ins for iManager require CIMOM connections for tasks that transmit sensitive information (such as a user name and password) between iManager and the _admin volume on the OES 11 that server you are managing. Typically, CIMOM is running, so this should be the normal condition when using the server. CIMOM connections use Secure HTTP (HTTPS) for transferring data, and this ensures that sensitive data is not exposed.

If CIMOM is not currently running when you click *OK* or *Finish* for the task that sends the sensitive information, you get an error message explaining that the connection is not secure and that CIMOM must be running before you can perform the task.

IMPORTANT: If you receive file protocol errors, it might be because SFCB is not running.

You can use the `rcsfcb` command to help resolve CIMOM and SFCB issues:

To perform this task	At a terminal console prompt, enter as the root user
To start SFCB	<code>rcsfcb start</code>
To stop SFCB	<code>rcsfcb stop</code>
To check SFCB status	<code>rcsfcb status</code>
To restart SFCB	<code>rcsfcb restart</code>

3.1.12 Other OES Services

Ensure that you install and configure additional OES 11 services that might be required by each of the other services mentioned in this section. Refer to the individual guides for those services for information about how to install and manage them.

3.2 Installing NCP Server and Dynamic Storage Technology

NCP Server for Linux and Dynamic Storage Technology can be installed during the OES 11 installation, or on an existing server. Before you set up DST volumes on the server, ensure that you configure the DST global policies.

- ♦ [Section 3.2.1, “Installing on a New OES 11 Server,” on page 29](#)
- ♦ [Section 3.2.2, “Installing on an Existing OES 11 Server,” on page 30](#)

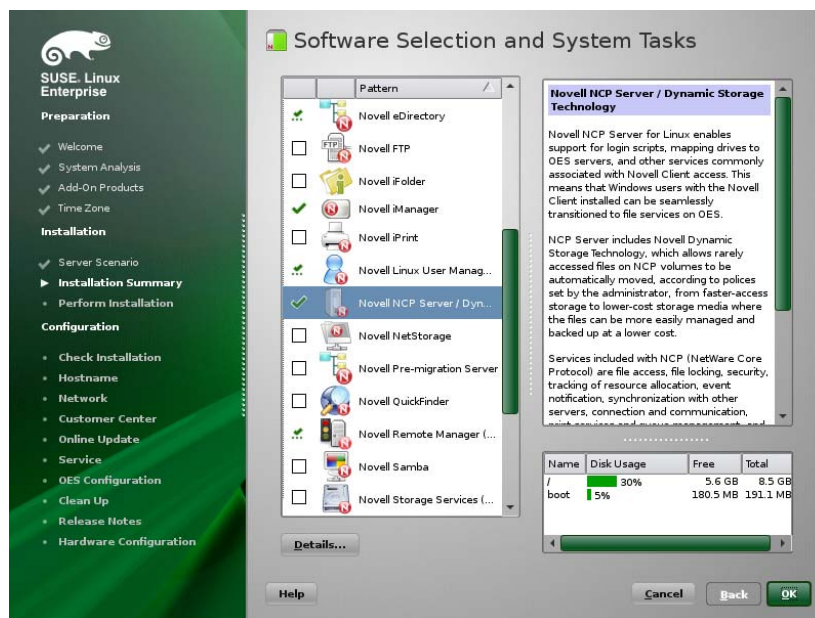
3.2.1 Installing on a New OES 11 Server

NCP Server for Linux and Dynamic Storage Technology can be installed during the OES 11 installation. For general installation instructions, see the [OES 11: Installation Guide](#).

- 1 During the YaST install, on the *Install Settings* page, click *Software* to view details.
- 2 Select *Novell NCP Server / Dynamic Storage Technology* from the *OES Services* options.

When you select *Novell NCP Server / Dynamic Storage Technology*, the following additional *OES Services* options are automatically selected:

- ♦ *Novell Backup / Storage Management Services*
- ♦ *Novell eDirectory*
- ♦ *Novell Linux User Management*
- ♦ *Novell Remote Manager (NRM) for Linux*



- 3 Select *Novell Storage Services* from the *OES Services* options.

IMPORTANT: DST shadow volumes are supported only for Novell Storage Services volumes.

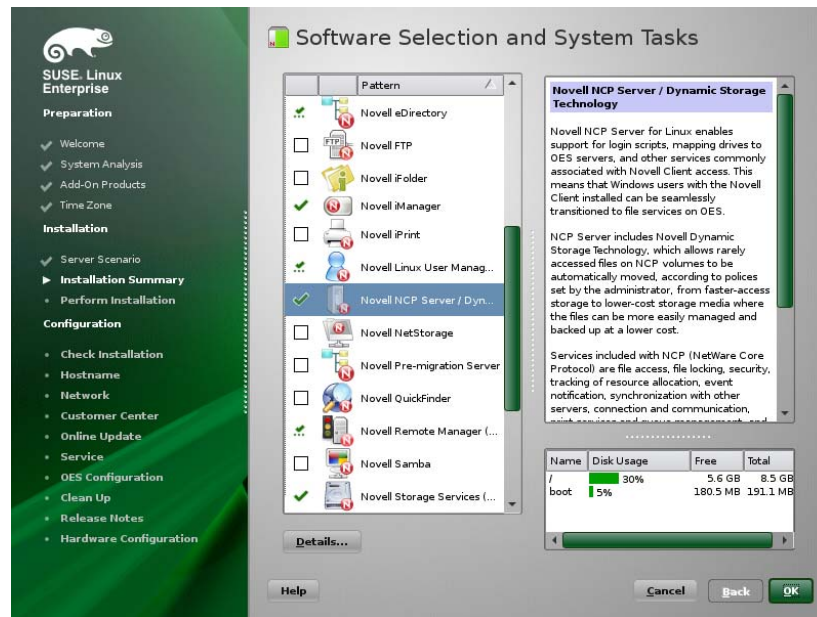
- 4 (Optional) Select *Novell iManager* from the *OES Services* options.

You must install Novell iManager somewhere in your network, but it is not necessary to install it on every server.

- 5 (Optional) If you plan to configure shared DST shadow volumes in a cluster, select *Novell Cluster Services (NCS)* from the *OES Services* options.

For detailed information about configuring cluster settings after the install for Novell Cluster Services for Linux, see “[Configuring Novell Cluster Services](#)” in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

- 6 (Optional) If you plan to provide access to DST shadow volumes for CIFS users, select one of the following from the *OES Services* options:
 - ♦ *Novell CIFS*
 - ♦ *Novell Samba*
- 7 Click *Accept* to continue with the installation.



- 8 After you have installed and configured the server, continue with [Section 3.3, “Configuring Global Policies for DST,”](#) on page 31.

3.2.2 Installing on an Existing OES 11 Server

You can install NCP Server and Dynamic Storage Technology at any time after the initial OES 11 install by using *YaST > Open Enterprise Server > OES Install and Configuration*. For general instructions for installing and configuring OES Services on an existing OES 11 server, see “[Installing or Configuring OES 11 on an Existing Server](#)” in the *OES 11: Installation Guide*.

- 1 Log in to the server as the *root* user, then launch YaST.
- 2 In YaST, select *Open Enterprise Server > OES Install and Configuration*.
- 3 On the Software Selection page under *OES Services*, select *Novell NCP Server / Dynamic Storage Technology* and any other compatible OES components that you want to install.

IMPORTANT: Services that are already installed are indicated by a blue check mark in the status check box next to the service. If a service is already installed, do not select it again.

When you select *Novell NCP Server / Dynamic Storage Technology*, the following additional *OES Services* options are automatically selected:

- ♦ *Novell Backup / Storage Management Services*

- ♦ *Novell eDirectory*
 - ♦ *Novell Linux User Management*
 - ♦ *Novell Remote Manager (NRM) for Linux*
- 4 If it is not already installed, select *Novell Storage Services* from the *OES Services* options.
 - 5 (Optional) If it is not already installed, select *Novell iManager* from the *OES Services* options.
You must install Novell iManager somewhere in your network, but it is not necessary to install it on every server.
 - 6 (Optional) If it is not already installed, and if you plan to configure shared DST shadow volumes on a cluster node, select *Novell Cluster Services (NCS)* from the *OES Services* options.
For detailed information about configuring cluster settings after the install for Novell Cluster Services for Linux, see “[Configuring Novell Cluster Services](#)” in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.
 - 7 (Optional) If you plan to provide access to DST shadow volumes for CIFS users, select one (not both) of the following protocol solutions from the *OES Services* options if it is not already installed:
 - ♦ *Novell CIFS*
 - ♦ *Novell Samba*
 - 8 Click *Accept* to continue with the installation.
 - 9 After you have installed and configured the server, continue with [Section 3.3, “Configuring Global Policies for DST,”](#) on page 31.

3.3 Configuring Global Policies for DST

After DST has been installed on the server, configure the global policies for DST. Global policies apply to all DST shadow volumes on the server.

In a cluster, the global policies should be configured with the same settings on all nodes where you plan to run a DST shadow volume cluster resource. Whenever you modify global policies on a given node in the cluster, you must make those same changes on the other nodes.

For information about setting DST global policies, see the following:

- ♦ [Section 9.1, “Replicating Branches of the Primary File Tree in the Secondary File Tree,”](#) on page 71
- ♦ [Section 9.2, “Shifting Files from the Secondary File Tree to the Primary File Tree,”](#) on page 72
- ♦ [Section 9.3, “Resolving Instances of Duplicate Files,”](#) on page 76
- ♦ [Section 9.4, “Automatically Loading ShadowFS,”](#) on page 81

3.4 Installing DST on Nodes in a Novell Cluster Services for Linux Cluster

NCP Server and Dynamic Storage Technology software are not cluster aware. They must be installed on every OES 11 node in the cluster where you plan to migrate or fail over the cluster resource that contains shadow volumes. You do not cluster NCP Server or DST services.

- 1 For each node in the OES 11 cluster, install NCP Server and Dynamic Storage Technology along with Novell Cluster Services.

For information, see [Section 3.2, “Installing NCP Server and Dynamic Storage Technology,”](#) on page 29.

- 2 On each node in the OES 11 cluster, configure the DST global policies with the same settings. Global policies apply to all DST shadow volumes on the server.

For information, see [Chapter 9, “Configuring DST Global Policies,”](#) on page 71.

IMPORTANT: Whenever you modify global policies on a given node in the cluster, you must make those same changes on the other nodes.

- 3 Set up the shadow volume cluster resource on the first node in the cluster by using a method described in [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,”](#) on page 139.

- 4 Copy the NCP/NSS bindings information to all nodes in the cluster where you want to fail over the cluster resource.

For information, see [Section 13.8, “Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes,”](#) on page 163.

- 5 Set up shadow volume policies for the shadow volume as described in [Chapter 11, “Creating and Managing Policies for Shadow Volumes,”](#) on page 109.

If you set up policies by using the *All Volumes* option, you must copy the policy information to all nodes. For information, see [Section 13.1.6, “DST Shadow Volume Policies in a Cluster,”](#) on page 144.

4 Using DST in a Virtual Environment

Dynamic Storage Technology (DST) for Novell Open Enterprise Server (OES) 11 works similarly on a native hardware environment and on a virtual machine, with the following caveats:

- ♦ DST supports up to 16 shadow volumes and up to 16 ShadowFS volumes in a virtualized guest server environment.
- ♦ DST is not supported for use in the virtualization host server environment.

Limits for the number of devices assigned to a virtual machine:

- ♦ **Para-virtualized:** 16 devices
- ♦ **Fully virtualized:** 4 devices

To get started with virtualization, see “[Introduction to Xen Virtualization](http://www.suse.com/documentation/sles11/book_xen/data/cha_xen_basics.html)” (http://www.suse.com/documentation/sles11/book_xen/data/cha_xen_basics.html) in the *Virtualization with Xen* (http://www.suse.com/documentation/sles11/book_xen/data/book_xen.html) guide.

For information on setting up virtualized OES 11, see “[Installing, Upgrading, or Updating OES on a VM](#)” in the *OES 11: Installation Guide* guide.

5 Installing and Configuring ShadowFS for Novell Samba Users

The Shadow File System (ShadowFS) provides a merged file tree view of the data on a Novell Dynamic Storage Technology (DST) shadow volume for Novell Samba users. This section describes how ShadowFS works and how to configure it with Novell Samba.

IMPORTANT: Novell CIFS works directly with NCP Server to provide a merged view for CIFS users. It is not necessary to install or set up ShadowFS.

- [Section 5.1, “Understanding ShadowFS,” on page 35](#)
- [Section 5.2, “Prerequisites for Using ShadowFS,” on page 36](#)
- [Section 5.3, “Preparing Your System for Using ShadowFS,” on page 36](#)
- [Section 5.4, “Installing ShadowFS and FUSE,” on page 37](#)
- [Section 5.5, “Setting Rights to ShadowFS Shares,” on page 38](#)
- [Section 5.6, “Creating a Samba Share,” on page 39](#)
- [Section 5.7, “Adding a User to Samba,” on page 40](#)
- [Section 5.8, “Connecting Users to the Share,” on page 40](#)
- [Section 5.9, “Testing Shadow Volume Policies,” on page 41](#)
- [Section 5.10, “Enabling or Disabling ShadowFS,” on page 41](#)
- [Section 5.11, “Starting and Stopping ShadowFS Manually,” on page 42](#)
- [Section 5.12, “Configuring Trustee Rights for Novell Samba Users,” on page 43](#)

5.1 Understanding ShadowFS

Shadow File System (ShadowFS) provides a merged file tree view of the DST volume for Novell Samba users. It allows users to access data on both locations via a share on the primary storage area by using the CIFS protocol instead of the NetWare Core Protocol (NCP). It is necessary to load ShadowFS only if Novell Samba is implemented on the server and CIFS/Samba users are given access to shadow volumes.

IMPORTANT: Performance for the Novell Samba clients to access the data via ShadowFS is slower than for NCP clients and Novell CIFS clients. For information, see [Table 6-1, “Performance for File Access Protocols Used with DST Volumes,” on page 48](#).

The ShadowFS technology is implemented on the FUSE (File Systems in Userspace) virtual file system. FUSE is an open source software package that is delivered in OES 11, and is installed automatically when you install Dynamic Storage Technology.

When ShadowFS loads, it checks the `/etc/NCPVolumes` file to see what NCP shadow volumes exist, then it automatically creates a local mount point in `/media/shadowfs/volumename` that presents a merged file tree that includes both volumes. This local mount point allows Novell Samba and other local applications (including backup utilities) to see the same combined view that NCP clients see when they access a shadow volume. Each instance of ShadowFS runs as a separate process.

The ShadowFS configuration file is `/etc/opt/novell/shadowfs.conf`.

The ShadowFS log file is `/var/opt/novell/log/shadowfs.log`.

5.2 Prerequisites for Using ShadowFS

❑ Before using ShadowFS, ensure that the following services have been installed and configured:

- ♦ NCP Server and Dynamic Storage Technology
- ♦ Novell eDirectory
- ♦ Novell Samba
- ♦ Linux User Management
- ♦ FUSE
- ♦ Novell Remote Manager for Linux
- ♦ Novell iManager for Linux

For information about these services, see [Section 3.1, “Installation Requirements for Dynamic Storage Technology,” on page 25](#).

❑ There must be at least one functional shadow volume on the server that is mounted in NCP. For information, see [Section 10.2, “Creating a DST Shadow Volume with NSS Volumes,” on page 87](#).

5.3 Preparing Your System for Using ShadowFS

Configure Novell Samba to prepare your system for using ShadowFS. For detailed instructions for installing, configuring, or setting up Novell Samba, see the [OES 11: Novell Samba Administration Guide](#).

1 Verify that Novell Samba services are installed and functioning properly:

- ♦ Samba server is running.
- ♦ Shares can be created.
- ♦ Users can access Samba shares.

Use the Novell Samba plug-in for iManager to configure and verify Samba services. In iManager, go to the *File Protocols > Samba > General* page with the server selected.

2 Novell Samba users must be Linux-enabled through Linux User Management in order to access data.

IMPORTANT: You must Linux-enable users before adding a Samba Password policy assignment for the Samba server. If you attempt to add a user to a group, and the user is not already Linux-enabled, you cannot continue.

The users must be members of a primary group that is Linux-enabled on the target server or workstation object where both the Primary Group ID and Primary Group Name are assigned to the user. This is the primary group that is later assigned rights to the Samba share. Only primary groups can be assigned as the Directory group for the Samba share.

Adding users to Samba automatically Linux-enables them with Linux User Management (LUM), and it also Samba enables them. You can also Linux-enable users by using Linux User Management.

To verify Linux-enabled users, go to the *Modify User > Linux Profile > General* page with the server selected. Ensure that the values match the users' Group Assignment.

- 3 Ensure that users have a Samba Password policy assignment at the eDirectory user, group or container level.

- 4 Ensure that users have a Universal Password.

Users must have a Universal Password set in order for Samba to work properly.

- 5 Linux-enable the group with Linux User Management.

You must assign a Unix Workstation object for the group. To verify, use iManager to go to the *Modify Group > Linux Profile > General* page, confirm that the *Enable Linux Profile* option is enabled, and confirm that a *Unix Workstation* object is assigned and has a Group ID.

NOTE: For the purposes of testing, you can PAM-enable services on the server, so that test users can SSH into the server and validate access to directory paths to shares. For information about configuring SSH for a user, see [SSH Services on OES 11](#) in the [OES 11: Planning and Implementation Guide](#).

5.4 Installing ShadowFS and FUSE

ShadowFS and FUSE are installed automatically when you install Dynamic Storage Technology. The following instructions are provided if you need to install it manually.

- 1 Open YaST as the root user.
- 2 In YaST, select *Software Management*.
- 3 In *Software Management*, search for *shadow* to find the *novell-shadowFS* package.
- 4 Select *novell-shadowFS*, click *Install*, click *Accept* to install it, then when prompted, accept its dependencies (such as FUSE).
- 5 Load FUSE by entering the following at a terminal console as the root user:

```
cd /opt/novell/ncpserv/sbin
modprobe fuse
```

There is no command line feedback to indicate if the command is successful.

- 6 Start ShadowFS by entering the following at a terminal console as the root user:

```
/opt/novell/ncpserv/sbin ./shadowfs
```

IMPORTANT: Ensure that you run only a single instance of *shadowfs* at a time. Do not enter the command multiple times.

For example, if the primary storage location is an NSS volume named VOL1 and the secondary storage location is an NSS volume named ARCVOL, the output would look similar to this:

```
SHIFT_ON_MODIFY: 1
SHIFT_ON_ACCESS: 0
SHIFT_DAYS_SINCE_LAST_ACCESS: 1
  Primary Tree 0: /media/nss/VOL1
  Shadow Tree 0: /media/nss/ARCVOL
shadowfs root 0: /media/shadowfs/VOL1
```

Loading ShadowFS creates the ShadowFS root volume /media/shadowfs/VOL1 where it creates the ShadowFS volumes. If multiple NCP volumes have shadow volumes, each of them is shadowed with ShadowFS and is reported. You cannot control whether to shadow only one or some of them.

5.5 Setting Rights to ShadowFS Shares

Grant POSIX rights for users so they can access files on the ShadowFS volume via the CIFS/Samba protocol. Rights are granted based on need. You set rights so that users can read, write, and execute in the ShadowFS volume's root location in the /media/shadowfs directory. Do not set POSIX rights to the actual NCP shares for the primary and secondary volumes.

- 1 Open a terminal console, then log in as the `root` user.
- 2 Go to the ShadowFS volume root location of /media/shadowfs by entering the following at the terminal prompt:

```
cd /media/shadowfs
```

- 3 Set directory ownership for the group-level access to the ShadowFS volume root by entering the following:

```
chown :groupname shadowfs_volumename
```

For example, if the *groupname* is *marketing* and the *shadowfs_volumename* is *USERS*, enter

```
chown :marketing USERS
```

- 4 Set POSIX rights for the directory group by entering the following:

```
chmod mode shadowfs_volumename
```

For example, to grant POSIX read, write, and execute permissions for the user and group levels, and to set read and execute only for the others (world) level, set the *mode* to 775 by entering:

```
chmod 775 USERS
```

You are setting directory rights for /media/shadowfs/USERS as drwxrwxr-x.

- 5 Visually verify POSIX rights by entering

```
ll
```

Continuing the example, the results should look like this:

```
drwxrwxr-x  3 root marketing  80 May 16 15:48 USERS
```

- 6 Verify that the CIFS/Samba user can access the ShadowFS volume and can create directories.
 - 6a Decide which user identity you want to use to test the setup. For example, you could assign the admin user as a user of the CIFS/Samba group, or use iManager to create a temporary user identity for a test user in the group.
 - 6b Use iManager to ensure that the test user is Linux-enabled with Linux User Management, and grant the user SSH rights for accessing the server.
For information about configuring SSH for a user, see “SSH Services on OES 11” in the *OES 11: Planning and Implementation Guide*.
 - 6c Use iManager to set eDirectory permissions on the volume or path for the test user.
 - 6d Use Secure Shell (SSH) to log in to the volume as a user in the group.
For example, use `ssh` to connect to the server and log in:


```
ssh username@server.context.com
password:*****
```
 - 6e Go to the ShadowFS volume location by entering


```
cd /media/shadowfs/USERS
```

The user should be able to `cd` to and see the directory. If not, recheck the preceding steps to ensure that you followed the steps correctly.
 - 6f As the user, create a directory. For example, enter


```
mkdir username
```

If the directory `/media/shadowfs/USERS/username` is created, the rights are working as expected.

5.6 Creating a Samba Share

Create a Samba share that points to the newly created ShadowFS root, so that users can access it. Rights do not need to be set at the Primary and Shadow volumes themselves, unless they are not visible or accessible to the user or group assignment.

- 1 Log in to iManager as the administrator user.
- 2 In iManager, click *File Protocols > Samba > Shares*.
- 3 Select a server to manage.
- 4 On the *Shares* page, click *New*.
- 5 Specify the following information:
 - ♦ **Share name:** Specify a share name that does not conflict with existing shares that are defined in the `smb.conf` file. To continue earlier examples in this section, `USERS` has been used, so the Samba share name must differ. For example, `usertest`.
 - ♦ **Path:** Specify the context-sensitive path of the ShadowFS root location for the `USERS` volume, such as `/media/shadowfs/USERS`.
 - ♦ **Comment:** Specify a description of the share, such as “User file storage for Windows users.”
 - ♦ **Inherit ACLs:** Enable this option to allow POSIX inheritance of access control lists and rights.
- 6 Click *Finish* to create the Samba share.
If the share is created successfully, it is listed on the *Shares* page.

5.7 Adding a User to Samba

If Linux-enabled users who need access are not already added to Samba, add them to the Samba server.

- 1 Log in to iManager as the administrator user.
- 2 In iManager, click *File Protocols > Samba > Shares*.
- 3 Select a server to manage, then click the *Users* tab.
- 4 On the *Shares > Users* page, click *Add*, then locate and select the users you want to add to Samba.

If a user is added successfully, the user name is listed on the *Users* page. The user should be listed with the default Samba user group *hostname-W-SambaUserGroup* and with the primary Linux-enabled user group to which the user was added earlier.

Users are automatically added to *hostname-W-SambaUserGroup* when they are added as Samba users via the Samba Management plug-in for iManager. If a user is already a member of another Linux-enabled group, adding the user to Samba adds the Samba group as the user's primary group.

If the user's previous primary group gave the user specific access to PAM-enabled services, the user likely loses those access rights, because the default Samba group gives users no rights to any PAM-enabled services. If this occurs, you can remove the user from the default Samba user group and reassign the user back to his or her previous primary group. This is done by modifying the user's properties.

- 5 If you need to modify a user's properties, go to *User > Modify > Linux Profile*, and change the *Primary Group Name* back to the previous group name. This also changes the *Primary Group ID*.
- 6 If you encounter problems with Samba, you can start, stop, or restart the Samba server from the *File Protocols > Samba > Shares > General* page.

5.8 Connecting Users to the Share

At this point, the Samba share users should be able to attach to server from a Windows client or other CIFS/SMB client. The procedure in this section explains the steps for a Windows XP client. Use a similar method on other Windows operating systems.

- 1 On a Windows XP computer, open *My Network Places*.
- 2 Select *Add Network Place*, then click *Next*.
- 3 Select *Choose another network location*, then click *Next*.
- 4 Type the location as `\\servername\Samba_sharename` (such as `\\svr1\usertest`), then click *Next*.

Connecting to the server can take a few seconds to minutes, depending on network speed, discovery of server and share, and so on.

- 5 When prompted, enter your user name (DN only, not FDN) and password.
- 6 Specify the name of this network place, or use the default place name, then click *Next*.
- 7 Enable *Open this network place when I click Finish*, then click *Finish*.

If the connection is good, an Explorer window opens for the mapped location.

- 8 Ensure that the rights are working by creating a new folder (right-click, then select *New > Folder*).
If the user can create a folder, rights are working.

5.9 Testing Shadow Volume Policies

If you are not familiar with policies on shadow volumes, you should test them against a test data set to understand how to use them to your advantage.

Add files of several different types to the new share, then either create a DST policy to move the files, or do an inventory to search for specific file types, then move them to the shadow.

SSH in as the user, or root, and look at the primary, shadow, and Shadowfs root paths to see if things are where you expect them to be.

5.10 Enabling or Disabling ShadowFS

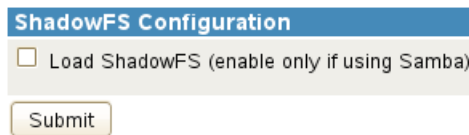
By default, ShadowFS and FUSE are not started unless you start them manually. You can set a global policy for *ShadowFS Configuration* that starts them automatically.

IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

- ♦ [Section 5.10.1, “Loading ShadowFS and FUSE,” on page 41](#)
- ♦ [Section 5.10.2, “Verifying ShadowFS Commands in the init.d Script,” on page 41](#)

5.10.1 Loading ShadowFS and FUSE

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options*.
- 2 In the *ShadowFS Configuration* area, view the current setting for *Load ShadowFS*.



ShadowFS Configuration

☐ Load ShadowFS (enable only if using Samba)

Submit

This command executes the `init.d` script, which puts the necessary commands in the boot sequence.

- 3 Enable or disable *Load ShadowFS* by selecting or deselecting the check box.
- 4 In the *ShadowFS Configuration* area, click *Submit* to save and apply the change.

5.10.2 Verifying ShadowFS Commands in the init.d Script

In *ShadowFS Configuration* on the Dynamic Storage Technology page, you can enable the *Load ShadowFS* check box to execute the `init.d` script. This puts the commands `shadowfs` and `fuse` startup commands in the boot sequence.

You can verify that the commands are available by viewing the script in a text editor. The following lines should be in the `init.d` script:

```
modprobe fuse
/opt/novell/ncpserv/sbin/shadowfs
```

5.11 Starting and Stopping ShadowFS Manually

FUSE (`fuse`) and ShadowFS (`shadowfs`) are required when Novell Samba users are accessing NSS volumes via CIFS/Samba. If FUSE or ShadowFS stop running, you must start them manually. Only one instance of `shadowfs` should be running at a time.

5.11.1 Starting FUSE and ShadowFS

Loading ShadowFS creates a ShadowFS root `/media/shadowfs/<volumename>` directory for each of the mounted DST shadow volumes. The *volumename* is the same as volume name of the primary volume. The ShadowFS root directory contains the merged file tree view of the primary and secondary locations in the DST volume. A root is created for all of the mounted DST volumes; you cannot control whether to shadow only one or some of them.

- 1 On the server, open a terminal console, then log in as the root user.
- 2 At the terminal console prompt, start FUSE by entering

```
cd /opt/novell/ncpserv/sbin
modprobe fuse
```

There is no command line feedback to indicate if the command is successful.

- 3 At the terminal console prompt, start ShadowFS by entering

```
/opt/novell/ncpserv/sbin ./shadowfs
```

The output identifies the primary volume, secondary volume, and the `shadowfs` volume.

For example, if the primary storage location is an NSS volume named `VOL1` and the secondary storage location is an NSS volume named `ARCVOL`, the output would look similar to this:

```
SHIFT_ON_MODIFY: 1
SHIFT_ON_ACCESS: 0
SHIFT_DAYS_SINCE_LAST_ACCESS: 1
Primary Tree 0: /media/nss/VOL1
Shadow Tree 0: /media/nss/ARCVOL
shadowfs root 0: /media/shadowfs/VOL1
```

5.11.2 Starting FUSE and ShadowFS with `novell-shadowfs`

- 1 On the server, open a terminal console, then log in as the root user.
- 2 At the terminal console prompt, start FUSE and ShadowFS by entering

```
/etc/init.d/novell-shadowfs start
```

5.11.3 Stopping Shadowfs

- 1 On the server, open a terminal console, then log in as the root user.
- 2 At the terminal console prompt, stop the `shadowfs` process by entering

```
/etc/init.d/novell-shadowfs stop
```

If the process does not stop, you need to kill the process. Enter

```
killall shadowfs
```

5.12 Configuring Trustee Rights for Novell Samba Users

When you use ShadowFS to provide a merged view to the Novell Samba users, file access is controlled by the Novell trustee model for user access. You must use NCP rights management tools to set trustees, just as you do for NCP clients. For example, you can use the Files and Folders plug-in to iManager 2.7x, the Novell Client, or the `ncpcon rights` command to set trustees, trustee rights, and inherited rights filters for files and folders.

6 Planning for DST Shadow Volumes and Policies

This section describes guidelines for using Dynamic Storage Technology (DST) on Novell Open Enterprise Server (OES) 2 for Linux servers.

For installation requirements, see [Section 3.1, “Installation Requirements for Dynamic Storage Technology,”](#) on page 25.

- ♦ [Section 6.1, “Planning to Create DST Shadow Volumes,”](#) on page 45
- ♦ [Section 6.2, “Providing a Merged View for Users,”](#) on page 47
- ♦ [Section 6.3, “Using DST Shadow Volumes,”](#) on page 51
- ♦ [Section 6.4, “Using NSS Volumes in DST Shadow Volumes,”](#) on page 52
- ♦ [Section 6.5, “Using NSS File System Trustees, Rights, and Attributes on DST Shadow Volumes,”](#) on page 56
- ♦ [Section 6.6, “Using NSS Encrypted Volumes in a DST Shadow Volume,”](#) on page 56
- ♦ [Section 6.7, “Using NSS Quotas on DST Shadow Volumes,”](#) on page 56
- ♦ [Section 6.8, “Using DST Shadow Volumes with Novell Cluster Services,”](#) on page 57
- ♦ [Section 6.9, “Using Novell Distributed File Services with DST Shadow Volumes,”](#) on page 58
- ♦ [Section 6.10, “Using Virus Checking Utilities with DST Shadow Volumes,”](#) on page 59
- ♦ [Section 6.11, “Using Backup Utilities with DST Shadow Volumes,”](#) on page 60

6.1 Planning to Create DST Shadow Volumes

- ♦ [Section 6.1.1, “Storage Devices,”](#) on page 45
- ♦ [Section 6.1.2, “iSCSI Block Storage Devices,”](#) on page 46
- ♦ [Section 6.1.3, “File Systems,”](#) on page 47

6.1.1 Storage Devices

Volumes in a shadow volume pair can reside on any device that is seen as local to the DST server, such as direct-attached storage and Fibre Channel SAN devices. For information about using iSCSI SAN devices, see [Section 6.1.2, “iSCSI Block Storage Devices,”](#) on page 46.

Block storage devices used for the primary and secondary storage can have different performance characteristics. Typically, the secondary storage area is slower and less expensive.

6.1.2 iSCSI Block Storage Devices

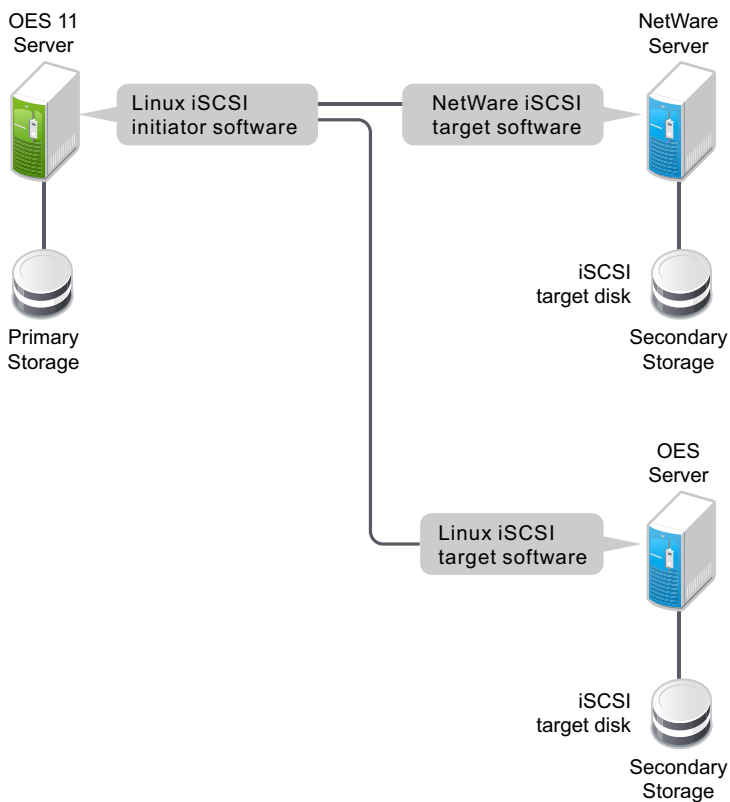
Dynamic Storage Technology supports using target iSCSI block storage devices to store the primary and secondary volumes in a shadow volume pair. Any iSCSI block storage device should work in a shadow volume pair, if it is compatible with the Linux iSCSI initiator software running on the OES 11 server where you create and manage the shadow volume pair. However, only iSCSI targets running on the following OES servers (or later versions) have been tested and are supported:

- ♦ OES 11
- ♦ OES 2 or later
- ♦ NetWare 6.5 SP7 or later
- ♦ OES 1 SP2

IMPORTANT: Third-party iSCSI solutions have not been tested, so they are not supported.

For example, [Figure 6-1](#) illustrates NetWare 6.5 and OES servers running the iSCSI target software and providing iSCSI target disks. The OES 11 server uses the Linux iSCSI initiator software to identify and access the iSCSI target disks.

Figure 6-1 NetWare and OES iSCSI Targets Mounted on an OES 11 Server



For information about setting up iSCSI target devices on OES 11 servers, see the following:

- ♦ “Setting Up an iSCSI Target” (http://www.suse.com/documentation/sles11/stor_admin/data/sec_inst_system_iscsi_target.html) in the *SLES 11 SP1 Storage Administration Guide* (http://www.suse.com/documentation/sles11/stor_admin/data/bookinfo.html)
- ♦ “Configuring iSCSI Targets” in the *NW 6.5 SP8: iSCSI 1.1.3 Administration Guide*

The iSCSI targets are connected by using the Linux iSCSI initiator software on the OES 11 server where you are creating DST shadow volumes. For information about configuring iSCSI initiators and discovering iSCSI target devices, see the following resources:

- ♦ “Configuring iSCSI Initiator” (http://www.suse.com/documentation/sles11/stor_admin/data/sec_inst_system_iscsi_initiator.html) in the *SLES 11 SP1 Storage Administration Guide* (http://www.suse.com/documentation/sles11/stor_admin/data/bookinfo.html)
- ♦ “Accessing iSCSI Targets on NetWare Servers from Linux Initiators” in the *NW 6.5 SP8: iSCSI 1.1.3 Administration Guide*

IMPORTANT: OES 11 does not support running iSCSI target software and initiator software on the same server.

6.1.3 File Systems

Dynamic Storage Technology supports using two Novell Storage Services (NSS) volumes in a shadow volume pair. For more information, see [Section 6.4, “Using NSS Volumes in DST Shadow Volumes,”](#) on page 52.

IMPORTANT: Mixing file systems for the primary and secondary areas in a given DST shadow volume pair is not supported.

6.2 Providing a Merged View for Users

Consider the guidelines in this section when planning how to provide access to the merged view of data in the DST shadow volume.

- ♦ [Section 6.2.1, “User Access and Authentication,”](#) on page 47
- ♦ [Section 6.2.2, “File Access Protocols,”](#) on page 48
- ♦ [Section 6.2.3, “ShadowFS and FUSE,”](#) on page 50

6.2.1 User Access and Authentication

All user file access is done via the merged view. Users connect to a share on the primary volume to see the merged view. Users should not be allowed to connect directly to the primary volume or secondary volume.

File system access rights are based on the Novell Trustee Model just as they are for a single NSS volume. You must connect to the share on the primary volume by using the Novell Client or similar NCP client tools, then set permissions while working in the merged view of the data. The permissions for data on both locations are saved on the primary volume. Dynamic Storage Technology uses those permissions to control access to data stored on the secondary volume.

All users (except the root user) of the shadow volume must have User objects defined in eDirectory. The root user of the OES 11 server is the only local user who has direct access to the volumes. For information about configuring eDirectory users, see the [Novell eDirectory 8.8 Administration Guide](#).

6.2.2 File Access Protocols

A merged user view of the file system is available for both NCP and CIFS users. The CIFS access can be set up by using Novell CIFS or using Novell Samba, but OES does not support using both of these CIFS user access solutions on the same server. In this guide, Novell Samba access is referred to as *CIFS/Samba*. NCP Server is required to be installed and running even if all users access data via Novell CIFS or Novell Samba.

This section describes the requirements and guidelines for file access protocols:

- ♦ “Performance for File Access Protocols” on page 48
- ♦ “Cross-Protocol File Locking” on page 48
- ♦ “NCP” on page 48
- ♦ “Novell CIFS” on page 49
- ♦ “Novell Samba with ShadowFS and FUSE” on page 50
- ♦ “Novell AFP (Not Supported)” on page 50
- ♦ “Other Linux Protocols (Not Supported)” on page 50

Performance for File Access Protocols

Using DST affects the file access performance, depending on the file access protocol being used, as shown in [Table 6-1](#).

Table 6-1 Performance for File Access Protocols Used with DST Volumes

User Access	Aggregate Performance
Novell Client users	Performance is reduced by less than 10%.
Novell CIFS users	Performance is reduced by about 25%.
CIFS/Samba users (requires Novell Samba, FUSE, ShadowFS, and Linux-enabling of users with Linux User Management)	Performance is reduced by up to 48%.

Cross-Protocol File Locking

When users access the files via multiple protocols, you should enable the NCP Server Cross-Protocol File Locks option to protect against data corruption. For information, see “[Configuring Cross-Protocol File Locks for NCP Server](#)” in the *OES 11: NCP Server for Linux Administration Guide*

NCP

The DST Shadow Volumes engine supports file access for NCP users. Users access data via an NCP share on the primary storage location, by using the Novell Client or other NCP clients. For information about configuring NCP Server for the OES 11 server, see the *OES 11: NCP Server for Linux Administration Guide*.

Novell Client: See the following resources for the latest release of the Novell Client, which provides NCP access for users on Linux and Windows clients:

- ♦ Novell Client for SLE 11 (http://www.novell.com/documentation/linux_client/index.html)

- ♦ [Novell Client 2.0 SP3 for Linux](http://www.novell.com/documentation/linux_client/index.html) (http://www.novell.com/documentation/linux_client/index.html)
- ♦ [Novell Client 1.0 SP1 for Windows Vista, Windows 7, and Windows Server 2008](http://www.novell.com/documentation/vista_client/index.html) (http://www.novell.com/documentation/vista_client/index.html)
- ♦ [Novell Client 4.91 SP5 for Windows XP/2003](http://www.novell.com/documentation/noclienu/index.html) (<http://www.novell.com/documentation/noclienu/index.html>)

Only NCP client versions that are configured to receive broadcast messages are eligible to receive the duplicate file conflict messages. For information, see [Section 9.3.3, “Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts,”](#) on page 80.

NetStorage: NetStorage for Linux has limited use for accessing files on shadow volumes. NetStorage presents a merged view of the data, and the user can see, read, and write files. However, certain management functions (such as getting file properties, setting trustees, and salvaging files) work only if the files are on the primary volume. The user will find that the commands work for some files but not others because they are not aware of where the file is physically stored. For information about using NetStorage, see [OES 11: NetStorage Administration Guide for Linux](#).

Novell CIFS

Novell CIFS supports using NSS volumes in a DST shadow volume configuration. It supports the following DST features:

- ♦ **Merged View:** Novell CIFS works with NCP Server to provide a merged view of the two NSS volumes. CIFS users can access data on both volumes via a Novell CIFS share on the primary NSS volume.
- ♦ **Duplicate Files:** CIFS can handle duplicate files, but it does not support the broadcast message notification via NCP. It shows the instance of the file on the primary volume to users. The administrator or user can rename the file so that the secondary instance of the file is again visible. The user can then determine which instance to delete.

If the global policy is set to hide duplicate files, CIFS moves the files on the secondary volume to the `/. _DUPLICATE_FILES` folder where the administrator can access them for recovery, if necessary.
- ♦ **Global DST Policies:** When users access or modify files, CIFS honors the global DST policies for moving files from the secondary volume to the primary volume.

Setting up Novell CIFS for use with a DST shadow volume is similar to setting up CIFS for an NSS volume. You create the CIFS share on the primary volume, but not on the secondary volume. Enable the cross-protocol file locking parameter for NCP Server on the DST server.

Novell CIFS features should work as expected, including cross-protocol file locking. The key difference is that users access the merged view of data in both volumes via the CIFS share on the primary NSS volume. The users do not know that the data is stored on two different volumes.

For information, see the following:

- ♦ [OES 11: Novell CIFS for Linux Administration Guide](#)
- ♦ [“Configuring Cross-Protocol File Locks for NCP Server”](#) in the [OES 11: NCP Server for Linux Administration Guide](#)

Consider the following requirements when configuring Novell CIFS for use with DST volumes:

- ♦ Novell CIFS supports only NSS volumes on Linux. Thus, Novell CIFS can be used only with DST volumes built on NSS volumes.

- CIFS users access a merged view of the DST shadow volume by using a Novell CIFS share on the primary volume. Create a CIFS share on the Primary volume only; delete the share on the secondary (or do not give users rights to access the secondary share).
- Novell CIFS users don't see broadcast messages if the Broadcast Messages for Duplicate Files Conflicts feature is enabled for Duplicate Files errors. This DST option works only for Novell Client users as described in [Section 9.3.3, “Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts,” on page 80](#). If you have only Novell CIFS users and no NCP users, you might as well disable the broadcasting option.
- If you use Novell CIFS with a DST volume in a cluster, you need to add the Novell CIFS lines in the load/unload scripts for the DST cluster resource. The differences are described in [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,” on page 139](#).
- You cannot configure Novell CIFS and the CIFS/Samba setup on the same server. This limitation is derived from the requirement that Novell Samba and Novell CIFS cannot be installed on the same server, and is unrelated to DST.

Novell Samba with ShadowFS and FUSE

Novell Samba is supported for providing CIFS/Samba user access to shadow volumes. This Samba version is the standard Linux Samba that has been integrated with eDirectory. For information, see the [OES 11: Novell Samba Administration Guide](#).

In order for CIFS/Samba users to see a merged view of the shadow volume, you must also set up ShadowFS (Shadow File System) and FUSE (File System in Userspace). See [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 35](#) for installation and configuration requirements.

CIFS/Samba users must be Linux-enabled users of the OES 11 server. The Linux Samba service must also be LUM enabled. For information, see the [OES 11: Novell Linux User Management Administration Guide](#).

Enable the cross-protocol file locking parameter for NCP Server. For information, see “[Configuring Cross-Protocol File Locks for NCP Server](#)” in the [OES 11: NCP Server for Linux Administration Guide](#).

Novell AFP (Not Supported)

Novell AFP (Apple Filing Protocol) does not support DST shadow volumes. AFP users are able to see only the data that is on the primary volume. Do not create AFP shares on the primary or secondary volumes that are used in a DST shadow volume.

Other Linux Protocols (Not Supported)

User access to shadow volumes via other native Linux protocols (such as HTTP, FTP, NFS, and others) is not supported.

6.2.3 ShadowFS and FUSE

The Shadow File System (ShadowFS) is used to provide a merged view of the shadow volume tree when you use Novell Samba for user file access. ShadowFS must be running in order for the CIFS/Samba users to access the data.

When ShadowFS is running, it automatically creates a shadow file system directory for each of the shadow volumes, not just the ones where you plan to allow CIFS/Samba access. CIFS/Samba users see only those volumes where they have file system trustee rights.

ShadowFS requires FUSE (File System in Userspace) to be installed and running. For information, see [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 35.](#)

6.3 Using DST Shadow Volumes

Consider the guidelines in this section when working with DST shadow volumes.

- ♦ [Section 6.3.1, “Number of Shadow Volumes per Server,” on page 51](#)
- ♦ [Section 6.3.2, “Data Volumes,” on page 51](#)
- ♦ [Section 6.3.3, “Files and Folders,” on page 51](#)
- ♦ [Section 6.3.4, “File System Trustees and Rights,” on page 52](#)
- ♦ [Section 6.3.5, “File System Management Utilities,” on page 52](#)

6.3.1 Number of Shadow Volumes per Server

DST supports the following number of DST shadow volume pairs per DST server:

- ♦ **Physical server:** 32
- ♦ **Virtual server:** 16

IMPORTANT: This constraint is imposed because of a known defect in FUSE (File System in Userspace).

6.3.2 Data Volumes

DST shadow volumes are intended for use with data volumes that contain unstructured data. Consider the following guidelines for choosing which volumes to use with DST:

- ♦ Do not put system files and application files on DST shadow volumes.
- ♦ Do not create a DST shadow volume for the `_ADMIN` volume.
- ♦ If the volume contains database files, rebuild situations might occur because of the additional latency related to the DST handling, or if the secondary storage area becomes unavailable for any reason.

Policies should exclude directories that contain databases such as those for Novell GroupWise and MySQL. You can alternatively create policies in such a way that they do not affect database files.

6.3.3 Files and Folders

- ♦ New files are automatically created on the primary volume.
- ♦ While a file is moved from one area to the other, the file is locked so that clients cannot access it during relocation.
- ♦ A policy cannot move a file between the areas if the file is open.

When DST enforces policies or moves files, the relocation request fails if a user has the file open; only files that are not in use can be moved.
- ♦ If you rename a folder through the merged view, the name is changed on the instance of the folder in the primary location and the secondary location.

- ♦ Always use the merged view when renaming or modifying files. Do not rename or modify files or directories by directly accessing them on the secondary location.

If you rename a folder by directly accessing the folder on the secondary location, the instance of the folder on the primary location is not renamed or deleted. Instead, an instance is created on the primary location for the newly renamed folder. The renamed folder contains the files that were stored in it when it was renamed. The files appear to have disappeared from the original instance of the folder.

6.3.4 File System Trustees and Rights

When the NCP protocol is used in conjunction with the NSS file system, all native NCP functionality (security, rights, trustees, salvage, directory quotas, and so on) is preserved in a DST environment. No functionality is lost, and no management patterns are changed.

When you use Novell CIFS or Novell Samba, all native CIFS functionality for security, rights, and so on is preserved in a DST environment. The conversion of CIFS ACLs (access control lists) to NSS ACLs based on the POSIX definitions is based on code resident in Samba and is not supported for modification by Novell.

IMPORTANT: The CIFS support of ACLs is offered as-is, and is not modified to take advantage of the expanded management features of NSS file systems.

6.3.5 File System Management Utilities

You can continue using existing file management utilities that currently execute successfully against the designated file systems. DST is transparent to this operation. All file management operations currently available to NSS users through Novell iManager 2.7, NSSMU, and Novell Remote Manager for Linux function transparently for shadow volumes. File operations and the location of the file are transparent to the NCP and CIFS clients.

6.4 Using NSS Volumes in DST Shadow Volumes

Dynamic Storage Technology supports shadow volumes created with Novell Storage Services volumes. Consider the guidelines and caveats in this section when planning your shadow volume solution.

- ♦ [Section 6.4.1, “DST Support for NSS Volume Attributes,” on page 53](#)
- ♦ [Section 6.4.2, “DST Support for NSS Features and Actions,” on page 54](#)

6.4.1 DST Support for NSS Volume Attributes

Ensure that you enable the same NSS volume attributes on both volumes in the shadow relationship to ensure a consistent user experience. For example, if Salvage is enabled for the primary volume but not for the secondary volume, files that are deleted when they reside on the secondary volume are purged immediately, and are not available for salvage.

[Table 6-2](#) describes which NSS volume attributes are supported for use with Dynamic Storage Technology, and any caveats to consider when using them. For information about the volume attributes, see “[Volume Attributes](#)” in the *OES 11: NSS File System Administration Guide for Linux*.

Table 6-2 *DST Support for NSS Volume Attributes*

NSS Volume Attribute	Supported	Caveats
Allow mount point to be renamed	No	DST does not track the renaming of NSS volumes or their mount points. Before you rename or modify the mount point for an NSS volume, you must remove the shadow volume definition. Afterwards, you can re-create the shadow volume.
Backup	Yes	The Linux file system sees both volumes, so you back up each volume separately.
Compression	Yes	You can set compression on one or both volumes. Compressed files are uncompressed when they are moved from the primary volume to secondary volume, and vice versa. In order for the move to occur, there must be sufficient space on the source volume to allow both the uncompressed and compressed copies of the file to coexist until the move is completed. There must also be sufficient space on the destination volume for the uncompressed file to be stored. The file is re-compressed according to the compression schedule and settings in the destination volume.
Data Shredding	Yes	For security compliance reasons, you should set this attribute on both volumes if you use it.
Directory Quotas	Yes	Set a directory quota for a directory only on the primary volume. For more information, see Section 6.7 , “Using NSS Quotas on DST Shadow Volumes,” on page 56.
File-level Snapshot	Yes	No known issues.
Flush Files Immediately	Yes	No known issues.
Lookup Namespace	Yes	The default Lookup Namespace for NSS on Linux is Long, which treats file names as case insensitive. In prior versions, the default name space is UNIX. Using the Long name space helps improve performance because NetWare and Windows treat file names as case insensitive. This is especially important when files are accessed through the CIFS/Samba protocol.
Migration (to near-line HSM storage)	No	DST should not be used in combination with HSM storage solutions.

NSS Volume Attribute	Supported	Caveats
Modified File List (Use Event File List APIs instead.)	No	<p>By default, modified files are moved back to the primary location. If you disable the Shift Modified Files parameter, modified files might also be located on the secondary location.</p> <p>Modified File List is rarely used. It has been replaced by the Event File List APIs that provide more information than the Modified File List. For information, see “Using the Event File List to Refine the Backup” in the <i>OES 11: NSS File System Administration Guide for Linux</i>.</p>
Salvage	Yes	<p>Deleted files on a NSS volume that are salvageable remain salvageable after that volume is used in a shadow volume pair.</p> <p>Duplicate deleted folders might be presented when using Salvage (undelete) and Purge options for folders. You must restore the folders in order to see which one contains the deleted files (on the primary volume), and which is empty (on the secondary volume).</p> <p>NetStorage does not see the deleted files that are available for salvage on the secondary volume.</p>
User Space Quotas	Yes	<p>Set up the user space quotas separately on each of the volumes. For more information, see Section 6.7, “Using NSS Quotas on DST Shadow Volumes,” on page 56.</p>
User-level Transaction Model	No	<p>NSS does not support the NetWare Transaction Tracking System for NSS volumes on Linux.</p>

6.4.2 DST Support for NSS Features and Actions

[Table 6-3](#) describes caveats for using the NSS volume features and actions when working with DST shadow volumes.

Table 6-3 *Caveats for NSS Features and Actions*

NSS Feature	Supported	Caveats
Novell Archive and Version Services	Yes	File versions can be archived only for files located on the primary volume of the DST shadow volume. You cannot set up archive jobs for the secondary volume.
Novell Distributed File Services	Yes	Some limitations apply. For information, see Section 6.9, “Using Novell Distributed File Services with DST Shadow Volumes,” on page 58.
Encryption	Yes	Using encrypted NSS volumes is supported for DST shadow volume pairs. For information, see Section 6.6, “Using NSS Encrypted Volumes in a DST Shadow Volume,” on page 56.
Hard links	No	DST does not support hard links on NSS volumes used in a shadow volume. if a file is a hard link, and the hard-linked file is moved between the primary and the secondary area, the move is really a copy and has the effect of breaking the hard link and creating an additional version of the file that is not linked to the other ones.
Media format for enhanced hard links	Yes	The media format that supports enhanced hard links is supported, but the hard links themselves are not.
Multiple Server Activation Prevention	Yes	Each pool enforces this separately.
Pool low-space warnings and watermarks	Yes	You must set the pool-level watermarks for low-space warnings separately for the primary pool and the secondary pool. IMPORTANT: NSS does not have a volume-level low-space-warning feature. However, you can take advantage of the NCP Server global parameters for managing low-space warnings for NCP volumes on NSS, Ext3, and Reiser file systems. For information, see “ NCP Volumes Low-Space Warning ” in the OES 11: NCP Server for Linux Administration Guide .
Pool snapshots	Yes	Take pool snapshots separately for the primary and secondary pools. IMPORTANT: For NSS on Linux, pool snapshots are not supported for clustered pools. If the primary volume is configured to contain the most frequently used data, pool snapshots of the primary pool have a higher percentage of changed data than does the secondary pool.
Renaming a volume's mount point	No	Renaming a volume's mount point breaks the shadow volume. If you need to rename a volume's mount point, remove the shadow, rename the volume's mount point, then create the shadow volume again.
Renaming a volume	No	Renaming a volume breaks the shadow volume. If you need to rename a volume, remove the shadow, rename the volume, then create the shadow volume again.
Resizing (growing) a pool	Yes	No known issues.

NSS Feature	Supported	Caveats
Sharing a pool and its volumes in a cluster	Yes	When using NSS volumes in shared pools, you must manage both pools' resources in the primary pool resource load and unload scripts. For information, see Section 6.8, "Using DST Shadow Volumes with Novell Cluster Services," on page 57.
Volume quotas	Yes	Set the volume quotas separately for each volume. For more information, see Section 6.7, "Using NSS Quotas on DST Shadow Volumes," on page 56.

6.5 Using NSS File System Trustees, Rights, and Attributes on DST Shadow Volumes

Authentication and file access is controlled by the file system trustees and rights that you set from the merged view. Users do not have direct access to the secondary volume.

Explicit trustee settings for files and folders are stored in both volumes.

Inherited trustee rights are calculated and enforced based on the trustee settings for the folders on the primary volume. The primary folder tree contains instances of the folders on the secondary volume in order to support this function.

File system attributes are enforced by the NSS file system. For NSS on Linux, the Read Only, Read/Write, Execute, and Hidden attributes are available.

6.6 Using NSS Encrypted Volumes in a DST Shadow Volume

If encrypted NSS volumes are used, both the primary and secondary volumes should be encrypted in order to provide the same level of security on both volumes.

The first time the volumes are mounted after a server reboot, the encrypted volumes must be mounted manually by using NSSMU in order to provide the encryption passwords. Mount the secondary volume first so that it is available to DST when you mount the primary volume.

6.7 Using NSS Quotas on DST Shadow Volumes

DST supports using volume, directory, and user quotas features of NSS volumes. However, DST does not have a unified quota system for the two volumes that manages quotas for the combined primary and secondary volumes in a shadow volume pair.

- ♦ [Section 6.7.1, "NSS Volume Quotas,"](#) on page 57
- ♦ [Section 6.7.2, "NSS Directory Quotas,"](#) on page 57
- ♦ [Section 6.7.3, "NSS User Quotas,"](#) on page 57

6.7.1 NSS Volume Quotas

Volume quotas specify how big a volume can grow within a NSS pool. You can set a volume quota on the primary volume, secondary volume, or both volumes in the shadow volume pair. Each quota is enforced independently of the other.

Users of the shadow volume pair can map drives only to the primary volume. They are not aware of the existence of the secondary volume. Users see only the volume quota status for the primary volume. The volume quota information is not presented with a total space usage across both volumes. Users can actually store up to the quota amount set on each of the volumes, where each limit is enforced separately.

When the user has data stored on both the primary and secondary volume, the user sees the amount of space used only on the primary volume, which does not accurately reflect the total of space used on the two volumes.

The administrator can check the combined space available on the shadow volume pair and on each volume separately by using Novell Remote Manager for Linux.

6.7.2 NSS Directory Quotas

Directory quotas are set on specific directories and specify how much data can reside in that specific directory. You can set a directory quota only on the primary volume. When a secondary volume is in a shadow volume pair, the directory quotas set on it are not enforced. The directory quota is enforced only for the space consumed on the primary volume.

The users can store up to the directory quota amount for the directory on the primary volume, and an unlimited amount up to the maximum volume size on the secondary volume.

Users see only the directory quota status for the primary volume. The directory quota information is not presented with a total for the directory across both volumes.

6.7.3 NSS User Quotas

User quotas are set on specific users and specify how much data a user can store on a specific volume. You can set a user quota for a user on the primary volume, secondary volume, or both volumes in the shadow volume pair. Quotas on each volume are enforced independently of the other.

Users see only the user quota status for the primary volume. The user quota information is not presented with a total space usage across both volumes. Users can actually store up to the user quota amount set on each of the volumes, where each limit is enforced separately.

6.8 Using DST Shadow Volumes with Novell Cluster Services

DST supports using DST shadow volumes with Novell Cluster Services for Linux for clusters of up to 16 nodes. Clustering is supported for NSS volumes on shared Fibre Channel and iSCSI devices. Users can access files via NCP and via either Novell CIFS or CIFS/Samba.

The following caveats apply:

- ♦ All nodes where you plan to fail over the shadow volume must be running OES 11 and be configured for DST. The nodes must have the same configuration of file systems, access protocols, and so on.
- ♦ DST and the NCP Server services are not cluster aware. They must be installed and configured separately on each node in the cluster.

- ♦ Global policies for DST must have the same settings on each node in the server. To manage a global DST policy for a given node, open Novell Remote Manager for Linux by using the IP address of the node, not the cluster resource. For information about configuring DST global policies, the [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#).
- ♦ To manage shadow volume policies in a cluster, open Novell Remote Manager for Linux by using the IP address of the cluster resource. You can also open Novell Remote Manager by using the IP address of the physical node where the cluster resource is currently mounted if you know which node it is on.
- ♦ The individual shadow volume’s policies fail over along with the shadow volume.
- ♦ The primary volume and the secondary volume are managed in the primary cluster resource load and unload scripts. This allows the configuration to be failed over or cluster migrated to a different node as a single resource.

For planning information about installing and configuring shadow volumes in a cluster, see. [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,” on page 139](#)

6.9 Using Novell Distributed File Services with DST Shadow Volumes

Novell Distributed File Services (DFS) is installed automatically as part of the NSS file system. Dynamic Storage Technology supports using DFS junctions on the primary NSS volume in a shadow volume pair. The primary volume can also be the target of a junction. Primary NSS volumes that contain DFS junctions or are junction targets can reside in an Novell Cluster Services cluster.

DST does not support using DFS junctions on the secondary volume. The secondary volume cannot be the target of a junction.

Junctions that are created on a primary NSS volume behave normally as they would for a single NSS volume. The policy enforcer is designed to prevent junctions from being moved between the primary and secondary volumes when policies are run.

[Table 6-4](#) summarizes the supported DST configurations for use with DFS:

Table 6-4 *DST Support for Novell DFS Features*

Novell DFS Features	Primary NSS Volume	Secondary NSS Volume	Cluster	File Access Protocol
Junctions	Yes	No	Yes	NCP Novell CIFS. DFS support must be enabled in CIFS. See “DFS Junction Support in CIFS Linux” in the <i>OES 11: Novell CIFS for Linux Administration Guide</i> . Linux Samba does not support DFS junctions for NSS volumes.
Junction targets	Yes	No	Yes	Not applicable
Move/split volumes	No	No	No	Not applicable

When you use DST shadow volumes in combination with Novell DFS junctions, consider the following caveats:

- ♦ Junctions are broken when they reside on secondary NSS volumes. If you use an existing NSS volume as a secondary volume, delete junctions on it before you create the shadow volume pair. Make a note of the paths of the junctions and their targets. After the shadow volume pair is working, you can re-create the junctions in the same path on the primary volume.
- ♦ If you use an existing NSS volume as a secondary volume, any junctions pointing to it are broken when you create the shadow volume pair. You must create a new junction that points to the same location on the primary volume of that shadow relationship. After the new junction is working, delete the junction that points to the secondary volume.
- ♦ Do not create a shadow relationship for an NSS volume if a DFS move volume or split volume job is in progress.
- ♦ You must remove the shadow volume before you start a DFS move or split volume job.

6.10 Using Virus Checking Utilities with DST Shadow Volumes

You can continue use of existing virus checking utilities that currently execute successfully against the designated file systems on the primary volume. DST is transparent to this operation. Because the only access to the secondary volume is through the primary volume, there is no need for a virus checking operation directly on the secondary volume unless the shadow volume is removed, allowing the volume to act independently again.

6.11 Using Backup Utilities with DST Shadow Volumes

Applications that directly access the local Linux file system see the primary file tree and the secondary file tree as independent directories. Thus, backup tools can apply one backup policy to the primary file tree and a different backup policy to the secondary file tree. The only operations that take place on the secondary volume are backup, or remove and archive.

Using shadow volumes allows backups of important data to be made faster and more frequently because you can apply different backup policies for the primary volume and secondary volume. For example, the server administrator can partition the volume's data into two categories:

- ♦ Important data that needs to be maintained on quality storage and backed up frequently.
- ♦ Less important data that can be stored on less expensive storage and backed up less frequently.

An analysis or inventory of a volume's data shows that a large portion of it is seldom used. Having a shadow volume allows the server administrator to spend more on the most important data and spend less on the less important data. The frequently used data can be backed up nightly. The seldom-used data can be backed up weekly or monthly. Getting the less important data out of the way enables the backups of your important data to run more quickly and efficiently. Partitioning your data in this way can significantly reduce the cost of hosting it.

Because the most important files are located in the primary storage area, disaster recovery can also be faster. The server administrator can restore the critical files by restoring the primary storage area first, then restore the secondary storage area. This lets the users quickly get the files they need most, and they do not need to wait while files they do not usually need are restored. In addition, more fault tolerant replication solutions can be deployed for the primary storage area where it matters most.

7 Management Tools for DST

This section provides an overview of the management tools for Dynamic Storage Technology (DST) in Novell Open Enterprise Server (OES) 11

- ♦ [Section 7.1, “Dynamic Storage Technology Plug-In for Novell Remote Manager for Linux,” on page 61](#)
- ♦ [Section 7.2, “NCP Console \(NCPCON\) Commands,” on page 66](#)
- ♦ [Section 7.3, “Management Tools for NSS Volumes,” on page 66](#)
- ♦ [Section 7.4, “Management Tools for Clustering,” on page 67](#)

7.1 Dynamic Storage Technology Plug-In for Novell Remote Manager for Linux

The Dynamic Storage Technology Options plug-in to Novell Remote Manager for Linux allows you to create, manage, and remove shadow volumes built with Novell Storage Services volumes. The plug-in is automatically installed in Novell Remote Manager when you install NCP Server and Dynamic Storage Technology on your OES 11 server.

- ♦ [Section 7.1.1, “Accessing Novell Remote Manager,” on page 61](#)
- ♦ [Section 7.1.2, “Starting, Stopping, or Restarting Novell Remote Manager on Linux,” on page 62](#)
- ♦ [Section 7.1.3, “Quick Reference for Dynamic Storage Technology Options,” on page 63](#)
- ♦ [Section 7.1.4, “Quick Reference for NCP Server Options,” on page 65](#)
- ♦ [Section 7.1.5, “Quick Reference for DST Global Policy Settings,” on page 65](#)
- ♦ [Section 7.1.6, “Shadow Volume Inventory and Trustee Reports,” on page 66](#)

7.1.1 Accessing Novell Remote Manager

- 1 In a Web browser, go to the URL of the server that you want to manage.

For example, enter the following in the address (URL) field:

`http://server_IP_address:8008` or `other_configured_port_number`

For example:

`http://192.168.123.11:8008`

`https://192.168.123.11:8009`

- 2 Log in to Novell Remote Manager as the `root` user of the server or as the Novell eDirectory administrator user who has sufficient rights to manage the server and its file systems.

The `root` user logs in as a local user of the server, not through eDirectory. If eDirectory, Linux User Management, or PAM are not working, the `root` user can still log in to NRM to manage the server. The `root` user can always log in directly to the server to manage it.

NRM is PAM-enabled, so any Linux-enabled user can log in. Depending on the user's trustee rights for the server, the user gets access only to the tasks the user has rights to perform.

7.1.2 Starting, Stopping, or Restarting Novell Remote Manager on Linux

Novell Remote Manager on Linux is installed and runs by default. If it hangs, you can use the `/etc/init.d/novell-httpstkd` script to get status or to stop, start, or restart `httpstkd`. For the latest information about `httpstkd`, see [“Starting or Stopping HTTPSTKD”](#) in the *OES 11: Novell Remote Manager Administration Guide*.

- 1 Open a terminal console, then log in as the `root` user.
- 2 At the terminal console prompt, enter the command for the task you need to perform:

Task	Command
Status	<code>rcnovell-httpstkd status</code>
Start	<code>rcnovell-httpstkd start</code>
Stop	<code>rcnovell-httpstkd stop</code>
Restart	<code>rcnovell-httpstkd restart</code>

7.1.3 Quick Reference for Dynamic Storage Technology Options

The Dynamic Storage Technology Options plug-in (shown in [Figure 7-1](#)) in Novell Remote Manager for Linux is the primary tool for configuring global policies for all DST shadow volumes, creating and managing DST shadow volumes, and configuring shadow volume policies.

Figure 7-1 *View File System > Dynamic Storage Technology Options*

Dynamic Storage Technology Options

Dynamic Storage Technology allows you optimize the use of your storage by automatically moving data to storage best optimized for the data type or frequency of use. You can create one or more policies to manage, and optimize the use of your storage.

Volume Information

Volume Name	Shadow Status
SYS	Add Shadow Inventory

No Dynamic Storage Technology policies defined.

Create a new policy

Stop all running policies

Duplicate File Resolution Options

Broadcast conflict message to user: ☒

Action to be taken:

Show duplicate shadow files

Submit

ShadowFS Configuration

☐ Load ShadowFS (enable only if using Samba)

Submit

[Table 7-1](#) describes the management tasks available for the *View File Systems > Dynamic Storage Technology Options* task in Novell Remote Manager for Linux.

Table 7-1 *View File Systems > Dynamic Storage Technology Options*

Subtasks	Management Tasks
Volume Information	<p>View a list of NCP volumes and NSS volumes on the server.</p> <p>Click the <i>Add Shadow</i> link next to an NSS volume to view information about where you can create a shadow volume.</p> <p>IMPORTANT: NCP volumes on Linux POSIX file systems are not supported as shadow volumes. This capability is planned for a future release.</p> <p>Click the <i>Inventory</i> link next to a shadow volume to view an inventory report for both the primary and secondary volumes.</p> <p>Click the <i>View Log</i> link next to an NSS volume to download a copy of the audit log for the selected volume.</p>
Add Shadow link	<p>This option takes you to the Share Information page. Scroll down to the <i>Volume Tasks</i> area to find the <i>Add Shadow Volume</i> task.</p> <p>The Share Information page and Add Shadow Volume page do not distinguish or validate whether the volumes you choose are actually supported file systems and available combinations.</p> <p>IMPORTANT: NSS volumes must already exist when you create the shadow volume. The <i>Create if not present</i> option is available for future support of NCP volumes on Linux file systems. Do not use this option for NSS volumes.</p>
Inventory link	<p>View statistics and graphical trend displays for the volume's files and directories. For a DST shadow volume, the report includes information for both the primary storage area (primary area) and the secondary storage area (shadow area).</p>
Volume Information (Info icon)	<p>NCP share information, such as the Linux file system path for the volume, file system type, NCP volume ID, status, capacity, and cache statistics.</p> <p>Open files listed for each NCP connection.</p> <p>Add a shadow volume for the NCP volume.</p> <p>For unmounted DST shadow volumes, click the <i>Info</i> icon to access the dialog box to remove the shadow volume relationship. This removes the entry in the <code>ncpserv.conf</code> file, but does not delete the volume itself.</p> <p>To unmount a shadow volume, click <i>Manage NCP Services > Manage Shares</i>, then click the <i>Unmount</i> option next to the shadow volume.</p>
Dynamic Storage Technology Policies	<p>Create a new policy.</p> <p>View a list of existing policies.</p> <p>Click the <i>Policy Name</i> link to modify or delete the policy.</p>
Duplicate File Resolution Options	<p>Set a global policy for how to handle duplicate files.</p>
ShadowFS Configuration	<p>Set a global policy for whether to automatically start FUSE and Shadow File System, which are needed to provide access to users via Samba.</p> <p>IMPORTANT: Do not enable ShadowFS if you are using Novell CIFS.</p>

7.1.4 Quick Reference for NCP Server Options

Table 7-2 describes the DST tasks available for the *Manage NCP Services > Manage Shares* task in Novell Remote Manager for Linux. For a complete list of NCP Server management tasks, see “[Quick Reference for the NCP Server Plug-In for Novell Remote Manager for Linux](#)” in the *OES 11: NCP Server for Linux Administration Guide*.

Table 7-2 *Manage NCP Services > Manage Shares*

Subtasks	Management Tasks
NCP/NSS Bindings	In the <i>Configuration</i> area, click <i>NCP/NSS Bindings</i> to view a list of NSS volumes on the server. Set the <i>NCP Available</i> setting to No for NSS volumes that you want to use as secondary storage locations for DST shadow volumes.
Mount/Unmount	Mount or unmount the primary volume for a shadow volume. The primary volume must be unmounted in order to access the Remove Shadow Volumes task.
Info > Remove Shadow Volume	For unmounted DST shadow volumes, click the <i>Info</i> icon to access the dialog box to remove the shadow volume relationship. This removes the entry in the <code>ncpserve.conf</code> file, but does not delete the two volumes and their data.

7.1.5 Quick Reference for DST Global Policy Settings

Table 7-3 describes the DST parameters available for the *Manage NCP Services > Manage Server* task in Novell Remote Manager for Linux. For descriptions of the parameters, see [Section A.4.1, “Understanding DST Parameters for the SET Command,”](#) on page 183.

Table 7-3 *Manage NCP Services > Manage Server > Server Parameter Information*

Parameter Name	Default Value	Valid Values
SHIFT_MODIFIED_SHADOW_FILES	1	0 - Disable 1 - Allow
SHIFT_ACCESSED_SHADOW_FILES	0	0 - Disable 1 - Allow
SHIFT_DAYS_SINCE_LAST_ACCESS	1	0 - Disable 1 to 365 (in days)
DUPLICATE_SHADOW_FILE_ACTION	0	0 - Show duplicate shadow files (default) 1 - Hide duplicate shadow files 2 - Rename duplicate shadow files 3 - Delete duplicate files from shadow area 4 - Move duplicate shadow files to / ._DUPLICATE_FILES

Parameter Name	Default Value	Valid Values
DUPLICATE_SHADOW_FILE_BROADCAST	1	0 - Disable 1 - Allow
REPLICATE_PRIMARY_TREE_TO_SHADOW	0	0 - Disable 1 - Allow

7.1.6 Shadow Volume Inventory and Trustee Reports

In Novell Remote Manager, the Volume Inventory feature detects shadow volumes and displays information from the primary and secondary volumes. The complete inventory profile displays three categories of information: combined areas, primary area, and shadow area. With Novell Remote Manager's shadow volume inventory, you can also select files that meet specific criteria (such as files that have not been accessed for two years, files that have not been modified in a year, all .mp3 files, and so on). Use the inventory information to profile each area's files and move them as needed.

For general information about the volume inventory feature, see [“Inventorying Directories or NCP Volumes”](#) *OES 11: Novell Remote Manager Administration Guide*.

Novell Remote Manager also allows you to generate a trustee report for the shadow volume. For information, see [“Generating and Viewing NCP Trustee Reports for NSS Volumes”](#) *OES 11: Novell Remote Manager Administration Guide*.

7.2 NCP Console (NCPCON) Commands

You can optionally use the NCP Console (NCPCON, `ncpcon(8)` command) to manage Dynamic Storage Technology pairs from a terminal console. For information, see [Section A.1, “Using NCPCON for DST Commands,”](#) on page 175.

7.3 Management Tools for NSS Volumes

- [Section 7.3.1, “Storage Plug-In for Novell iManager 2.7x,”](#) on page 66
- [Section 7.3.2, “Files and Folders Plug-In for Novell iManager 2.7x,”](#) on page 67
- [Section 7.3.3, “NSS Management Utility \(NSSMU\),”](#) on page 67

7.3.1 Storage Plug-In for Novell iManager 2.7x

Use the Storage plug-in for iManager to create and manage Novell Storage Services (NSS) volumes that you use as DST shadow volumes. For information, see [“Novell iManager and Storage-Related Plug-Ins”](#) in the *OES 11: NSS File System Administration Guide for Linux*.

7.3.2 Files and Folders Plug-In for Novell iManager 2.7x

Use the Files and Folders plug-in for iManager to manage file system trustees, trustee rights, and inherited rights filters for files and directories on NSS volumes that you use as DST shadow volumes. You can also set file ownership, directory quotas, and file system attributes. For information, see [“Files and Folders Plug-In Quick Reference”](#) in the *OES 11: NSS File System Administration Guide for Linux*.

7.3.3 NSS Management Utility (NSSMU)

You can also use the NSS Management Utility (NSSMU, `nssmu(8)` command) to create and manage NSS volumes that you use in DST shadow volumes. For information, see [“NSS Management Utility \(NSSMU\) Quick Reference”](#) in the *OES 11: NSS File System Administration Guide for Linux*.

7.4 Management Tools for Clustering

Use the Clustering plug-in for Novell iManager 2.7 to create and manage the cluster resources, load scripts, and unload scripts for clustered NSS pools that contain the NSS volumes you use as DST shadow volumes. For information, see [“Creating Cluster Resources”](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

8 Managing Services for DST

The health of Dynamic Storage Technology depends on other services that are running on the Novell Open Enterprise Server (OES) 11 server. This section identifies those dependencies and provides instructions for how to get them started again if they are not running.

- [Section 8.1, “Restarting the Novell NCP/NSS IPC \(ncp2nss\) Daemon,” on page 69](#)
- [Section 8.2, “Restarting the Novell eDirectory \(ndsd\) Daemon,” on page 69](#)
- [Section 8.3, “Starting and Stopping ShadowFS,” on page 70](#)

8.1 Restarting the Novell NCP/NSS IPC (ncp2nss) Daemon

If NSS is installed, NCP Server runs the Novell NCP/NSS IPC (`/etc/init.d/ncp2nss`) daemon in order to synchronize its settings with NSS. When you modify NCP Server settings by using Novell Remote Manager for Linux, NCP Server automatically restarts `ncp2nss` so that the new settings are immediately synchronized with NSS. If you modify values for any of the DST global parameters for NCP Server by directly editing the `/etc/opt/novell/ncpserv.conf` file, you must manually restart `ncp2nss`.

- 1 On the OES 11 server, open a terminal console, then log in as the root user.
- 2 At the terminal console prompt, enter
- 3 If `ncp2nss` restarts successfully, the following messages are displayed in the terminal console:

```
Shutting down Novell NCP/NSS IPC daemon...
Exited
Starting the Novell NCP/NSS IPC daemon.
```

8.2 Restarting the Novell eDirectory (ndsd) Daemon

When you modify NCP Server settings by using Novell Remote Manager for Linux, NCP Server automatically restarts the Novell eDirectory daemon to apply the new settings. If you modify values for any of the DST global parameters for NCP Server by directly editing the `/etc/opt/novell/ncpserv.conf` file, you must restart the Novell eDirectory daemon to put the changes into effect.

Use the following steps to stop and start `ndsd` when a single instance is running. For information about stopping and starting `ndsd` when you are running multiple instances of it on the same server, see “[Managing Multiple Instances](#)” in the *Novell eDirectory 8.8 What’s New* (<http://www.novell.com/documentation/edir88/edir88new/data/front.html>).

IMPORTANT: Restarting or stopping ndsd automatically disconnects all user connections and does not warn users before the connection is broken. Users can reconnect to the server after the service starts.

- 1 Use one of the following commands to stop ndsd:

```
rcnsd stop  
/etc/init.d/nsd stop
```

- 2 Use one of the following commands to start ndsd:

```
rcnsd start  
/etc/init.d/nsd start
```

8.3 Starting and Stopping ShadowFS

ShadowFS must be running in order to provide a merged view to CIFS/Samba users if you are using Novell Samba to provide file access to a DST shadow volume.

To configure a global policy to start ShadowFS at boot time, see [Section 9.4, “Automatically Loading ShadowFS,” on page 81](#).

Only one instance of ShadowFS should be loaded at a time. Before you attempt to manually start ShadowFS, ensure that you have stopped any running instances of it.

- 1 Log in as the root user, then open a terminal console.
- 2 Do one of the following:
 - ♦ **Start:** Enter the following at a command prompt to start ShadowFS:

```
/etc/init.d/novell-shadowfs start
```

- ♦ **Stop:** Enter the following at a command prompt to stop ShadowFS:

```
/etc/init.d/novell-shadowfs stop
```

9 Configuring DST Global Policies

This section describes how to configure global policies for Dynamic Storage Technology (DST) on a Novell Open Enterprise Server (OES) 11 server. Global policies apply to all shadow volumes on a DST server.

IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

- ♦ [Section 9.1, “Replicating Branches of the Primary File Tree in the Secondary File Tree,” on page 71](#)
- ♦ [Section 9.2, “Shifting Files from the Secondary File Tree to the Primary File Tree,” on page 72](#)
- ♦ [Section 9.3, “Resolving Instances of Duplicate Files,” on page 76](#)
- ♦ [Section 9.4, “Automatically Loading ShadowFS,” on page 81](#)

9.1 Replicating Branches of the Primary File Tree in the Secondary File Tree

You can create a global policy to control when branches in the primary file tree are replicated to the secondary file tree.

When a new directory is created, the folder is created in the primary file tree. A configurable option called *Replicate Primary Tree to Shadow* determines whether a matching path is automatically created at that time, or later when a policy is enforced that actually moves data in the folder to the secondary location. By default, the branches are not created in the secondary file tree until they are needed. Performance is better when the branches are created only as needed.

IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

Valid settings for the Replicate Primary Tree to Shadow are:

- ♦ **Disabled (0, default):** Branches of the primary file tree are replicated to the secondary file tree as needed when data is moved from the primary storage area to the secondary storage area.
- ♦ **Enabled (1):** Branches of the primary file tree are replicated to the secondary file tree immediately as they are created on the primary file tree, even if they do not currently contain data in the secondary storage location. Paths in the primary file tree and secondary file tree are the same at all times.

To configure the Replicate Primary Tree to Shadow parameter:

- 1 Log in as the `root` user to Novell Remote Manager.
- 2 Select *Manage NCP Services > Manage Server* to view the *Server Parameter Information*.
- 3 Click the link for the `REPLICATE_PRIMARY_TREE_TO_SHADOW` setting.

- 4 In *New Value*, do one of the following:
 - ♦ **Disable Immediate Path Replication:** Type 0 to replicate paths in the secondary file tree as they are needed when the data is actually moved to the secondary storage area.
 - ♦ **Allow Immediate Path Replication:** Type 1 to replicate all paths in the secondary file tree immediately as they are created on the primary file tree.
- 5 Click *Change*.
- 6 On the *Server Parameter Information* page, verify that the new setting is displayed for the `REPLICATE_PRIMARY_TREE_TO_SHADOW` parameter.

For information about using the `SET` command to modify this global policy, see [Section A.4, “Configuring Global DST Policies by Using the SET Command,”](#) on page 182.

9.2 Shifting Files from the Secondary File Tree to the Primary File Tree

You can configure global policies for how files in the secondary file tree are automatically moved back to the primary volume. By default, files are moved back to the primary if they are modified, but not if they are accessed.

- ♦ [Section 9.2.1, “Understanding Shift Parameters,”](#) on page 72
- ♦ [Section 9.2.2, “Configuring a Global Policy for Shifting Modified Shadow Files,”](#) on page 75
- ♦ [Section 9.2.3, “Configuring a Global Policy for Shifting Accessed Shadow Files,”](#) on page 76
- ♦ [Section 9.2.4, “Configuring a Global Policy for the Days Since Last Access,”](#) on page 76
- ♦ [Section 9.2.5, “Using the SET Command to Set Global Policies,”](#) on page 76

9.2.1 Understanding Shift Parameters

You can control how files are automatically moved from the secondary storage area to the primary storage area by configuring three parameters:

- ♦ Shift Modified Shadow Files
- ♦ Shift Accessed Shadow Files
- ♦ Shift Days Since Last Access

IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

This section describes the parameters, and recommends combinations of the policies to achieve different goals.

- ♦ [“Shift Modified Shadow Files”](#) on page 73
- ♦ [“Shift Accessed Shadow Files”](#) on page 73
- ♦ [“Shift Days Since Last Access”](#) on page 74
- ♦ [“Use Cases for Shifting Shadow Files”](#) on page 74

Shift Modified Shadow Files

When files in the secondary file tree are modified, a configurable global policy called *Shift Modified Shadow Files* allows the files to be moved to the primary file tree (default), or kept in the secondary file tree. When this parameter is enabled, the file is automatically moved back to the primary storage area when the file is closed. This global policy applies to all DST shadow volumes on a given server.

Valid settings for Shift Modified Shadow Files are:

- ♦ **Disabled (0):** When a file that resides on the secondary storage area is modified, it remains on the secondary storage area.

IMPORTANT: Applications are not aware that DST stores files in two locations. Depending on how an application works, a file might reside on the secondary storage when it is opened, and reside on the primary storage after it is modified.

For example, when you open a file to modify it, Microsoft Word creates a new temporary file and copies the content to it. It saves any changes in the new file, and deletes the old one. Because DST creates all new files on the primary location, the temporary file is created and saved on the primary storage, and the old file is deleted on the secondary location.

This behavior is not unique to Microsoft applications; other word processors and applications behave in the same fashion. When you plan your solution, you must be aware of how the applications you use actually work. If an application's behavior overrides your intended data locations in the shadow volume, you can use policies to achieve the desired separation.

-
- ♦ **Enabled (1, default):** If a file that resides on the secondary storage area is modified, it is automatically shifted to the primary storage area after it is closed. The file remains on the primary storage area until a policy is enforced that shifts it to the secondary storage area.

For example, if your policy is to place newer files in the primary file tree and to place older files in the secondary file tree, you want an older file in the secondary file tree to move to primary file tree if the file's content is modified. The Shift Modified Shadow Files parameter is enabled by default, so this is the default behavior.

On the other hand, if you are placing files of one type (such as .doc and .ppt) in the primary area and files of a different type (such as .mp3 and .jpg) in the secondary area, you want files to stay where they are whenever they are modified. In this case, you should disable the Shift Modified Shadow Files parameter.

Shift Accessed Shadow Files

When files in the secondary file tree are accessed (but not changed), a configurable global policy called *Shift Accessed Shadow Files* allows the files to be left in the secondary file tree (default), or to be moved to the primary file tree. When this parameter is enabled, a file is shifted if it is accessed as read-only a second time during a specified period of time. The file is automatically moved back to the primary area when the file is closed. By default, the period of time is 1 day. Use the Shift Days Since Last Access parameter to specify the period of time. This global policy applies to all DST shadow volumes on a given server.

Valid settings for the Shift Accessed Shadow Files are:

- ♦ **Disabled (0, default):** When a file that resides on the secondary storage area is accessed twice in the specified period, it remains on the secondary storage area.
- ♦ **Enabled (1):** If a file that resides on the secondary storage area is accessed twice in the specified period, it is automatically shifted to the primary storage area after it is closed. The file remains on the primary storage area until a policy is enforced that shifts it to the secondary storage area.

For example, if you are placing files that are changing in the primary area and files that are not changing in the secondary area, you want files to stay where they are whenever they are accessed but not changed. The Shift Accessed Shadow Files parameter is disabled by default, so this is the default behavior.

On the other hand, if your policy is to place in-use files in the primary file tree and to place unused files in the secondary file tree, you want an in-use file in the secondary file tree to move to primary file tree if the file is accessed, whether it changes or not. In this case, you should enable the Shift Accessed Shadow Files parameter.

Shift Days Since Last Access

The Shift Days Since Last Access parameter specifies the number of days to use when determining if a file should be moved back to the primary storage area. When it is used with `SHIFT_ACCESSED_SHADOW_FILES`, the parameter sets the time when files are migrated back to the primary storage area after the second access within the specified elapsed time.

Valid settings for the Shift Accessed Shadow Files are:

- ♦ **Disabled (0):** Files are not shifted on access.
- ♦ **Number of Days (1 to 365):** If a file that resides on the secondary storage area is accessed twice in the specified period, it is automatically shifted to the primary storage area after it is closed. The default is 1 day.

Use Cases for Shifting Shadow Files

[Table 9-1](#) describes use cases for shifting files based on the global policies.

Table 9-1 Shift Behaviors for Files in the Secondary File Tree

	Don't Shift Modified Shadow File to Primary	Shift Modified Shadow File to Primary (Default)
Don't Shift Accessed Shadow File to Primary (Default)	<p>Files can be modified or accessed without being shifted to the primary file tree.</p> <p>For example, you can separate files by file type, with the less important files in the secondary area. Thereafter, the files remain where you moved them. You can periodically apply volume-level policies that move file types from the primary to the secondary.</p> <p>Back up the primary area more frequently because it contains the most important file types.</p>	<p>Modified files are shifted to the primary file tree, but accessed files are not. This is the default combination.</p> <p>Separate files so that recently modified files are located in the primary area. Older files remain in the secondary area.</p> <p>Back up the primary area more frequently because it contains all of the recently changed files.</p>
Shift Accessed Shadow File to Primary	<p>Files are shifted when they are accessed twice in a specified period, but not when they are modified.</p> <p>No use case exists for this combination.</p>	<p>Files are shifted when they are modified, or if they are accessed twice in a specified period.</p> <p>This is desirable for migration-on-demand solutions that move data gradually from an old volume to a new, higher-performance location.</p> <p>Unchanged, seldom-used files are available to users, but do not require frequent backups.</p>

9.2.2 Configuring a Global Policy for Shifting Modified Shadow Files

To configure the Shift Modified Shadow Files parameter:

- 1 Log in as the `root` user to Novell Remote Manager.
- 2 Select *Manage NCP Services > Manage Server* to view the Server Parameter Information page.
- 3 Click the link for the `SHIFT_MODIFIED_SHADOW_FILES` setting.
- 4 In *New Value*, do one of the following:
 - ♦ **Disable Modified Files from Shifting to Primary:** Type 0 to keep files on the secondary storage area when they are modified.
 - ♦ **Allow Modified Files to Shift to Primary:** Type 1 to shift files on the secondary storage area to the primary storage area when they are modified. This is the default.
- 5 Click *Change*.
- 6 On the Server Parameter Information page, verify that the new setting is displayed for the `SHIFT_MODIFIED_SHADOW_FILES` parameter.

9.2.3 Configuring a Global Policy for Shifting Accessed Shadow Files

To configure the Shift Accessed Shadow Files parameter:

- 1 Log in as the `root` user to Novell Remote Manager.
- 2 Select *Manage NCP Services > Manage Server* to view the Server Parameter Information page.
- 3 Click the link for the `SHIFT_ACCESSED_SHADOW_FILES` setting.
- 4 In *New Value*, do one of the following:
 - ♦ **Disable Accessed Files from Shifting to Primary:** Type 0 to keep files on the secondary storage area when they are accessed. This is the default.
 - ♦ **Allow Accessed Files to Shift to Primary:** Type 1 to shift files on the secondary storage area to the primary storage area when they are accessed twice during a specified period.
- 5 Click *Change*.
- 6 On the Server Parameter Information page, verify that the new setting is displayed for the `SHIFT_ACCESSED_SHADOW_FILES` parameter.

9.2.4 Configuring a Global Policy for the Days Since Last Access

To configure the Shift Days Since Last Access parameter:

- 1 Log in as the `root` user to Novell Remote Manager.
- 2 Select *Manage NCP Services > Manage Server* to view the Server Parameter Information page.
- 3 Click the link for the `SHIFT_DAYS_SINCE_LAST_ACCESS` setting.
- 4 In *New Value*, do one of the following:
 - ♦ **Disable:** Type 0 to disable this parameter.
 - ♦ **Number of Days:** Type an integer value from 1 to 365 (in days) that specifies the number of days to wait for a second access of a shadow file. If the second access occurs during this period, the file can be moved if the `SHIFT_ACCESSED_SHADOW_FILES` parameter is also enabled.
- 5 Click *Change*.
- 6 On the Server Parameter Information page, verify that the new setting is displayed for the `SHIFT_DAYS_SINCE_LAST_ACCESS` parameter.

9.2.5 Using the SET Command to Set Global Policies

For information about using the `SET` command to modify these global policies, see [Section A.4, “Configuring Global DST Policies by Using the SET Command,”](#) on page 182.

9.3 Resolving Instances of Duplicate Files

You might want to change the default policies for how duplicate files are resolved for DST shadow volumes.

- ♦ [Section 9.3.1, “Understanding Conflict Resolution for Duplicate Files,”](#) on page 77
- ♦ [Section 9.3.2, “Configuring a Global Policy for Actions to Resolve Duplicate Files Conflicts,”](#) on page 79

- ♦ [Section 9.3.3, “Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts,”](#) on page 80
- ♦ [Section 9.3.4, “Resolving Instances of Duplicate Files in the /._DUPLICATE_FILES Directory,”](#) on page 81

9.3.1 Understanding Conflict Resolution for Duplicate Files

The Duplicate File Resolution policies are designed to handle the case where files with the same name are located in matching directories in both the primary storage location and the secondary storage location. Duplicate files typically are caused by restoring instances of the same file to both the primary storage location and the secondary storage location. If you back up the primary volume more frequently than the secondary volume, the instance of the file that is restored on the primary storage area should be the most current of the two files.

Figure 9-1 Duplicate File Resolution Options (Defaults)

Duplicate File Resolution Options	
Broadcast conflict message to user:	<input checked="" type="checkbox"/>
Action to be taken:	Show duplicate shadow files
Submit	

IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

The following global policies can be set to govern handling of duplicate files for all shadow volumes on the server:

- ♦ [“Handling Instances of Duplicate Files”](#) on page 77
- ♦ [“Broadcasting Conflict Messages to NCP Users”](#) on page 78
- ♦ [“Recommended Policy Settings for Duplicate Files Conflict Resolution”](#) on page 79

Handling Instances of Duplicate Files

[Table 9-3](#) describes the options for handling duplicate instances of files. For information about configuring the *Actions to be taken* parameter, see [Section 9.3.2, “Configuring a Global Policy for Actions to Resolve Duplicate Files Conflicts,”](#) on page 79.

Table 9-2 *Actions for Duplicate File Resolution*

Parameter Options	User View	Resolution
Show duplicate shadow files (default)	The file name appears twice in directory listings.	The administrator or user manually renames one of the files so the system can tell them apart. The user should then determine whether or not to delete one of the instances, and which instance to delete.
Hide duplicate shadow files	Only one instance of the file name is displayed in the directory listings. Client file operations are directed to the instance located on the primary area. If the client deletes the file, the instance in the primary area is deleted, and the instance in the secondary area is then visible.	The users are not aware that a conflict exists. However, the user might see files randomly reappear after they delete a file.
Rename duplicate shadow files	Automatically renames the duplicate file located on the secondary area by adding a unique extension to the name.	Both instances of the file (the file on the primary area and the renamed file on the secondary area) appear in directory listings. The user needs to be informed that such instances might occur so the user can determine which file instance to keep.
Delete duplicate files from the shadow area	Automatically deletes duplicate files located on the secondary storage area.	The users are not aware that a conflict exists. Because duplicate files are typically caused by restoring instances of the same file to both the primary and secondary areas, the instance located on the primary area should be the most current of the two.
Move duplicate shadow files to / ._DUPLICATE_FILES	Causes the duplicate file located on the secondary storage area to be moved to the / ._DUPLICATE_FILES directory at the root of the secondary volume. If there is a file name conflict in the destination directory, then a unique extension is also added to the file name.	The users are not aware that a conflict exists. This option is less risky than automatically deleting duplicate files. It might require occasional cleanup work to be performed in the / ._DUPLICATE_FILES directory.

Broadcasting Conflict Messages to NCP Users

DST leverages the broadcast message capability of NCP Server for Linux. You can disable the broadcast messages option in DST if you choose not to broadcast messages when duplicate files are discovered. If the option is enabled, the messages are received only by client versions that support broadcast messages, and only if the client itself has broadcast messages enabled.

If the option is enabled, a message is broadcast by default to NCP users of the file, whenever

duplicate file conflicts occur.

There are two prerequisites for using broadcast messages:

- ♦ **NCP Server:** NCP Server must be configured to support broadcast messages by setting the Disable Broadcast parameter for the SET command to 0 (disabled).
- ♦ **Novell Client:** The Novell Client version being used by the NCP users must be capable of receiving broadcast messages, and the client must be configured to receive broadcast messages. The broadcast message capability is called Send Message in the Novell Client. The Send Message feature is available in the Novell Client 4.91 SP4 or later for Windows XP/2003, the Novell Client 1.0 SP1 for Windows Vista/7/2008, and the Novell Client 2.0 or later for Linux.

For information about configuring the Broadcast Conflict Messages to Users parameter, see [Section 9.3.3, “Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts,” on page 80.](#)

Recommended Policy Settings for Duplicate Files Conflict Resolution

The settings for broadcasting messages and handling files are configured separately. [Table 9-3](#) summarizes recommendations for combining the two. However, if users are CIFS/Samba users who cannot receive broadcast messages, or if the version of the Novell Client that is in use does not support receiving broadcast messages, you should simply disable broadcast, and select an action that makes sense in your environment.

For information, see [“Handling Instances of Duplicate Files” on page 77.](#)

Table 9-3 Recommended Global Policies for Duplicate Files Resolution

Action to be Taken	Broadcast Conflict Messages to Users
Show duplicate shadow files (default)	Enable broadcast (default)
Hide duplicate shadow files	Disable broadcast
Rename duplicate shadow files	Optionally enable broadcast
Delete duplicate files from the shadow area	Disable broadcast
Move duplicate shadow files to / ._DUPLICATE_FILES	Disable broadcast

9.3.2 Configuring a Global Policy for Actions to Resolve Duplicate Files Conflicts

You can set a global policy for the actions to be taken to resolve duplicate file conflicts.

By default, the *Actions to be taken* parameter is set to show duplicate shadow files to the user. For information about the other options, see [“Handling Instances of Duplicate Files” on page 77.](#)

For information about using the SET command to modify this global policy, see [Section A.4, “Configuring Global DST Policies by Using the SET Command,” on page 182.](#)

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options*.
- 2 In the *Duplicate File Resolution Options* area, view the current setting for *Actions to be taken*.

- 3 From the *Actions to be taken* drop-down list, select one of the following options:
 - ♦ *Show duplicate shadow files* (default)
 - ♦ *Hide duplicate shadow files*
 - ♦ *Rename duplicate shadow files*
 - ♦ *Delete duplicate files from shadow area*
 - ♦ *Move duplicate shadow files to / . _DUPLICATE_FILES*
- 4 In the *Duplicate File Resolution Options* area, click *Submit* to save and apply the change.

9.3.3 Enabling or Disabling Broadcast Messages for Duplicate Files Conflicts

You can set a global policy that enables or disables broadcast messages to be sent to NCP clients when duplicate file conflicts are detected.

When *Broadcast Conflict Messages to Users* is enabled (the default setting), a message is broadcast to NCP users of the file when duplicate instances of the file occur on the primary storage location and secondary storage location. For information, see [“Broadcasting Conflict Messages to NCP Users” on page 78](#) and [“Recommended Policy Settings for Duplicate Files Conflict Resolution” on page 79](#).

IMPORTANT: In order for users to be able to receive the duplicate-file-conflict messages, NCP Server must be configured to support broadcast messages and the Novell clients must be configured to receive broadcast messages. For instructions, see [“Enabling or Disabling Broadcast Message Support”](#) in the *OES 11: NCP Server for Linux Administration Guide*.

For information about using the SET command to modify this global policy, see [Section A.4, “Configuring Global DST Policies by Using the SET Command,” on page 182](#).

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options*.
- 2 In the *Duplicate File Resolution Options* area, enable or disable *Broadcast Conflict Messages to Users* by selecting or deselecting the check box next to it. It is enabled by default.

- 3 In the *Duplicate File Resolution Options* area, click *Submit* to save and apply the change.

- 4 If you enabled Broadcast Conflict Messages, ensure that NCP Server is configured to support broadcast messages by verifying that the Disable Broadcast (DISABLE_BROADCAST) parameter for the SET command is disabled.
 - 4a In Novell Remote Manager for Linux, select *Manage NCP Services*, then select *Manage Server*.
 - 4b In the *Set Parameter Information* table, locate the DISABLE_BROADCAST parameter, then view the current value of the parameter. By default, the parameter is disabled (set to 0), which means that NCP Server supports broadcast messages.

DISABLE_BROADCAST	0
-------------------	-------------------

- 4c If the DISABLE_BROADCAST parameter is enabled (set to 1), click the link for the value in the *Parameter Value* column to open a page where you can change the value.

DISABLE_BROADCAST	1
-------------------	-------------------

- 4d In *New Value*, type 0, then click *Change* to save and apply the settings that disable the DISABLE_BROADCAST parameter, which enables broadcasting for NCP Server.

IMPORTANT: Messages are received only by logged-in users who are using Novell Client versions that are capable of receiving broadcast messages, and that are configured to receive them.

DISABLE_BROADCAST	
Current Value	New Value
1	<input type="text" value="0"/> <input type="button" value="Change"/>
<input type="button" value="Back"/>	

9.3.4 Resolving Instances of Duplicate Files in the /._DUPLICATE_FILES Directory

If you enable *Move duplicate shadow files to /._DUPLICATE_FILES* as the action to be taken when duplicate file conflicts occur, it might require occasional cleanup work to be performed in the /._DUPLICATE_FILES directory.

9.4 Automatically Loading ShadowFS

If CIFS/Samba users need access to DST volumes, you can set a global policy to automatically load ShadowFS and FUSE at boot time.

ShadowFS and FUSE must be running in order for CIFS/Samba users to see a merged view of the shadow volume tree. This is required only when you use the Novell Samba package to provide CIFS/Samba access to files for users of the DST volumes. For information about using and managing ShadowFS, see [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 35](#).

By default, ShadowFS and FUSE are not started automatically at boot time. You can set the *ShadowFS Configuration > Enable ShadowFS* option that starts them at boot time. It also starts them when you first enable the global policy if they are not already running.

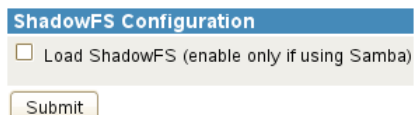
IMPORTANT: If you use shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster.

- ♦ [Section 9.4.1, “Using Novell Remote Manager to Set the Autostart,” on page 82](#)
- ♦ [Section 9.4.2, “Using the Command Line to Set the Autostart,” on page 82](#)
- ♦ [Section 9.4.3, “Manually Starting and Stopping ShadowFS,” on page 82](#)

9.4.1 Using Novell Remote Manager to Set the Autostart

The *Load ShadowFS* option in Novell Remote Manager provides a GUI interface for setting up ShadowFS to start at boot time. It also starts ShadowFS when the option is first enabled if ShadowFS is not already running.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options*.
- 2 In the *ShadowFS Configuration* area, view the current setting for *Load ShadowFS*.



- 3 Enable or disable *Load ShadowFS* by selecting or deselecting the check box.
- 4 In the *ShadowFS Configuration* area, click *Submit* to save and apply the change.

9.4.2 Using the Command Line to Set the Autostart

You can set the service to autostart upon future reboots at the command line instead of using Novell Remote Manager:

- 1 Log in as the root user, then open a terminal console.
- 2 Do one of the following:
 - ♦ **Enable Autostart:** Enter the following at a command prompt to enable the autostart of novell-shadowfs:

```
chkconfig novell-shadowfs on
```
 - ♦ **Disable Autostart:** Enter the following at a command prompt to disable the autostart of novell-shadowfs:

```
chkconfig novell-shadowfs off
```

9.4.3 Manually Starting and Stopping ShadowFS

Only one instance of ShadowFS should be loaded at a time. Before you attempt to manually start ShadowFS, ensure that you have stopped any running instances of it.

- 1 Log in as the root user, then open a terminal console.
- 2 Do one of the following:
 - ♦ **Start:** Enter the following at a command prompt to start ShadowFS:

```
/etc/init.d/novell-shadowfs start
```

- ♦ **Stop:** Enter the following at a command prompt to stop ShadowFS:

```
/etc/init.d/novell-shadowfs stop
```

10 Creating and Managing DST Shadow Volumes for NSS Volumes

Dynamic Storage Technology (DST) supports shadow volume pairs with two Novell Storage Services (NSS) volumes on Novell Open Enterprise Server (OES) 11. This section describes how to create and manage shadow volume pairs with NSS volumes.

- ♦ [Section 10.1, “Understanding DST Shadow Volumes,” on page 85](#)
- ♦ [Section 10.2, “Creating a DST Shadow Volume with NSS Volumes,” on page 87](#)
- ♦ [Section 10.3, “Giving Users a Merged View of the Shadow Volume,” on page 92](#)
- ♦ [Section 10.4, “Configuring the NCP/NSS Bindings for an NSS Volume,” on page 92](#)
- ♦ [Section 10.5, “Copying a Trustee Database to the Primary NSS Volume,” on page 95](#)
- ♦ [Section 10.6, “Viewing a List of NCP Shares,” on page 96](#)
- ♦ [Section 10.7, “Mounting and Dismounting DST Shadow Volumes,” on page 96](#)
- ♦ [Section 10.8, “Viewing the Name and Path Information for a Shadow Volume,” on page 97](#)
- ♦ [Section 10.9, “Viewing Information about a Shadow Volume,” on page 97](#)
- ♦ [Section 10.10, “Auditing File Move Events for the Shadow Volume,” on page 100](#)
- ♦ [Section 10.11, “Backing Up DST Shadow Volumes,” on page 101](#)
- ♦ [Section 10.12, “Removing the Shadow Relationship for a Non-Clustered DST Shadow Volume,” on page 104](#)

10.1 Understanding DST Shadow Volumes

The DST shadow volume is a virtual NCP (NetWare Core Protocol) volume that consists of a primary storage area and a secondary storage area. The primary and secondary areas use NSS volumes.

- ♦ [Section 10.1.1, “Primary Volume,” on page 86](#)
- ♦ [Section 10.1.2, “Secondary Volume,” on page 86](#)
- ♦ [Section 10.1.3, “Merged View,” on page 86](#)
- ♦ [Section 10.1.4, “How Directories Are Created in the Shadow Volume,” on page 86](#)
- ♦ [Section 10.1.5, “Global Policies,” on page 86](#)
- ♦ [Section 10.1.6, “Shadow Volume Policies,” on page 87](#)
- ♦ [Section 10.1.7, “File Inventory for the Shadow Volume,” on page 87](#)
- ♦ [Section 10.1.8, “Moving Specified Files between Volumes,” on page 87](#)

10.1.1 Primary Volume

The primary volume is an NSS volume that is mounted on the OES 11 server that is running DST. Shadow volumes are known by their primary volume name. Typically, the primary volume is on the higher-performance device.

When the primary volume has a state of *Shadowed*, the volume ID that is assigned as its NCP volume ID represents the DST shadow volume pair of volumes. The secondary volume does not have a separate volume ID while it is in the shadow relationship.

10.1.2 Secondary Volume

The secondary volume is an NSS volume that is mounted on the OES 11 server that is running DST. This volume is also referred to as the *shadow path*. The secondary volume is also referred to as the *secondary file tree*.

The secondary volume is typically a new volume. It should have a similar setup as the primary volume for key attributes settings, such as Salvage, Encryption, and Lookup Namespace. For guidelines and caveats about using NSS volume attributes with Dynamic Storage Technology, see [Table 6-2, “DST Support for NSS Volume Attributes,” on page 53](#).

10.1.3 Merged View

The primary file tree and the secondary file tree have the same directory structure. A file can be located in either the primary file tree or the secondary file tree. The merged view presents these two file trees as a single file tree, as shown in [Figure 1-1, “User View of the File System Directory,” on page 14](#).

The NCP clients and management tools see a merged view of files on the DST shadow volume when they access the primary volume. Novell CIFS also provides a merged view for CIFS users that access CIFS shares on the primary volume.

If Novell Samba is used with DST shadow volumes, a CIFS/Samba user sees the merged view that is provided by the ShadowFS component of DST.

10.1.4 How Directories Are Created in the Shadow Volume

New directories are created in the primary file tree. A configurable global policy called *Replicate Primary Tree to Shadow* determines when the directory path is created in the secondary file tree:

- ♦ At the time when the directory is created in the primary file tree
- ♦ Only when files are moved based on policy enforcement

Performance is better when the branches are created only as needed. For information see [Section 9.1, “Replicating Branches of the Primary File Tree in the Secondary File Tree,” on page 71](#).

10.1.5 Global Policies

Global policies govern the behavior of DST, and apply to all shadow volumes on a given server. Before you configure shadow volumes on the server, ensure that you configure the global policies listed in [Table 10-1](#).

Table 10-1 Global Policies

Global Policy Parameter	For Information
REPLICATE_PRIMARY_TREE_TO_SHADOW	Section 9.1, “Replicating Branches of the Primary File Tree in the Secondary File Tree,” on page 71
SHIFT_MODIFIED_SHADOW_FILE	Section 9.2, “Shifting Files from the Secondary File Tree to the Primary File Tree,” on page 72
SHIFT_ACCESSED_SHADOW_FILE	
SHIFT_DAYS_SINCE_LAST_ACCESS	
DUPLICATE_SHADOW_FILE_ACTION	Section 9.3, “Resolving Instances of Duplicate Files,” on page 76
DUPLICATE_SHADOW_FILE_BROADCAST	

10.1.6 Shadow Volume Policies

Shadow volume policies manage how files are distributed across the shadow volume’s primary and shadow areas. A Shadow Volume policy allows you to specify when the policy is enforced (one time, hourly, daily, weekly, and so on), which volumes the policy applies to, which direction files are moved (primary to shadow or shadow to primary), and which files are moved (file type, modify date, access date, size, and so on). Multiple policies can be applied to the same volumes and multiple policies can be scheduled to run concurrently.

For information about configuring global policies for DST, see [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#).

For information about creating or modifying Dynamic Storage Technology policies for shadow volumes, see [Chapter 11, “Creating and Managing Policies for Shadow Volumes,” on page 109](#).

10.1.7 File Inventory for the Shadow Volume

You can generate an inventory of the files located on the two volumes by selecting the *Inventory* link next to the primary volume on the Dynamic Storage Technology Options page. This provides statistics broken out for both volumes and for each volume separately. For information, see [Section 12.5, “Viewing Statistics for the Shadow Volume,” on page 134](#)

10.1.8 Moving Specified Files between Volumes

The Inventory page allows you to navigate through the statistics reports to determine a list of files to be moved between the two volumes (primary to secondary, or secondary to primary). For information, see [Section 12.6, “Using Inventory Detail Reports to Move, Copy, or Delete Files on the Shadow Volume,” on page 135](#).

10.2 Creating a DST Shadow Volume with NSS Volumes

A DST shadow volume links two existing NSS volumes. Typically, one of the volumes contains data and one is newly created. For information about how to create NSS volumes, see the [OES 11: NSS File System Administration Guide for Linux](#).

This section describes how to create unshared DST shadow volumes. For information about using shared NSS volumes to create a shared DST shadow volume in a cluster environment, see [Chapter 13, “Configuring DST Shadow Volumes with Novell Cluster Services,” on page 139](#).

IMPORTANT: The following procedures use VOL1 for the primary storage area, and ARCVOL as the secondary storage area. Ensure that you substitute the actual names of the NSS volumes you are using in each of the steps.

- ♦ [Section 10.2.1, “Preparing the NSS Volumes for Use in the Shadow Volume,” on page 88](#)
- ♦ [Section 10.2.2, “Disabling the NCP/NSS Bindings for the Secondary Volume,” on page 89](#)
- ♦ [Section 10.2.3, “Adding a Shadow to the Primary NSS Volume,” on page 90](#)
- ♦ [Section 10.2.4, “Moving Data between the Two Volumes,” on page 91](#)

10.2.1 Preparing the NSS Volumes for Use in the Shadow Volume

- 1 Open Novell Remote Manager for Linux in a Web browser, then log in to the DST server as the root user.
- 2 Select *View File System > Dynamic Storage Technology Options* to view a list of mounted volumes.
- 3 On the Dynamic Storage Technology page, ensure that the NSS volume that you want to use as the primary volume appears in the *Volume Information* list with a status of *Add Shadow*. If it is not listed, the NSS volume might be unmounted, or its NCP/NSS bindings might be disabled.
 - 3a Select *Manage NCP Services > Manage Shares* to view a list of active volumes.
 - 3b If the NSS volume is in the list but it is not mounted, the volume’s name is not hyperlinked and a *Mount* button is located next to it.



To mount the volume, click the *Mount* button next to the volume name. Continue with [Step 4](#).

- 3c If the NSS volume does not appear in the list of active volumes, click *NCP/NSS Bindings* to view the *Available NSS Volumes* list. If the NSS volume is in the list, check the NCP/NSS Bindings parameter to see if it is disabled.

If the *NCP Accessible* value is set to No, the volume’s NCP/NSS binding is disabled. The most likely reason is that the volume is already being used as the secondary volume in another shadow volume. In that case, you must choose another volume to use as a primary volume.

If you are certain that the volume is not being used in another shadow volume, you can enable the NCP/NSS Bindings setting:

 - 3c1 Select *Yes* in the *NCP Accessible* column for the NSS volume, then click *Save Selection* to save and apply the change.
 - 3c2 If the volume is not automatically mounted, select *Manage NCP Services > Manage Shares* to view the *Volume Information* list, then click the *Mount* button next to the volume name to mount it.
 - 3d If the volume does not appear in the list of active volumes, and it does not appear on the NCP/NSS Bindings page in the *Available NSS Volumes* list, the volume probably is not mounted in NSS.

Exit Novell Remote Manager, then use NSSMU or the storage plug-in for Novell iManager to mount the volume in NSS. These tools automatically mount the volume for NSS and for NCP. When the volumes are mounted, return to [Step 1](#) and begin again.
- 4 On the Dynamic Storage Technology page, ensure that the NSS volume that you want to use as the secondary volume appears in the *Volume Information* list with a status of *Add Shadow*.

The secondary volume must be mounted in NCP in order to perform the next step.

For example, the volume ARCVOL is the NSS volume that is planned to be used for the secondary volume. The volume is in the *Volume Information* list with a *Shadow Status* value of *Add Shadow*.

Volume Information		
Volume Name	Shadow Status	
① ARCVOL	Add Shadow	Inventory
① VOL1	Add Shadow	Inventory
① _ADMIN	No Shadow	Inventory
① SYS	Add Shadow	Inventory

- 5 (Optional) If the secondary volume contains data and the primary volume is a newly created volume, copy the trustee database file on the secondary volume to the primary volume before you create the shadow volume relationship.

Any existing file system trustee and rights settings on a secondary volume that contains data are not automatically re-used by DST for the shadow volume. Copying the existing trustee database allows you to leverage the current settings. Otherwise, you must reconfigure file system access rights from the merged view after you create the shadow volume.

For information, see [Section 10.5, “Copying a Trustee Database to the Primary NSS Volume,” on page 95](#).

- 6 Continue with [Section 10.2.2, “Disabling the NCP/NSS Bindings for the Secondary Volume,” on page 89](#).

10.2.2 Disabling the NCP/NSS Bindings for the Secondary Volume




- 1 Open Novell Remote Manager for Linux in a Web browser, then log in to the DST server as the root user.
- 2 Select *View File System > Dynamic Storage Technology Options* to view a list of mounted volumes.
- 3 Select *Manage NCP Services > Manage Shares*, click *NCP/NSS Bindings*.
- 4 In the *Available NSS Volumes* list, select *No* in the *NCP Accessible* column for the NSS volume that you want to use as the secondary volume.

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input type="radio"/> No: <input checked="" type="radio"/> Save Selection	ARCVOL	/media/nss/ARCVOL
Yes: <input checked="" type="radio"/> No: <input type="radio"/> Save Selection	VOL1	/media/nss/VOL1

- 5 Click *Save Selection* to save and apply the change.
- 6 Go to the Dynamic Storage Technology page, and verify that the secondary volume (for example, ARCVOL) is no longer listed.
- 7 Continue with [Section 10.2.3, “Adding a Shadow to the Primary NSS Volume,” on page 90](#)

10.2.3 Adding a Shadow to the Primary NSS Volume

- 1 Open Novell Remote Manager for Linux in a Web browser, then log in to the DST server as the root user.
- 2 Use one of the following methods to go to the volume's Share Information page of the NSS volume that you want to use as the primary storage area.
 - ♦ Select *View File System > Dynamic Storage Technology Options* to go to the Dynamic Storage Options page, then click the *Add Shadow* link next to the volume name of the NSS volume. For example, click the *Add Shadow* link for VOL1.

Volume Information		
Volume Name	Shadow	Status
 VOL1	Add Shadow	Inventory
 _ADMIN	No Shadow	Inventory
 SYS	Add Shadow	Inventory


- ♦ Select *Manage NCP Services > Manage Shares* to open the Manage Shares page, then click the *Information* (i) icon next to the volume name of the NSS volume.



- 3 On the volume's Share Information page, scroll down to the *Volume Tasks* area, then click *Add Shadow Volume*.



- 4 Specify the following information for the secondary storage area for the DST shadow volume, then click *Create* to define the shadow volume.

Create Shadow for Volume VOL1 

Shadow Path:

☐ Create if not present

- ♦ **Shadow Path:** Type the Linux path for the NSS volume that you want to use as the secondary storage area. The default Linux path where NSS volumes are mounted is `/media/nss/volumename`.
For example, to specify the NSS volume named ARCVOL as the secondary storage area, type `/media/nss/ARCVOL` in the *Shadow Path* field.
- ♦ **Create If Not Present:** For NSS volumes, the volume must already exist. Ensure that this option is deselected (not checked) when shadowing NSS volumes.

IMPORTANT: This option is a placeholder for future capabilities to support shadow volumes for NCP volumes on Linux POSIX file systems (such as Ext3, Reiser, and XFS).

- 5 On the volume's Share Information page, ensure that the *File System Shadow Path* information shows the shadow path you specified in [Step 4](#).

VOL1 Share Information



Information	
Description	Value
File system path	/media/nss/VOL1
File system shadow path	/media/nss/ARCVOL
File system type	NSS
NCP volume ID	2
Status	mounted, online, NSS, salvageable
Capacity	488.51 MB
Advanced Information	View

- 6 Select *View File System > Dynamic Storage Technology Options* to go to the Dynamic Storage Options page, then verify that the *Shadow Status* for the volume is set to *Shadowed* and the *View Log* link is available.

Volume Information		
Volume Name	Shadow Status	
❶ VOL1	Shadowed	Inventory View Log
❶ _ADMIN	No Shadow	Inventory
❶ SYS	Add Shadow	Inventory

- 7 Continue with [Section 10.2.4, “Moving Data between the Two Volumes,”](#) on page 91.

10.2.4 Moving Data between the Two Volumes

- 1 In Novell Remote Manager, select *View File System > Dynamic Storage Technology Options* to go to the Dynamic Storage Options page, then create one or multiple shadow volume policies for the shadow volume.

Shadow volume policies can be configured to move files according to the time since the file was last modified, accessed, or changed; by file names; by file types; or by file size. You can schedule policies to run automatically, or you can run them on demand.

For information about creating and scheduling shadow volume policies, see [Chapter 11, “Creating and Managing Policies for Shadow Volumes,”](#) on page 109.

- 2 (Optional) Move selected data on demand by running customized inventory reports, then using the inventory detail reports to move selected files to either volume according to the time since the file was last modified, accessed, or changed; by file names; by file types; or by file size.

For information, see [Section 12.6, “Using Inventory Detail Reports to Move, Copy, or Delete Files on the Shadow Volume,”](#) on page 135.

10.3 Giving Users a Merged View of the Shadow Volume

Users see a merged view of the data by accessing a share on the primary volume. The following user access is supported:

- ♦ [Section 10.3.1, “NCP,” on page 92](#)
- ♦ [Section 10.3.2, “Novell CIFS,” on page 92](#)
- ♦ [Section 10.3.3, “Novell Samba with ShadowFS and FUSE,” on page 92](#)

10.3.1 NCP

Configure file access for the NCP users on the primary NSS volume, just as you would for a single NSS volume. NCP automatically provides a merged view of the data.

10.3.2 Novell CIFS

Configure file access for the CIFS users on the primary NSS volume, just as you would for a single NSS volume. NCP automatically provides a merged view of the data.

10.3.3 Novell Samba with ShadowFS and FUSE

Configure file access for the Novell Samba users by configuring ShadowFS and FUSE, then create a share on the primary NSS volume. Linux Samba and the CIFS/Samba users must be enabled for Linux User Management.

For information, see [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 35](#).

10.4 Configuring the NCP/NSS Bindings for an NSS Volume

The NCP/NSS Bindings parameter for an NSS volume governs whether the volume is automatically mounted on system restart in NCP Server. When the parameter is enabled, the NSS volume is automatically mounted for NCP Server. When it is disabled, the NSS volume is not mounted for NCP Server. The NCP/NSS Bindings parameter is enabled by default, making the volume NCP accessible.

NSS volumes are automatically mounted by default on system restart, first in NSS, then in NCP Server. This is the desired behavior for all independent NSS volumes that are not in shadow volumes, and for NSS volumes that you use as primary storage locations in a DST shadow volumes. When an NSS volume is used as the secondary storage area in a DST shadow volume, you want the NSS volume to be mounted in NSS, but not in NCP Server. This allows DST to control access to the secondary storage area via the primary storage area. Files in the secondary storage area cannot be directly accessed by users.

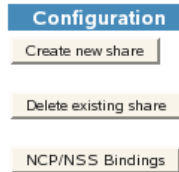
After you remove a shadow volume, the NCP/NSS Bindings parameter for the NSS volume that was used as the secondary storage area remains disabled until you enable it. You must enable the bindings and mount the volume in order to enable users to access the now independent volume.

- ♦ [Section 10.4.1, “Disabling the NCP/NSS Bindings for an NSS Volume,” on page 93](#)
- ♦ [Section 10.4.2, “Enabling the NCP/NSS Bindings for an NSS Volume,” on page 93](#)
- ♦ [Section 10.4.3, “Enabling or Disabling NCP/NSS Bindings by Editing the /etc/opt/novell/ncp2nss.conf File,” on page 94](#)

10.4.1 Disabling the NCP/NSS Bindings for an NSS Volume

The volume's NCP/NSS Bindings parameter must be disabled for NSS volumes that you use as secondary storage locations in a DST shadow volumes.

- 1 In Novell Remote Manager for Linux, select *Manage NCP Services > Manage Shares*.
- 2 In the *Configuration* area of the NCP Shares page, click *NCP/NSS Bindings*.



- 3 In the *Available NSS Volumes* list, locate the NSS volume that you want to disable.
- 4 In the *NCP Accessible* column, click *No* to make the NSS volume not accessible to NCP so that it is not mounted in NCP after it is mounted in NSS.

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input type="radio"/> No: <input checked="" type="radio"/> Save Selection	ARCVOL	/media/nss/ARCVOL
Yes: <input checked="" type="radio"/> No: <input type="radio"/> Save Selection	VOL1	/media/nss/VOL1

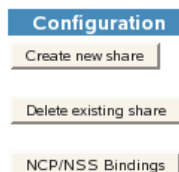
- 5 Beneath the volume's setting for *NCP Accessible*, click *Save Selection* to save and apply the new setting.
- 6 Verify that the NSS volume is not available for NCP by selecting *Manage NCP Services > Manage Shares* to view a list of active volumes.

If the NCP/NSS Bindings parameter is successfully disabled, the NSS volume should not appear in the *Volume Information* list.

10.4.2 Enabling the NCP/NSS Bindings for an NSS Volume

The volume's NCP/NSS Bindings parameter must be enabled for NSS volumes that you use as primary storage locations in a DST shadow volumes, and for all independent NSS volumes that are not in shadow volumes. This is the default.

- 1 In Novell Remote Manager for Linux, select *Manage NCP Services > Manage Shares*.



- 2 In the *Configuration* area of the NCP Shares page, click *NCP/NSS Bindings* to open the NCP/NSS Bindings page.

- 3 In the *Available NSS Volumes* list, locate the NSS volume that you want to enable.

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input type="radio"/> No: <input checked="" type="radio"/> Save Selection	ARCVOL	/media/nss/ARCVOL
Yes: <input checked="" type="radio"/> No: <input type="radio"/> Save Selection	VOL1	/media/nss/VOL1

- 4 If the volume's *NCP Accessible* setting is *No*, click *Yes* to make the NSS volume accessible to NCP so that the volume is automatically mounted in NCP after it is mounted in NSS.

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input checked="" type="radio"/> No: <input type="radio"/> Save Selection	VOL1	/media/nss/VOL1
Yes: <input type="radio"/> No: <input checked="" type="radio"/> Save Selection	ARCVOL	/media/nss/ARCVOL

- 5 Beneath the volume's setting for *NCP Accessible*, click *Save Selection* to save and apply the new setting.

The volume appears in the *Active Shares* list on the NCP Shares page.

- 6 Verify that the NSS volume is available for NCP by selecting *Manage NCP Services > Manage Shares* to view a list of active volumes.

If the NSS/NCP Bindings parameter is enabled, the NSS volume appears in the *Volume Information* list, and a *Mount* button is displayed next to it.

- 7 Click *Mount*.

When the volume is successfully mounted, the volume's name is hyperlinked, and an *Unmount* button is displayed next to it.

10.4.3 Enabling or Disabling NCP/NSS Bindings by Editing the `/etc/opt/novell/ncp2nss.conf` File

When the NCP/NSS bindings parameter is disabled for a volume, NCP Server adds an `EXCLUDE_VOLUME` entry to the `/etc/opt/novell/ncp2nss.conf` file. You can manually disable or enable the NSS volume's NCP/NSS bindings parameter by adding or removing this entry from the file, then restarting the NCP2NSS daemon.

- 1 Open the `/etc/opt/novell/ncp2nss.conf` configuration file in a text editor.
- 2 Do one of the following:
 - ♦ **Disable the NCP/NSS Binding:** Add an `EXCLUDE_VOLUME` entry for the volume you plan to use as secondary NSS volume in order to exclude the volume from being automatically mounted for NCP Server.

```
EXCLUDE_VOLUME nss_volumename
```

Replace *nss_volumename* with the name of the NSS volume. For example, to disable the bindings for the NSS volume named ARCVOL:, add the following line. Note that you do not include the colon after the volume name.

```
EXCLUDE_VOLUME ARCVOL
```

- ♦ **Enable the NCP/NSS Binding:** Locate the EXCLUDE_VOLUME entry for the NSS volume, then remove that line from the file.

- 3 Save the file.
- 4 Restart the Novell eDirectory daemon by entering the following commands:

```
rcnlds stop  
rcnlds start
```

- 5 Restart the NCP/NSS IPC daemon to synchronize the changes you made to the `/etc/opt/novell/ncp2nss.conf` file:

- 5a** At the terminal console prompt, enter

```
/etc/init.d/ncp2nss restart
```

- 5b** If the NCP/NSS IPC daemon restarts successfully, the following messages are displayed in the terminal console:

```
Shutting down Novell NCP/NSS IPC daemon...  
Exited  
Starting the Novell NCP/NSS IPC daemon.
```

10.5 Copying a Trustee Database to the Primary NSS Volume

In a typical DST shadow volume, the primary volume contains data and the secondary volume is empty. If the secondary volume is the one with data, you should copy its existing trustee database to the primary volume before you create the shadow volume relationship. Otherwise, you must reconfigure the file system trustees and file access rights in the merged view before you allow users to access the shadow volume.

For all NCP volumes (NSS and NCP on Linux POSIX volumes), the trustee information is obtained at volume mount time from the `._NETWARE/.trustee_database.xml` file. For an NSS volume, the Linux path to the file is `/media/nss/volumename/._NETWARE/.trustee_database.xml`.

When the shadow relationship exists, all trustee changes are copied to both locations in order to keep the copies of the trustee information synchronized. When you remove a shadow volume, each volume has a complete copy of the trustee information.

- 1 In Novell Remote Manager, log in as the root user.
- 2 Select *Manage NCP Services > Manage Shares* to view a list of active volumes.
- 3 Dismount the NSS volumes that you will be using for DST from NCP Server by selecting the *Unmount* button next to each volume.

This dismounts the volumes from NCP, but they are still mounted by NSS.

- 4 In a file browser, rename or delete the `/media/nss/primary_volumename/._NETWARE/.trustee_database.xml` file on the primary volume.
- 5 Open a terminal console as the root user, then copy the trustee file from the secondary volume location to the primary volume location by entering the following at a terminal console prompt:

```
cp /media/nss/secondary_volumename/._NETWARE/.trustee_database.xml /media/nss/primary_volumename/._NETWARE/.trustee_database.xml
```

For example:

```
cp /media/nss/ARCVOL/._NETWARE/.trustee_database.xml /media/nss/VOL1/._NETWARE/.trustee_database.xml
```

- 6 Select *Manage NCP Services > Manage Shares* to view a list of active volumes.
- 7 Mount the primary volume and secondary volume for NCP Server by selecting the *Mount* button next to each volume.
- 8 At the terminal console prompt, enter the following command to synchronize the NSS trustee information that is now on the primary volume with NCP Server:


```
ncpcon nss resync=primary_volumename
```
- 9 Continue with [Section 10.2, “Creating a DST Shadow Volume with NSS Volumes,”](#) on page 87.

10.6 Viewing a List of NCP Shares

In Novell Remote Manager, the NCP Server plug-in appears as the *Manage NCP Services* role in the left panel. This allows you to mount or unmount NCP volumes, NSS volumes, and DST shadow volumes from the NCP Server. Unmounting an NSS volume from NCP does not dismount the volume from NSS.

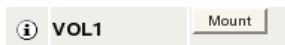
- 1 Open Novell Remote Manager, then log in to the DST server as the `root` user.
- 2 Use either of the following methods to view a list of NCP shares and their status:
 - ♦ Select *Manage NCP Services > Manage Shares*.
 - ♦ Select *View File System > Dynamic Storage Technology Options* to open the Volume Information report, then click *Share Management Home*.

10.7 Mounting and Dismounting DST Shadow Volumes

To mount or dismount the DST shadow volume for NCP Server, you mount or dismount the primary storage area. Unmounting an NSS volume from NCP does not dismount the volume from NSS.

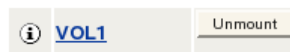
To mount a shadow volume:

- 1 In Novell Remote Manager, click *Manage NCP Services > Manage Shares*, then click the *Mount* button next to the volume name of the primary storage area for the DST shadow volume you want to mount.



To dismount a shadow volume:

- 1 In Novell Remote Manager, click *Manage NCP Services > Manage Shares*, then click the *Unmount* button next to the volume name of the primary storage area for the DST shadow volume you want to dismount.



10.8 Viewing the Name and Path Information for a Shadow Volume

You can quickly get name and path information for the member volumes in the DST shadow volume by using the `ncpcon volume data` command.

- 1 Log in to the DST server as the `root` user, then open a terminal console.
- 2 At the terminal console prompt, enter

```
ncpcon volume data
```

This information is also available in Novell Remote Manager as described in [Section 10.9.3, “Viewing the Share Information for a Shadow Volume,” on page 99](#).

10.9 Viewing Information about a Shadow Volume

In Novell Remote Manager on the Dynamic Storage Technology Options page, the *Volume Information* report (as shown in [Figure 10-1](#)) contains information about all NCP volumes on the server. This includes NSS volumes (which are by default NCP volumes) and NCP shares on Linux POSIX file systems such as Ext3, Reiser, and XFS.

IMPORTANT: DST supports NSS volumes to be used in shadow volumes at this time.

Figure 10-1 *Volume Information Report*

Dynamic Storage Technology Options ?			
Dynamic Storage Technology allows you optimize the use of your storage by automatically moving data to storage best optimized for the data type or frequency of use. You can create one or more policies to manage, and optimize the use of your storage.			
Volume Information			
Volume Name	Shadow Status		
 NCPVOL1	Add Shadow	Inventory	
 VOL1	Shadowed	Inventory	View Log
 _ADMIN	No Shadow	Inventory	
 SYS	Add Shadow	Inventory	

The report does not distinguish between the underlying file systems for the NCP volumes. Ensure that you create shadows only for NCP volumes based on the NSS file system. You can identify whether a volume is an NSS volume by clicking the *Information* icon next to the volume name, then viewing its underlying file system type.

To understand the information provided in the report, see the following sections:

- ♦ [Section 10.9.1, “Accessing the Volume Information Report,” on page 98](#)
- ♦ [Section 10.9.2, “Viewing the Shadow Status of a Volume,” on page 98](#)
- ♦ [Section 10.9.3, “Viewing the Share Information for a Shadow Volume,” on page 99](#)

10.9.1 Accessing the Volume Information Report

- 1 Open Novell Remote Manager, then log in as the `root` user.
- 2 Select *View File System > Dynamic Storage Technology Options* to open the Volume Information report.

10.9.2 Viewing the Shadow Status of a Volume

In the *Volume Information* report, the *Shadow Status* column displays whether or not a volume has a shadow. There are three states:

Table 10-2 Shadow Status in the Volume Information Report

Shadow State	Description
No Shadow	The NSS _ADMIN volume cannot be shadowed, and displays a status of No Shadow.
Add Shadow	<p>The volume is an NSS volume or an NCP volume that is eligible for shadowing. You must separately verify that the volume satisfies the guidelines and caveats that are specified in Chapter 6, “Planning for DST Shadow Volumes and Policies,” on page 45.</p> <p>IMPORTANT: Select the <i>Add Shadow</i> link only for NCP volumes where the underlying file system is the NSS file system.</p>
Shadowed	The volume is the primary volume in a DST shadow volume. To identify the secondary storage area for this volume, click the <i>Information</i> icon next to the volume name to go to the Share Information page, then view the <i>File System Shadow Path</i> .

10.9.3 Viewing the Share Information for a Shadow Volume

The Share Information page displays details about the NCP volume, such as its Linux file system path, the file system path of its shadow area (if it is shadowed), the file system type, and capacity.

Figure 10-2 NCP Volume Share Information


VOL1 Share Information 		
Information		
Description	Value	
File system path	/media/nss/VOL1	
File system shadow path	/media/nss/ARCVOL	
File system type	NSS	
NCP volume ID	2	
Status	mounted, online, NSS, salvageable	
Capacity	488.51 MB	
Local cache	Parameter	Value
	trustee count	0
	cached files	9
	evicted files	0
	cached folders	7
	cache retrieved	59
	cache retrieved locked	7
Pool name	POOL1	
Pool attributes	2833362296	
GUID	5f63e720-6afb-01dc-80-00-ac7e4c66ba5f	

Table 10-3 describes each of the reported parameters on the Share Information page:

Table 10-3 NCP Volume Share Information

Parameter	Description
File System Path	The mount point of the selected volume.
File System Shadow Path	If the selected volume is shadowed, this is the mount point of its secondary storage area.
File System Type	The underlying file system type, such as NSS, Ext3, Reiser, or XFS.
NCP Volume ID	<p>The unique identifier given to the volume by the NCP engine. Values range between 0 and 254 (up to 255 volumes mounted concurrently).</p> <p>When the primary volume has a state of <i>Shadowed</i>, its NCP volume ID represents the DST shadow volume pair of volumes. There is not a separate NCP volume ID assigned to the secondary volume while it is in the shadow volume relationship.</p>
Status	The status of the selected volume, such as if it is mounted and online or offline for the NCP engine. For NSS volumes, it also shows which attributes are enabled, such as user quotas, directory quotas, and salvage.
Capacity	The total amount of space allocated to the volume.
Advanced Information	<p>Click <i>View</i> to reveal the following information:</p> <p>Local Cache: Shows the current status of cache parameters, such as trustee count, cached files, evicted files, cached folders, cache retrieved, and cache retrieved locked.</p> <p>Pool Name: For NSS, the name of the NSS pool where the volume resides.</p> <p>Pool Attributes: For NSS, the attribute identifier for the volume's pool.</p> <p>GUID: The Novell eDirectory globally unique identifier for the selected volume.</p>
Open Files	<p>Reports the connection number (station) of the NCP client connection, the typeless fully distinguished eDirectory user name (such as <code>username.context</code>) who opened the connection, and the files that are currently open for that connection.</p> <p>You manage NCP connections to the primary storage area of the DST shadow volume. Users do not connect directly to the secondary storage area. To manage connections, go to the <i>Manage NCP Services</i> role, then click <i>Manage Connections</i>.</p>

10.10 Auditing File Move Events for the Shadow Volume

For volumes with a *Shadow Status* of *Shadowed*, all file moves between the primary volume and the secondary volume are logged to the shadow volume's audit file. An audit log for a DST shadow volume is located in the `._NETWARE` directory located at the root of the primary volume. For NSS volumes, the default file path for the log is `/media/nss/volumename/._NETWARE/volumename.audit.log`.

For example, if the primary area is named `VOL1`, the audit file is `/media/nss/VOL1/._NETWARE/VOL1.audit.log`.

- 1 In Novell Remote Manager for Linux, log in as the `root` user.
- 2 Select *View File System > Dynamic Storage Technology Options*, locate the volume in the list, then click the *View Log* link next to it.

Volume Information		
Volume Name	Shadow Status	
❶ VOL1	Shadowed	Inventory View Log
❶ _ADMIN	No Shadow	Inventory
❶ SYS	Add Shadow	Inventory

- When you are prompted, select whether to view the file in a text editor, or to save a copy to your local computer.

The “local computer” is the computer where you are running the Web browser for accessing the server via Novell Remote Manager.

10.11 Backing Up DST Shadow Volumes

- [Section 10.11.1, “Planning Your Backup Solution,” on page 101](#)
- [Section 10.11.2, “Planning Your Restore Solution,” on page 102](#)
- [Section 10.11.3, “Using the /etc/NCPVolumes XML File for Backup,” on page 103](#)
- [Section 10.11.4, “Configuring the Backup Attribute for NSS Volumes,” on page 104](#)
- [Section 10.11.5, “Configuring a Backup for Trustee Information on NSS Volumes on Linux,” on page 104](#)

10.11.1 Planning Your Backup Solution

Applications that directly access the local Linux file system see the primary file tree and the secondary file tree as independent directories. The backup utility does not see the merged view of the file tree that the end user sees. Thus, backup tools can apply one backup policy to the primary file tree and a different backup policy to the secondary file tree. In a DST volume, the only operations that take place directly on the secondary volume are backup (or remove and archive) and restore functions.

Using shadow volumes allows backups of important data to be made faster and more frequently because you can apply different backup policies for the primary volume and secondary volume.

For example, the server administrator can partition the volume’s data into two categories:

- Important data that needs to be maintained on quality storage and backed up frequently.
- Less important data that can be stored on less expensive storage and backed up less frequently.

An analysis or inventory of a volume’s data shows that a large portion of it is seldom used. Having a shadow volume allows the server administrator to spend more on the most important data and spend less on the less important data. The frequently used data can be backed up nightly. The seldom-used data can be backed up weekly or monthly.

Getting the less important data out of the way enables the backups of your important data to run more quickly and efficiently. Partitioning your data in this way can significantly reduce the cost of hosting it.

Because the most important files are located in the primary storage area, disaster recovery can also be faster. The server administrator can restore the critical files by restoring the primary storage area first, then restore the secondary storage area. This lets users quickly get the files they need most, and they do not need to wait while files they do not usually need are restored. In addition, more fault tolerant replication solutions can be deployed for the primary storage area where it matters most.

Ensure that policies are not being run during the backup window.

10.11.2 Planning Your Restore Solution

You can restore the data separately to each volume by using the backups you made of each area. If ShadowFS is running, you can also restore the data by using the ShadowFS local mount point in `/media/shadowfs/volumename` that presents a merged file tree that includes both volumes. The advantages and disadvantages of each restore option are described below.

- ♦ [“Restoring Data Separately to the NSS Volumes” on page 102](#)
- ♦ [“Restoring Data to the ShadowFS File Tree” on page 102](#)

Restoring Data Separately to the NSS Volumes

Consider the following advantages and disadvantages when restoring data separately to the NSS volumes. You restore data backed up from the primary path to the primary NSS volume. You restore data backed up from the secondary path to the secondary NSS volume.

- ♦ [“Advantages” on page 102](#)
- ♦ [“Disadvantages” on page 102](#)

Advantages

- ♦ Files are restored directly to the primary volume and secondary volume where they were when the files were backed up, so there is no need for the information to be transferred again through policies.
- ♦ There is no performance hit when you restore directly to each volume like there is when restoring to the ShadowFS file tree.
- ♦ The restoration size is not an issue because you are restoring to the proper volume rather than through the ShadowFS file tree view.
- ♦ You can back up the NSS volume by using the NSS Extended Attributes (XAttr) settings to preserve the NetWare metadata (`netware.metadata`) for file system rights and attributes, and restore that information to each volume as you restore data. For information about XAttr, see [“Extended Attributes \(XAttr\) Commands”](#) the *OES 11: NSS File System Administration Guide for Linux*.

Disadvantages

- ♦ Ensure that no policy runs are in progress while data is being restored.
- ♦ Potential conflicts might occur if you restore duplicate versions of the file on each of the volumes. The duplicate files are resolved by DST global policies instead of being resolved by the backup software. By default, the duplicate files are allowed to coexist, and a conflict message is broadcast to users. For information about duplicate file resolution, see [Section 9.3, “Resolving Instances of Duplicate Files,” on page 76](#).
- ♦ When you restore partial data, you need to know whether the most recent version of the data is located on the backup for the primary volume or the secondary volume.

Restoring Data to the ShadowFS File Tree

If ShadowFS is running, you can also restore the data by using the ShadowFS local mount point in `/media/shadowfs/volumename` that presents a merged file tree that includes both volumes.

- ♦ [“Advantages” on page 103](#)
- ♦ [“Disadvantages” on page 103](#)

Advantages

- ♦ The backup software sees both volumes through the merged file tree view. You can restore the primary volume, secondary volume, or both volumes through this view, and let any duplicates be handled by your backup software.
- ♦ Whether the data is on the backup for the primary volume or the backup for the secondary volume, if both are restored, the users' data is restored.

Disadvantages

- ♦ Ensure that no policy runs are in progress while data is being restored.
- ♦ The FUSE technology used by ShadowFS is slower than using the NCP view, but the backup software cannot see the NCP view.
- ♦ If you back up the NSS volume by using the NSS Extended Attributes (XAttr) settings to preserve the NetWare metadata (`netware.metadata`) for file system rights and attributes, this information cannot be restored through the shadowfs merged view of the data because XAttr requires that the destination location be an NSS volume. The shadowfs view is a mount point and is not seen by the backup software as an NSS volume. For information about XAttr, see [“Extended Attributes \(XAttr\) Commands”](#) the *OES 11: NSS File System Administration Guide for Linux*.
- ♦ All files restored through the ShadowFS file tree view are copied to the primary volume. The data that you restore from the backup for the secondary volume is not returned to the secondary volume until you run policies or use inventory scans to move the data back to the secondary volume.
- ♦ Because all data is restored to the primary volume when you restore through the ShadowFS file tree view, it is possible to run out of space. The primary volume must be large enough to accommodate holding both volumes worth of data unless you restore in phases; that is, restore some directories, then shift data to the secondary, then restore more directories.

10.11.3 Using the /etc/NCPVolumes XML File for Backup

A backup utility can use the `/etc/NCPVolumes` XML file to easily locate each mounted NCP volume and find its primary and secondary file trees. The file contains an entry for each mounted volume. It lists the volume's name and the path for the volume's primary file tree (PRIMARY_ROOT). If the volume is a shadow volume, it also shows the path for the secondary file tree (SHADOW_ROOT).

For example, the following XML entry defines the DST shadow volume named VOL1. The volumes are NSS volumes, with VOL1 as the primary storage location, and ARCVOL as the secondary storage location.

```
<VOLUME>
  <NAME>VOL1</NAME>
  <PRIMARY_ROOT>/media/nss/VOL1</PRIMARY_ROOT>
  <SHADOW_ROOT>/media/nss/ARCVOL</SHADOW_ROOT>
</VOLUME>
```

10.11.4 Configuring the Backup Attribute for NSS Volumes

You can use Novell Storage Management Services tools for backup and restore of NSS volumes. You can back up each NSS volume separately, and restore them separately. You need to be aware of the relationship on restore because you can get duplicate files. However, the mechanics of the backup and restore with SMS are the same as they are with any NSS volume. Refer to the SMS documentation for information about how to use SMS for NSS backup and restore.

The NSS Backup attribute must be enabled on the NSS volumes if you use SMS tools for backup of NSS volumes. The attribute is enabled by default when you create a new NSS volume.

To enable the Backup attribute for an existing NSS volume:

- 1 In iManager, click *Storage > Volumes*.
- 2 Select a server to manage to view a list of the NSS volumes on it.
- 3 In the *Volumes* list, select the volume that you want manage, then wait for the page to refresh to show the volume's details.
- 4 Click *Properties* to view the settings for the volume attributes.
- 5 On the *Attributes* tab, select the *Backup* attribute, then click *Apply*.

10.11.5 Configuring a Backup for Trustee Information on NSS Volumes on Linux

If you plan to use a backup utility with DST, you might need to add an NSS attribute that allows for backing up and restoring file system trustee assignments, trustee rights, and inherited rights filters. NSS provides the `nss /ListXattrNWMetadata` switch to enable this capability. For information, see "[ListXattrNWMetadata Option](#)" in the *OES 11: NSS File System Administration Guide for Linux*.

10.12 Removing the Shadow Relationship for a Non-Clustered DST Shadow Volume

Removing a DST shadow volume simply removes the relationship between the primary and secondary storage area. It does not remove the underlying volumes themselves. The files remain on whichever storage area they are on at the time when you remove the shadow relationship.

- ♦ [Section 10.12.1, "Preparing to Remove a Shadow Volume," on page 105](#)
- ♦ [Section 10.12.2, "Removing the Shadow Volume Relationship by Using Novell Remote Manager for Linux," on page 105](#)
- ♦ [Section 10.12.3, "Removing a Shadow Volume by Editing Configuration Files," on page 107](#)

IMPORTANT: If you are using clustered shadow volumes, see [Section 13.10, "Removing the Shadow Relationship for a Clustered DST Shadow Volume," on page 164](#).

10.12.1 Preparing to Remove a Shadow Volume

Before you remove a shadow volume relationship, ensure that you shift data between the two volumes that make up the shadow volume, according to where you want the data to reside after the DST shadow volume relationship is removed.

- 1 In Novell Remote Manager for Linux, log in as the `root` user.
- 2 Select *View File System > Dynamic Storage Technology Options*, locate the volume in the list, then click the *Inventory* link next to it.

View the volume inventory for the shadow volume to determine the space in use and the available space for both the primary and the secondary areas of the shadow volume. Ensure that there is sufficient free space available in either location for the data that you plan to move to that location.

- 3 Use any combination of the following techniques to shift data between the two areas:
 - ♦ **Shadow Volume Policies:** Run an existing shadow volume policy by using the *Execute Now* option in the *Frequency* area of the policy. You can also create a new shadow volume policy that moves specific data, and run the policy by using the *One Time* and *Execute Now* options in the *Frequency* area of the policy.

For information about configuring policies to move data between the primary and secondary areas, see [Chapter 11, “Creating and Managing Policies for Shadow Volumes,” on page 109](#).

- ♦ **Inventories:** Use the detailed inventory reports or customized inventories to move specific files to either area.

For information about using the volume customized inventory options to move data between the primary and secondary areas, see [Section 12.7, “Generating a Custom Inventory Report,” on page 136](#).

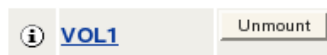
10.12.2 Removing the Shadow Volume Relationship by Using Novell Remote Manager for Linux

- 1 In Novell Remote Manager for Linux, log in as the `root` user.
- 2 Select *Manage NCP Services > Manage Shares* to go to the NCP Shares page.
- 3 Ensure that you know which NSS volume is being used as the secondary volume so that you can manage it independently later.
 - 3a On the NCP Shares page, locate the primary NSS volume in the *Active Shares* list, then click the *Information* icon next to the share name.
 - 3b On the primary volume’s Share Information page, view the volume information in the *File System Shadow Path*.

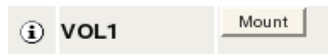
In the following example, `ARCVOL` is an NSS volume that is the secondary storage area in the shadow volume.

File system path	/media/nss/VOL1
File system shadow path	/media/nss/ARCVOL

- 4 On the NCP Shares page, locate the primary NSS volume in the *Active Shares* list, then click the *Unmount* button next to the share name.

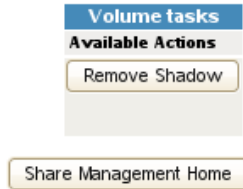


- 5 On the Manage Shares page, click the *Information* (i) icon next to the volume name of the NSS volume to access the *Remove Shadow Action Options*.



- 6 On the volume's Share Information page under *Volume Tasks > Remove Shadow Action Options*, click *Remove Shadow*.

VOL1 Share Information

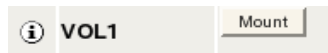


After the shadow volume is removed, the page refreshes to report a successful removal.

Remove Shadow from Volume VOL1



- 7 Select *Share Management* to go to the NCP Shares page, locate the volume that was the primary volume in the *Active Shares* list, then click the *Mount* button next to it.



- 8 Verify that the shadow volume was removed by using one of the following methods:
- ◆ Select *View File System > Dynamic Storage Technology Options* to go to the Dynamic Storage Options page. The former primary volume now has an *Add Shadow* link next to it instead of a *Shadowed* link.

Volume Information		
Volume Name	Shadow Status	
① VOL1	Add Shadow	Inventory
① _ADMIN	No Shadow	Inventory
① SYS	Add Shadow	Inventory

- ◆ Select *Manage NCP Services > Manage Shares*, then click the *Information* icon next to the former primary volume's name. The *File System Shadow Path* field displays n/a (not applicable).

File system path	/media/nss/VOL1
File system shadow path	n/a

- 9 Enable the NCP/NSS Bindings on the volume that was used as the secondary volume (for example, ARCVOL) in order to mount the volume for NCP.

For information, see [Section 10.4.2, “Enabling the NCP/NSS Bindings for an NSS Volume,” on page 93](#).

10.12.3 Removing a Shadow Volume by Editing Configuration Files

- 1 Open a terminal console, then log in as the root user.
- 2 Edit the `/etc/opt/novell/ncpserv.conf` file to remove the following entry for your volume, then save your changes.

```
SHADOW_VOLUME primary_volumename secondary_volume_path
```

For example:

```
SHADOW_VOLUME VOL1 /media/nss/ARCVOL
```

- 3 Stop and restart the eDirectory `ndsd` daemon for the changes to take effect by entering

```
/etc/init.d/ndsd stop
```

```
/etc/init.d/ndsd start
```

- 4 Make the secondary NSS volume available for mounting in NCP by removing the `EXCLUDE_VOLUME` entry for the volume in the `/etc/opt/novell/ncp2nss.conf` file.

If necessary, edit the `/etc/opt/novell/ncp2nss.conf` file to remove the following entry for it:

```
EXCLUDE_VOLUME nss_volumename
```

An entry is automatically removed from the `/etc/opt/novell/ncp2nss.conf` file by using Novell Remote Manager for Linux to set the *Manage NCP Services > Manage Shares > NCP/NSS Bindings > NCP Accessible* option to Yes for the NSS volume. For instructions, see [Section 10.4.2, “Enabling the NCP/NSS Bindings for an NSS Volume,” on page 93](#).

- 5 Stop and restart the eDirectory `ndsd` daemon for the changes to take effect by entering

```
/etc/init.d/ndsd stop
```

```
/etc/init.d/ndsd start
```

- 6 Restart the NCP/NSS IPC daemon to synchronize the changes you made to the `/etc/opt/novell/ncp2nss.conf` file.

- 6a At the terminal console prompt, enter

```
/etc/init.d/ncp2nss restart
```

- 6b If `ncp2nss` restarts successfully, the following messages are displayed in the terminal console:

```
Shutting down Novell NCP/NSS IPC daemon...
Exited
Starting the Novell NCP/NSS IPC daemon.
```

11 Creating and Managing Policies for Shadow Volumes

This section describes how to configure and manage Dynamic Storage Technology policies for shadow volumes on a Novell Open Enterprise Server (OES) 11 server.

- ♦ [Section 11.1, “Understanding Shadow Volume Policy Options,” on page 109](#)
- ♦ [Section 11.2, “Creating a Shadow Volume Policy,” on page 116](#)
- ♦ [Section 11.3, “Modifying a Shadow Volume Policy,” on page 119](#)
- ♦ [Section 11.4, “Running a Policy On Demand,” on page 119](#)
- ♦ [Section 11.5, “Viewing DST Policies and Policy Status,” on page 120](#)
- ♦ [Section 11.6, “Viewing Information about the Files Moved During a Policy Run,” on page 121](#)
- ♦ [Section 11.7, “Stopping a Running Policy,” on page 121](#)
- ♦ [Section 11.8, “Deleting a Shadow Volume Policy,” on page 122](#)

For information about setting global policies for DST on the server, see [Chapter 3, “Installing Dynamic Storage Technology,” on page 25](#).

11.1 Understanding Shadow Volume Policy Options

Shadow Volume policies manage how files are distributed across the shadow volume’s primary and secondary areas. A Shadow Volume policy allows you to specify when the policy is enforced (one time, hourly, daily, weekly, and so on), which volumes the policy applies to, which direction files are moved (primary area to its secondary area, or secondary area to its primary area), and which files are moved (by file name, file type, time stamps, or file size).

DST policies are configured in Novell Remote Manager for Linux. DST provides the following policy options:

- ♦ [Section 11.1.1, “Last Executed,” on page 110](#)
- ♦ [Section 11.1.2, “Description,” on page 110](#)
- ♦ [Section 11.1.3, “Start Time,” on page 110](#)
- ♦ [Section 11.1.4, “End Time,” on page 110](#)
- ♦ [Section 11.1.5, “Start Day,” on page 110](#)
- ♦ [Section 11.1.6, “Frequency,” on page 111](#)
- ♦ [Section 11.1.7, “Command Status,” on page 111](#)
- ♦ [Section 11.1.8, “Volume Selection,” on page 112](#)
- ♦ [Section 11.1.9, “Volume Operations,” on page 112](#)
- ♦ [Section 11.1.10, “Subdirectory Restrictions,” on page 113](#)

- ♦ [Section 11.1.11, “Search Criteria,” on page 114](#)
- ♦ [Section 11.1.12, “Stop,” on page 116](#)

11.1.1 Last Executed

For an existing policy, the *Last Executed* parameter reports the last time the policy ran successfully. This parameter is not configurable.

11.1.2 Description

Description is the user-defined name for the policy. It should be descriptive of the policy it represents, and meaningful to the administrator. This name appears in the *Dynamic Storage Technology Policies* table on the main *Dynamic Storage Technology Options* page.

Description (required):

11.1.3 Start Time

Start Time specifies the time of day to begin a run to enforce the policy. For hourly policies, the policy enforcement begins at the selected minutes past each hour. Time is specified based on a 24-hour clock. For example, 18:00 (6:00 p.m.) is the default start time.

Start Time: :

11.1.4 End Time

End Time specifies the time of day to stop work on an enforcement run. Specifying an end time for a scheduled run allows you to prevent policy enforcement from happening during busy work hours. Time is specified based on a 24-hour clock. For example, 07:00 (7:00 a.m.) is the default end time.

End Time: :

If the policy enforcement process is still running when the end time is reached, the policy’s queued work is paused until the next scheduled run. When the policy run begins at its next scheduled time, it continues with the queued work, and adds new work to the end of the queue.

11.1.5 Start Day

For policies that run weekly, *Start Day* specifies the day of the week to enforce the policy. You can specify only one day of the week for a given policy. Options are *Saturday* (default), *Sunday*, *Monday*, *Tuesday*, *Wednesday*, *Thursday*, or *Friday*.

Start Day: (for weekly commands)
 (for one time or monthly commands)

For policies that are run one time or monthly, *Start Day* specifies the month and day of the month when the policy is scheduled to be enforced.

11.1.6 Frequency

Frequency specifies how often the policy is enforced when the *Command Status* is set to *Active*. [Table 11-1](#) describes each frequency option. The *Execute Now* option can be selected or deselected in combination with any one of the scheduled frequency options.

Frequency:

☐ One Time

☐ Hourly

☐ Daily

☒ Weekly

☐ Monthly

☐ Execute now

Table 11-1 Frequency Options for DST Policies

Option	Description
<i>One Time</i>	Whenever the policy's <i>Command Status</i> is set to <i>Active</i> , the policy runs one time, then changes the <i>Command Status</i> to <i>Inactive</i> . You can activate the policy to run again by changing its status.
<i>Hourly</i>	The policy enforcement process runs once each hour. It begins at the number of minutes past the hour specified by the <i>Start Time</i> . The process continues until it is done, or until the number of minutes past the hour specified by the <i>End Time</i> . Unfinished work is queued until the next run.
<i>Daily</i>	The policy enforcement process runs once each day. It begins at the time specified by the <i>Start Time</i> . The process continues until it is done, or until the time specified by the <i>End Time</i> . Unfinished work is queued until the next run.
<i>Weekly</i> (default)	The policy enforcement process runs once each week. It begins on the day of the week specified by the <i>Start Day</i> . The process continues until it is done, or until the time specified by the <i>End Time</i> . Unfinished work is queued until the next run.
<i>Monthly</i>	The policy enforcement process runs once each month. It begins on the month and day specified by the <i>Start Day</i> , then it runs every month afterwards on that day of the month. The process continues until it is done, or until the time specified by the <i>End Time</i> . Unfinished work is queued until the next run.
<i>Execute Now</i>	Select this option to run the policy now, in addition to its regularly scheduled runs. The policy enforcement process is initiated within a few minutes after the policy's <i>Command Status</i> is set to <i>Active</i> and saved (submitted). The process continues until it is done, or until the time specified by the <i>End Time</i> . Unfinished work is queued until the next run.

11.1.7 Command Status

Command Status governs whether a policy is actively enforced or inactive. Inactive policies can be changed back to active. New policies can be created and set to inactive without running them. Options are *Active* (default) and *Inactive*.

Command Status:

☒ Active

☐ Inactive

11.1.8 Volume Selection

Volume Selection allows you to specify the shadow volumes affected by a given policy. You can select one or multiple shadow volumes from a drop-down list of existing shadowed volumes, or select *All Shadowed Volumes*. You can have multiple policies associated with a given shadow volume. A given policy can apply to multiple shadow volumes.



When you work with DST shadow volumes in a cluster, you should create separate policies for the shadow volumes that exist in a given cluster resource. A given policy can apply to multiple shadow volumes in the cluster resource. You can have multiple policies associated with a given shadow volume in the cluster resource.

11.1.9 Volume Operations

Volume Operations specifies the direction the files are moved between the primary storage location (primary area) and the secondary storage location (shadow area).

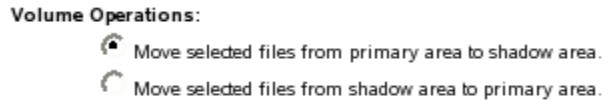


Table 11-2 *Volume Operations for a Policy*

Option	Description
<i>Move selected files from primary area to shadow area</i> (default)	When the policy is enforced, all files on the primary storage location that meet all of the search criteria are moved from the primary storage location to the secondary storage location.
<i>Move selected files from shadow area to primary area</i>	When the policy is enforced, all files on the secondary storage location that meet all of the search criteria are moved from the secondary storage location to the primary storage location.

11.1.10 Subdirectory Restrictions

In the *Subdirectory Restrictions* area, you specify the *Scope* and *Subdirectory List* information that determines whether the policy applies to everything in a volume, only to a specified directory (and its contents), or to all directories but the one specified.

Subdirectory Restriction:

Scope:

Subdirectory list: (Example: /subdir1/subdir2)

The *Scope* options allows you to specify included paths or excluded paths in a given policy, but not both. [Table 11-3](#) describes the options for *Scope*:

Table 11-3 Subdirectory Restrictions for the Scope of a Policy

Option	Description
<i>None</i> (default)	The policy is enforced for all subdirectories in the volume. Do not specify a path.
<i>Apply only in subdirectory</i>	The policy is enforced only for a specified subdirectory and its contents. You can specify multiple paths to be included when running the policy.
<i>Exclude subdirectory</i>	<p>The policy is enforced for all subdirectories in the volume, except for the specified subdirectory and its contents. You can specify multiple paths to be excluded when running the policy.</p> <p>For OES 11 with the latest patches applied, the Exclude Subdirectory option also allows you to specify a directory name that might exist in multiple places on a volume. You indicate this intended action by specifying only a directory name with no forward slashes, and the directory name must contain at least one wildcard (such as ? and *). All instances of directories that match the specified directory name are excluded from the policy run.</p>

The *Subdirectory List* allows up to 8 subdirectory paths on the primary volume to be specified for being included or excluded in a policy when it runs. Each additional path that you specify requires another pass through the data, so it increases the time needed to enforce the policy.

Specify the subdirectory paths relative to the root of the DST volume, not the full Linux path. Wildcards are not allowed in a subdirectory path. Each path must point to a valid subdirectory in the file system.

Precede subdirectory paths with a forward slash (/). For example:

/subdir1/subdir2

Directory names with spaces in them are supported in the subdirectory paths. For example:

/projects/project abc/dev

For OES 11 with the latest patches applied, the Exclude Subdirectory option supports using wildcards to specify a directory that might exist in multiple places on a volume. For example, to exclude all GroupWise archive subdirectories, specify the following directory name with wildcards:

of???arc

[Table 11-4](#) demonstrates how to take advantage of the ability to specify subdirectory paths and directories that have multiple occurring instances in the DST volume.

Table 11-4 *Sample Extended Subdirectory Entries and Intended Actions*

Exclude Subdirectory Entry	Intended Action for the Policy
/test	The preceding forward slash indicates that this is a subdirectory path relative to the root of the volume. This entry excludes only the /test directory located at the root level of the DST volume.
tes?	The absence of a forward slash and the presence of a question mark wildcard (?) in the directory name indicates that this is a directory that might have multiple instances as subdirectories in the volume. This entry excludes all instances of directories with 4 characters in the name that match the first 3 characters, and any character in the 4th position of the directory name.
tes*	The absence of a forward slash and the presence of an asterisk wildcard (*) in the directory name indicates that this is a directory that might have multiple instances as subdirectories in the volume. This entry excludes all instances of directories with names of any length that match the first 3 characters, and any characters to the end of the directory name.
test	No actions are taken for this entry. It is not preceded by a forward slash, so it does not qualify as a subdirectory path. It does not contain a wildcard, so it does not qualify as a directory entry.

11.1.11 Search Criteria

Files must match all of the specified criteria in order to be moved between the primary storage location and secondary storage location. Criteria options include file name or extension, time stamp, and file size. The conditions are combined (and-ed) together, which means that all conditions must be true for a file before it is queued for moving to the other location. Specify any of the following search criteria:

- ◆ [“Search Pattern” on page 115](#)
- ◆ [“Time Stamp Restrictions” on page 115](#)
- ◆ [“File Size Restriction” on page 116](#)

Search Pattern

Search Pattern allows you to set criteria based on the file name or extension. You can specify characters and wildcards to search by file name. You can specify files by types by specifying a wildcard and an extension, such as *.mp3. The default entry is *.* , which applies the policy to all file names and all file types.

Search Pattern:

You can specify up to 50 extensions in a given policy. Separate the multiple entries with a comma and no spaces. For example, to specify multiple image file extensions, type the following:

.bmp,.jpg,*.png,*.tif

You can specify files with spaces in the name. Enter the file name without quotes.

filename with spaces.txt,another file with spaces.jpg,yet another file.doc

Time Stamp Restrictions

Time Stamp Restrictions identifies which time stamps to use when applying the policy.

Time Stamp Restrictions:

Time Stamp:

☐ Last Modified Time

☐ Last Accessed Time

☐ Last Changed Time

Time from now:

Direction:

Days:

Weeks:

Months:

Years:

The time stamp types are:

- ♦ **Last Time Modified:** Time of last content modification for the selected file.
- ♦ **Last Time Accessed:** Time of last access.
- ♦ **Last Time Changed:** Time of last file status change.

The default is no time restriction (all Time Stamp options are deselected), so the default policy applies the policy for all existing files.

These time stamps are defined by POSIX and supported by Linux. Many operations change more than one time stamp. NCP can modify the access time and the modify time, but cannot control whether the change time is reset. The Last Time Changed value is controlled automatically. For example, if you copy a file from one location to another, NCP preserves the access and modify times, but the change time is reset because the file's path changed. That is, it had a status change but the file was not opened for access and its data was not modified.

You must also specify the specific time period to use in *Time from Now*. Direction options are *Greater than* and *Less than*. Specify a direction, then select one of the time periods described in [Table 11-5](#).

Table 11-5 Time Periods for the Time Stamp Restrictions in a Policy

Option	Description
Days	Specify 0 to 14 days. 0 days (the default) disables the option.
Weeks	Specify 0 to 10 weeks. 0 weeks (the default) disables the option.
Months	Specify 0 to 24 months. 0 months (the default) disables the option.
Years	Specify 0 to 24 years. 0 years (the default) disables the option.

For example, you can select all files that have a modified time greater than 6 months by selecting *Last Time Modified* in the *Time Stamp* field, *Greater than* for the *Direction* field, and 6 in the *Months* field.

File Size Restriction

Specifies the range of file sizes to search. *Direction* specifies to look for files that are greater than or less than the specified size in KB. Specify a value of 0 KB to disable the file size restriction. The default is no size restriction, which applies the policy for files of all sizes.

File Size Restriction:

Direction:

Size (KB):

11.1.12 Stop

A *Stop* button is available on the policy's View/Edit Shadow Volume policy page when the policy is running. You can use this option to stop an individual currently running policy. For information, see [Section 11.7, "Stopping a Running Policy," on page 121](#).

You can stop all currently running policies by using the *Stop all currently running policies* option on the Dynamic Storage Technology Options page.

11.2 Creating a Shadow Volume Policy

- [Section 11.2.1, "Prerequisite," on page 116](#)
- [Section 11.2.2, "Guidelines for Shadow Volume Policies," on page 117](#)
- [Section 11.2.3, "Creating a Shadow Volume Policy," on page 117](#)

11.2.1 Prerequisite

In order to configure policies that apply only to a specific shadow volume, the shadow volume must already be defined.

11.2.2 Guidelines for Shadow Volume Policies

- ♦ For each Dynamic Storage Technology shadow volume, you must establish at least one policy that controls how files are migrated from the primary storage area to the secondary storage area of the shadow volume, or vice versa.
- ♦ Any given shadow volume policy is best kept to a simple goal. Complex combinations of rules in a single policy can lead to confusion on how they are executed.
- ♦ You can have multiple policies associated with a given shadow volume.
- ♦ A given policy can apply to multiple shadow volumes.
- ♦ Multiple policies can be scheduled to be run concurrently.

11.2.3 Creating a Shadow Volume Policy

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.

Initially, no policies are defined, so you do not see a policy report.

No Dynamic Storage Technology policies defined.

Create a new policy

After one or more policies are defined, the policies are reported in a table.

Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0
Create a new policy			

- 2 Beneath the list of *Dynamic Storage Technology Policies*, click *Create a New Policy* to open a page where you can configure a new storage policy.

Novell Remote Manager

User: (root)

Linux 2.6.16.37-0.19-smp i686, SUSE Linux Enterprise Server 10 (i586) - Up Time: 5:09:40:31

Create New Shadow Volume Policy

Description (required):

Start Time: 18:00

End Time: 07:00

Start Day: Saturday (for weekly commands)

January 01 (for one time or monthly commands)

Frequency:

- ☐ One Time
- ☐ Hourly
- ☐ Daily
- ☒ Weekly
- ☐ Monthly

Command Status:

- ☒ Active
- ☐ Inactive

Volume Selection:

All Shadowed Volumes

Volume Operations:

- ☒ Move selected files from primary area to shadow area.
- ☐ Move selected files from shadow area to primary area.

Subdirectory Restriction:

Scope: None

Path:

Search Pattern: *.*

Time Stamp Restrictions:

Time Stamp:

- ☐ Last Modified Time
- ☐ Last Accessed Time
- ☐ Last Changed Time

Time from now:

Direction: > Greater than

Days: 0

- On the *Create New Shadow Volume Policy* page, specify a name for the policy in the *Description* field.
The name should be descriptive of the policy it represents, and meaningful to the administrator. For example, suppose you plan to create a policy for a shadow volume used by Project ABC, and exclude the path to the `contracts` directory. You might name the policy *Project ABC Exclude contracts*.
- On the *Create New Shadow Volume Policy* page, configure policy settings.
For information about policy options, see [Section 11.1, “Understanding Shadow Volume Policy Options,”](#) on page 109.
- Specify the *Command Status* as *Active* or *Inactive*.
A policy’s state must be active in order for it to run.
- If you want the policy changes to be enforced sooner than the next scheduled run, ensure that you select *Execute Now* in the *Frequency* area.
The policy run is triggered to begin within a few minutes after you save (submit) the policy.
- Click *Submit* (at the bottom of the page) in order to save the policy, and to schedule it if it is active.

The new policy is listed in the *Dynamic Storage Technology Policies* report on the Dynamic Storage Technology Options page.

Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0
Create a new policy			

11.3 Modifying a Shadow Volume Policy

You can modify a shadow volume policy at any time. For example, if the planned migration activity for a policy is not completed in the allowed time, you can adjust the policy run times and frequency until it meets your workload needs. Modified policies take effect the next time the policy runs, and do not affect currently running processes.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.

Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0
Create a new policy			

- 2 In the list of *Dynamic Storage Technology Policies*, click the *Name* link for the policy in order to view and modify the individual settings for the policy.

- 3 On the View/Edit Shadow Volume Policy page, view and modify the policy settings.

For information about policy settings, see [Section 11.1, “Understanding Shadow Volume Policy Options,”](#) on page 109.

- 4 Specify the *Command Status* as *Active* or *Inactive*.

A policy’s state must be active in order for it to run.

- 5 If you want the policy changes to be enforced sooner than the next scheduled run, select *Execute Now* in the *Frequency* area.

If the policy is not currently running, the policy runs within a few minutes after you click *Submit* in [Step 6](#).

If the policy is currently running, the updated policy does not run until the current run stops. That means the updated policy process is triggered within a few minutes after the currently running process completes or reaches the scheduled *End Time*.

- 6 If you make any changes, you must click *Submit* (at the bottom of the page) in order for the changes to take effect at the next scheduled run.

11.4 Running a Policy On Demand

You can run a policy on demand by enabling the *Execute Now* option in the policy’s *Frequency* settings. If the policy is not currently running, the policy run is triggered within a few minutes after you save (submit) the policy change. Otherwise, it begins a few minutes after the currently policy run ends.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.

Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0
Create a new policy			

- 2 In the list of *Dynamic Storage Technology Policies*, click the *Name* link for the policy to open the View/Edit Shadow Volume Policy page.
- 3 In the *Frequency* area, select *Execute Now*.
- 4 Scroll to the bottom of the page, then click *Submit*.

If the policy is not currently running, the policy runs within a few minutes after you click *Submit*.

If the policy is currently running, the on-demand run begins a few minutes after the currently running process completes or reaches the policy's scheduled *End Time*.

11.5 Viewing DST Policies and Policy Status

After you create DST policies, the Dynamic Storage Technology Policies table reports a list of policies, and information such as the shadow volumes to which the policy applies, when the policy was last executed, and the total number of files moved in the last run for that policy.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.

Initially, no policies are defined.

No Dynamic Storage Technology policies defined.

[Create a new policy](#)

After one or more policies are defined, the policies are reported in a table.

Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0
Create a new policy			

- 2 View the following summary of information about all current policies on the server:

Parameter	Description
Name	The administrator-defined description of the policy. You specify the name in the <i>Description</i> field in the policy form.
Volumes	A list of shadow volumes to which the policy applies. These are specified in <i>Volume Selection</i> field of the policy form.
Last Executed	The time the policy was last enforced.
Total Files Moved	The number of files moved between the primary storage location and the secondary storage location the last time the policy ran.

- 3 Click the *Name* link for the policy to view or modify the individual settings for the policy.
- 4 On the View/Edit Shadow Volume Policy page, view or modify the policy settings.

For information about policy settings, see [Section 11.1, “Understanding Shadow Volume Policy Options,”](#) on page 109.

- 5 If you make any changes, you must click *Submit* (at the bottom of the page) in order for the changes to take effect.

11.6 Viewing Information about the Files Moved During a Policy Run

If a file is moved during a policy run, the event is logged in the primary volume’s log file. It is also tracked in the volume’s audit log file (`/media/nss/<primary_volume_name>/ .NETWARE/ <primary_volume_name name>.audit.log`).

To view the primary volume’s log file by using Novell Remote Manager:

- 1 In Novell Remote Manager, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.
- 2 Under *Volume Information*, locate the shadow volume, then click the link to its log file.
- 3 In the log file, look for entries for the file moves.

For example, the following entry shows that the `/finance/rosebud_annual_report.pdf` file was successfully moved from the primary volume to the secondary volume:

```
<libncpengine name="volumeAuditOperations" timestamp="Wed Jun  8 18:00:21 2011 PM CEST" errno="0">
  <Move_status type="string">Successfully moved file</Move_status>
  <Direction type="string">primary to shadow</Direction>
  <File_path type="string">/finance/rosebud_annual_report.pdf</File_path>
</libncpengine>
```

11.7 Stopping a Running Policy

You can stop all currently running policies, or to stop an individual running policy. When a policy run begins, the policy is enforced on each of the shadow volumes that are specified in the policy’s *Volume Selection* parameter. Therefore, the stop command applies to all shadow volumes that are associated with the policy. It is not possible to stop the policy for only one of multiple associated shadow volumes.

It takes some time (several seconds to a few minutes) for a policy to stop gracefully. For each of its associated shadow volumes, the policy run stops after it completes the move for the file that is currently being moved. The list of files to be moved for each associated shadow volume is discarded.

You cannot restart the policy from the point where you stopped a policy run. The next time that the policy is started, it scans its associated shadow volumes to create new lists of files to be moved.

Use the procedures in this section to stop one or all of the currently running shadow volume policies.

- ♦ [Section 11.7.1, “Stopping All Running Shadow Volume Policies,”](#) on page 122
- ♦ [Section 11.7.2, “Stopping a Running Individual Shadow Volume Policy,”](#) on page 122

11.7.1 Stopping All Running Shadow Volume Policies

The *Stop all running policies* option on the Dynamic Storage Technology Options page can be used to stop all currently running Shadow Volume storage policies. This option is available whether or not there are any currently running policies.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.
- 2 Click *Stop all running policies*.
- 3 Click *Yes* to confirm that you want to stop all currently running Shadow Volume storage policies.
The status for each policy changes after its run is stopped gracefully for each of its associated shadow volumes.

11.7.2 Stopping a Running Individual Shadow Volume Policy

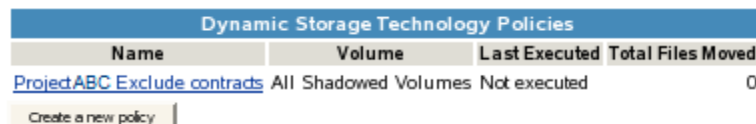
The *Stop* button on the View/Edit Shadow Volume Policy page can be used to stop a currently running individual Shadow Volume Policy rather than stopping all running policies. The *Stop* button is visible only while the policy is running.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.
- 2 In the list of *Dynamic Storage Technology Policies*, click the *Name* link for the policy in order to view the policy.
- 3 On the View/Edit Shadow Volume Policy page, scroll to the bottom of the page.
If the policy is idle, the *Stop* button is not shown.
If the policy is currently running, the *Stop* button is available.
- 4 Click *Stop*.
- 5 Click *Yes* to confirm that you want to stop the selected currently running Shadow Volume policy.
The policy's status changes after the run is stopped gracefully for each of its associated shadow volumes.

11.8 Deleting a Shadow Volume Policy

You can delete a shadow volume policy at any time. If a policy is currently running, the policy is deleted after the process completes its run or reaches the previously set End Time.

- 1 In Novell Remote Manager for Linux, select *View File System*, then select *Dynamic Storage Technology Options* to open the Dynamic Storage Technology Options page.
- 2 In the list of *Dynamic Storage Technology Policies*, click the *Name* link for the policy in order to view the policy.



Dynamic Storage Technology Policies			
Name	Volume	Last Executed	Total Files Moved
ProjectABC Exclude contracts	All Shadowed Volumes	Not executed	0

Create a new policy

- 3 On the View/Edit Shadow Volume Policy page, scroll to the bottom of the page, click *Delete*, then click *Yes* to confirm the deletion.

If the policy is not currently running, it is deleted immediately.

If the policy is currently running, it is deleted after the process stops.

12 Generating a File Inventory for DST Shadow Volumes

In Novell Remote Manager for Linux, you can view reports for the DST shadow volume, with statistics and information about files in the primary file tree and secondary file tree.

- ♦ [Section 12.1, “Understanding the File Inventory for a Shadow Volume,” on page 125](#)
- ♦ [Section 12.2, “Creating the Shadow Volume Inventory,” on page 134](#)
- ♦ [Section 12.3, “Viewing a Saved NCP Volume Report,” on page 134](#)
- ♦ [Section 12.4, “Emailing a Saved NCP Volume Report,” on page 134](#)
- ♦ [Section 12.5, “Viewing Statistics for the Shadow Volume,” on page 134](#)
- ♦ [Section 12.6, “Using Inventory Detail Reports to Move, Copy, or Delete Files on the Shadow Volume,” on page 135](#)
- ♦ [Section 12.7, “Generating a Custom Inventory Report,” on page 136](#)

12.1 Understanding the File Inventory for a Shadow Volume

The inventory provides key statistics about the files in the selected volume, such as files scanned and the available space trends. The inventory includes the following information:

- ♦ [Section 12.1.1, “Inventory Summary,” on page 125](#)
- ♦ [Section 12.1.2, “Available Space Trends,” on page 127](#)
- ♦ [Section 12.1.3, “Graphical Profiles,” on page 127](#)
- ♦ [Section 12.1.4, “Tabular Profiles,” on page 131](#)
- ♦ [Section 12.1.5, “Inventory Detail Reports,” on page 132](#)
- ♦ [Section 12.1.6, “Custom Shadow Volume Options,” on page 132](#)

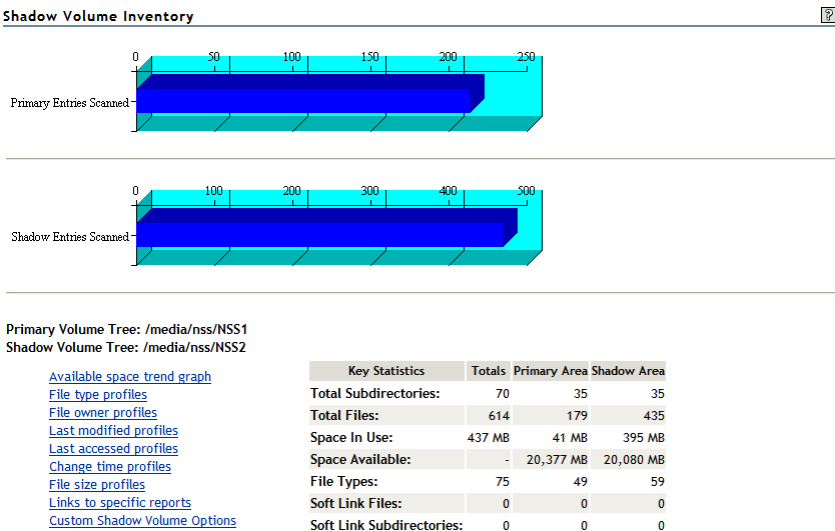
12.1.1 Inventory Summary

The inventory summary lists the number of files scanned on the primary storage area and the secondary storage area. It also lists key statistics for the primary storage area, the secondary storage area, and both areas combined as the shadow volume.

Key Statistics	Description
Total Subdirectories	The total number of subdirectories in the volume.
Total Files	The total number of files in the volume.

Key Statistics	Description
Space in Use	The amount of space currently in use in the volume for data and metadata. On NSS volumes where salvage is enabled, the space in use includes space used by deleted files and directories.
Space Available	The amount of free space in the volume.
File Types	The number of different file types in use throughout the entire volume.
Soft Link Files	The NSS file system and NCP Server do not support soft links to files. This is a placeholder for future non-NCP support.
Soft Link Subdirectories	The NSS file system and NCP Server do not support soft links to subdirectories. This is a placeholder for future non-NCP support.

The following figure is an example of the summary:

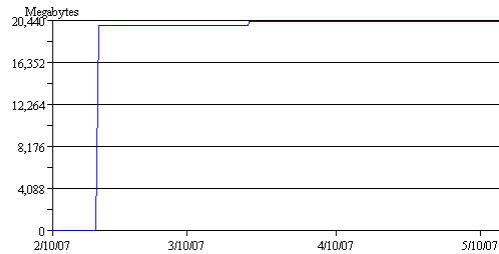


12.1.2 Available Space Trends

The *Available Space Trends* report shows the trends for space usage on the primary storage area and the secondary storage area. The following figure is an example of the *Available Space Trend* graphs:

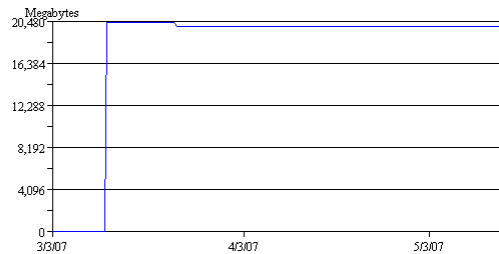
Available space trend graph (Primary Area):

Start Time: Sat Feb 10 16:00:00 2007
End Time: Tue May 15 11:00:00 2007



Available space trend graph (Shadow Area):

Start Time: Sat Mar 3 12:00:00 2007
End Time: Tue May 15 11:00:00 2007



12.1.3 Graphical Profiles

The *Profiles* portion of the inventory report graphically displays information about the shadow volume. Graphical profiles are displayed by size in bytes and file count for the following categories:

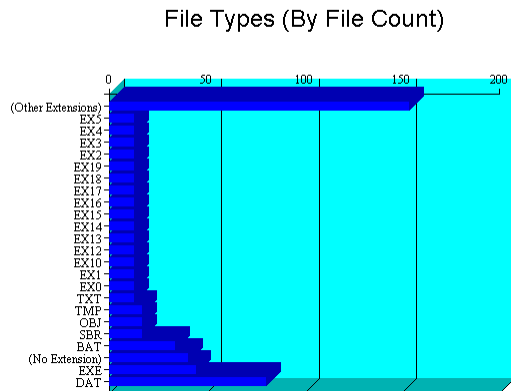
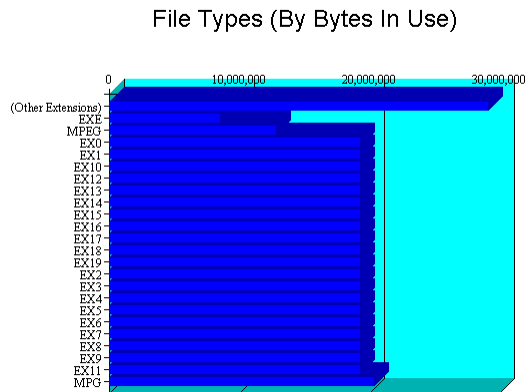
- ♦ “File Type Profiles” on page 128
- ♦ “File Owner Profiles” on page 129
- ♦ “Time Stamp Profiles” on page 129
- ♦ “File Size Profiles” on page 130

File Type Profiles

File Type Profiles indicates storage space usage by file types that are actually in use on your system, such as LOG, TDF, DAT, XML, EXE, and so on.

The following figure is an example of the *File Type Profiles* graphs:

File type profiles:
[Data Tables:](#)

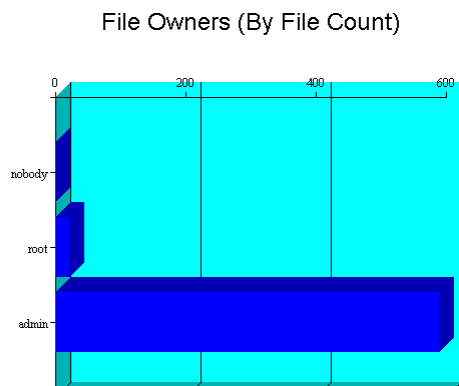
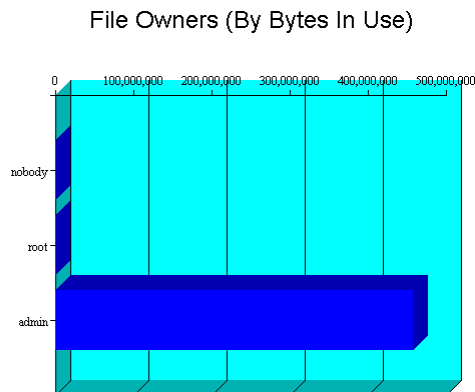


File Owner Profiles

File Owner Profiles indicates storage space usage by the designated owner of the file. It is not unusual in NCP to see the `root` user as the owner of files. For NCP volumes and NSS, file access is governed by the file system trustees assigned to the file, not the file owner. Trustees are users who have User objects defined in Novell eDirectory, and who have been granted file system rights for the file. NCP tracks ownership via the user's eDirectory GUID.

The following figure is an example of the *File Owner Profiles* graphs.

File owner profiles:
[Data Tables:](#)



Time Stamp Profiles

Three time stamp profiles are generated:

- ♦ **Files Modified Profiles:** Modified dates indicate the last time someone changed the contents of a file.
- ♦ **Files Accessed Profiles:** Access dates indicate the last time someone accessed a file, but did not change the contents if this differs from the modified date.
- ♦ **Files Changed Profiles:** Change dates indicate the last time someone changed the metadata of a file, but did not change the contents if this differs from the modified date.

Time stamps are grouped by the following time periods:

More than 2 years

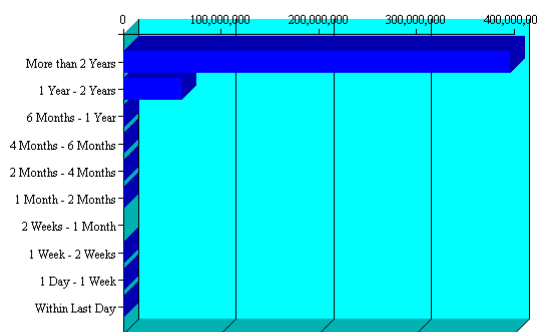
1 year to 2 years

6 months to 1 year
 4 months to 6 months
 2 months to 4 months
 1 month to 2 months
 2 weeks to 1 month
 1 week to 2 weeks
 1 day to 1 week
 Within last day

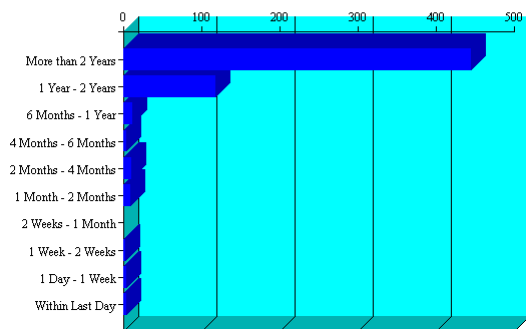
The following figure is an example of the *File Modified Profiles* graphs. Similar graphs are created for *File Accessed Profiles* and *File Changed Profiles*.

[Last modified profiles:](#)
[Data Tables:](#)

Last Modified Times (By Bytes In Use)



Last Modified Times (By File Count)



File Size Profiles

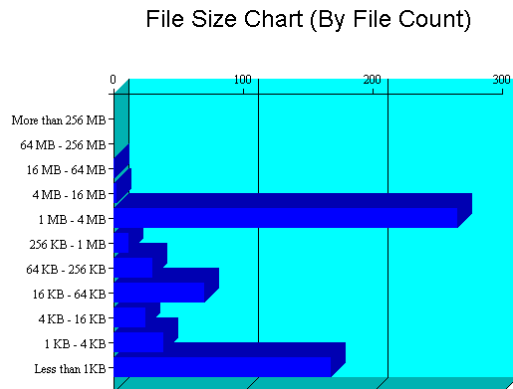
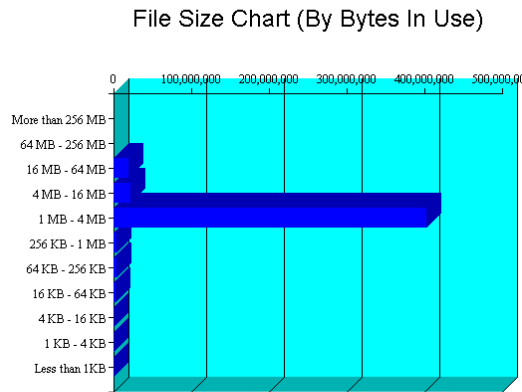
File Size Profiles reports the size of files, grouped by the following size ranges:

More than 256 MB
 64 MB to 256 MB
 16 MB to 64 MB
 4 MB to 16 MB
 1 MB to 4 MB
 256 KB to 1 MB
 64 KB to 256 KB

16 KB to 64 KB
 4 KB to 16 KB
 1 KB to 4 KB
 Less than 1 KB

The following figure is an example of the *File Size Profiles* graphs:

[File size profiles:](#)
[Data Tables:](#)



12.1.4 Tabular Profiles

Statistical data used to create the graphs is also available in tables that report statistics for the primary area, the secondary area, and both areas combined as the shadow volume. The count for file entries for the primary area and shadow (secondary) area are linked to detail reports that list the files matching that particular category and group. From the file lists, you have the option to copy, move, or delete one or multiple files.

For example, the following figure shows a few lines of a file-type information table:

File Extension	Total Space In Use	Total File Count	Primary Space	Primary Files	Shadow Space	Shadow Files
MPG	20,460,496	1	0	0	20,460,496	1
EX0	19,358,676	13	1,335,920	1	18,022,756	12
EX1	19,358,676	13	1,335,920	1	18,022,756	12

12.1.5 Inventory Detail Reports

An *Inventory Detail Report* lists all of the files that match a particular category and group for a file count entry in the tabular reports in the shadow volume inventory. You can select one or multiple files in the list, then select one of the following operations to be performed:

- ♦ Move the selected volumes to the other file tree.
- ♦ Move the selected files to a specified path on the server.
- ♦ Copy the selected files to a specified path on the server.
- ♦ Delete the selected files.

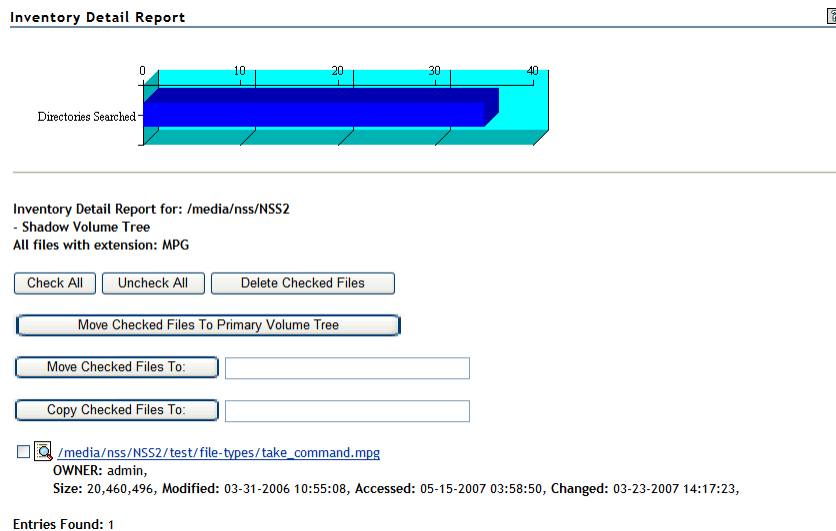
The action is performed on the selected files, and a confirmation list is displayed.

Volume Inventory

Moved: /media/nss/ARCVOL/hello~

Total files moved: 1

The following figure is an example of a detail report for file types that reside on the secondary volume:



12.1.6 Custom Shadow Volume Options

The *Custom Shadow Volume Options* section of the volume inventory allows you to generate reports based on key statistics of interest, and perform actions on them.

- ♦ [“Volume Operations” on page 133](#)
- ♦ [“Search Patterns” on page 133](#)
- ♦ [“File Owner Restrictions” on page 133](#)
- ♦ [“Time Stamp Restrictions” on page 133](#)
- ♦ [“File Size Restrictions” on page 133](#)

Volume Operations

You can perform one of the following volume operations on the files that match the search criteria you specify:

- ♦ List primary area selected files
- ♦ Move selected files from primary area to shadow area.
- ♦ List shadow area selected files.
- ♦ Move selected files from shadow area to primary area.

Search Patterns

In *Search Patterns*, you can specify wildcards and characters to select files by file names or extensions.

File Owner Restrictions

In *File Owner Restrictions*, select *None* or a user name. The search applies only to files where the file owner matches the specified owner.

Time Stamp Restrictions

You can specify one or multiple time stamps to consider for the search:

- ♦ Last Modified Time
- ♦ Last Accessed Time
- ♦ Last Changed Time

If no time stamp is selected, time stamps are not considered in the search criteria.

If a time stamp is selected, you can specify one or multiple time ranges to consider for the search:

Within last day
1 day to 1 week
1 week to 2 weeks
2 weeks to 1 month
1 month to 2 months
2 months to 4 months
4 months to 6 months
6 months to 1 year
1 year to 2 years
More than 2 years

File Size Restrictions

You can specify one or multiple ranges of file sizes to consider for the search:

Less than 1 KB
1 KB to 4 KB
4 KB to 16 KB
16 KB to 64 KB
64 KB to 256 KB

256 KB to 1 MB
1 MB to 4 MB
4 MB to 16 MB
16 MB to 64 MB
64 MB to 256 MB
More than 256 MB

12.2 Creating the Shadow Volume Inventory

- 1 Open Novell Remote Manager for Linux in a Web browser, then log in as the root user.
- 2 Use one of the following methods to view the volume inventory:
 - ♦ Select *View File System > Dynamic Storage Technology Options*, locate the volume in the list, then click the *Inventory* link next to it.

Volume Information		
Volume Name	Shadow Status	
❖ VOL1	Shadowed	Inventory View Log
❖ _ADMIN	No Shadow	Inventory
❖ SYS		Add Shadow Inventory

- ♦ Select *View File System > NCP Volume Inventory*, locate the volume in the *NCP Volumes Available for Inventory* list, then click the *Volume* link for the volume.

Volume Inventory		?
NCP Volumes available for Inventory		
Volume	Mount Point	
SYS	(/usr/novell/sys)	
_ADMIN	(/_admin)	
VOL1	(/media/nss/VOL1)	

12.3 Viewing a Saved NCP Volume Report

An inventory report is saved when you run an inventory on an NCP volume. You can view the last saved report by going to the *Manage NCP Services > Volume Inventory Reports* page and clicking the *View Last Report > Display* option for the volume. The saved report provides the same statistics as running *View File Systems > NCP Volumes Inventory*. Graphics are not available in a saved report.

12.4 Emailing a Saved NCP Volume Report

You can email a saved NCP volume inventory report to addresses that are configured in the `httpstkd.conf` file. To send the report, go to the *Manage NCP Services > Volume Inventory Reports* page and click the *Email Report > Send* option for the volume.

For information about configuring email for Novell Remote Manager, see “[Email Notification Commands](#)” in the *OES 11: Novell Remote Manager Administration Guide*.

12.5 Viewing Statistics for the Shadow Volume

- 1 In Novell Remote Manager, access the volume inventory for the shadow volume.

For information, see [Section 12.2, “Creating the Shadow Volume Inventory,”](#) on page 134.

- 2 In the inventory summary area, click a link to go directly to one of the following reports, or scroll to view the reports. For information about each statistical report, see [Section 12.1, “Understanding the File Inventory for a Shadow Volume,”](#) on page 125.
 - ♦ Available space trend graph
 - ♦ File type profiles
 - ♦ File owner profiles
 - ♦ Last modified profiles
 - ♦ Last accessed profiles
 - ♦ Change time profiles
 - ♦ File size profiles
 - ♦ Links to specific reports
 - ♦ Custom shadow volume options
- 3 Click the *Data Tables* link for a profile to jump directly to the tabular display of the information that was used to generate the graph.

12.6 Using Inventory Detail Reports to Move, Copy, or Delete Files on the Shadow Volume

- 1 In Novell Remote Manager, access the volume inventory for the shadow volume.
For information, see [Section 12.2, “Creating the Shadow Volume Inventory,”](#) on page 134.
- 2 In the summary area, click *Links to Specific Reports*, or scroll down to the *Links to Specific Reports* section to view the tabular reports of information used to generate the profiles.
- 3 Review the following categories to locate the files of interest:
 - ♦ Last modified range
 - ♦ Last accessed range
 - ♦ Change time range
 - ♦ File size range
 - ♦ File owner
 - ♦ File extension
- 4 Click the link of the data entry for the files that you want to manage. Files are grouped by Primary area and by shadow (secondary) area.
- 5 In the *Inventory Detail Report*, select one or multiple files in the list, then do one of the following:
 - ♦ Move the selected volumes to the other file tree (primary or shadow (secondary) file tree).
 - ♦ Move the selected files to a specified path on the server.
 - ♦ Copy the selected files to a specified path on the server.
 - ♦ Delete the selected files.

12.7 Generating a Custom Inventory Report

You can customize the inventory report to limit the search sizes and times reported. The reporting criteria can be combinations of the specific categories described in [Section 12.1.6, “Custom Shadow Volume Options,”](#) on page 132.

- 1 In Novell Remote Manager, access the volume inventory for the shadow volume.
For information, see [Section 12.2, “Creating the Shadow Volume Inventory,”](#) on page 134.
- 2 Scroll down to the *Custom Shadow Volume Options* area at the end of the shadow volume inventory.

Custom Shadow Volume Options

Volume Operations:

- ☒ List primary area selected files.
- ☐ Move selected files from primary area to shadow area.
- ☐ List shadow area selected files.
- ☐ Move selected files from shadow area to primary area.

Search Pattern:

File Owner Restriction:

Time Stamp Restrictions:

Time Stamp:

- ☐ Last Modified Time
- ☐ Last Accessed Time
- ☐ Last Changed Time

Range:

- ☐ Within Last Day
- ☐ 1 Day - 1 Week
- ☐ 1 Week - 2 Weeks
- ☐ 2 Weeks - 1 Month
- ☐ 1 Month - 2 Months
- ☐ 2 Months - 4 Months
- ☐ 4 Months - 6 Months
- ☐ 6 Months - 1 Year
- ☐ 1 Year - 2 Years
- ☐ More than 2 Years

File Size Restriction:

- ☐ Less than 1KB
- ☐ 1 KB - 4 KB
- ☐ 4 KB - 16 KB
- ☐ 16 KB - 64 KB
- ☐ 64 KB - 256 KB
- ☐ 256 KB - 1 MB
- ☐ 1 MB - 4 MB
- ☐ 4 MB - 16 MB
- ☐ 16 MB - 64 MB
- ☐ 64 MB - 256 MB
- ☐ More than 256 MB

- 3 In *Volume Operations*, select one of the following actions to perform on the files that meet the search criteria you specify for the scan in later steps.
 - ♦ List primary area selected files
 - ♦ Move selected files from primary area to shadow area.
 - ♦ List shadow area selected files.
 - ♦ Move selected files from shadow area to primary area.
- 4 In *Search Patterns*, specify wildcards and characters to select files by file name or extension. The default is *.* , which does not restrict the search to specific file names or extensions; all files are considered.

- 5** (Optional) In *File Owner Restrictions*, select *None*, or select a user name from the drop-down list.
If *None* is selected, file ownership is not considered for the search. If a user name is specified, the search applies only to files where the file owner matches the specified owner.
- 6** (Optional) In *Time Stamp*, specify one or multiple time stamps to be searched. If none are selected, the time stamps are not considered when searching.
- ♦ Last Modified Time
 - ♦ Last Accessed Time
 - ♦ Last Changed Time
- 7** In *Range*, if you specified a time stamp restriction, specify one or multiple ranges to be searched.
- Within last day
 - 1 day to 1 week
 - 1 week to 2 weeks
 - 2 weeks to 1 month
 - 1 month to 2 months
 - 2 months to 4 months
 - 4 months to 6 months
 - 6 months to 1 year
 - 1 year to 2 years
 - More than 2 years
- 8** (Optional) In *File Size Restrictions*, specify one or multiple file sizes to be searched.
- Less than 1 KB
 - 1 KB to 4 KB
 - 4 KB to 16 KB
 - 16 KB to 64 KB
 - 64 KB to 256 KB
 - 256 KB to 1 MB
 - 1 MB to 4 MB
 - 4 MB to 16 MB
 - 16 MB to 64 MB
 - 64 MB to 256 MB
 - More than 256 MB
- 9** After you specify the volume operation and search criteria, click *Start Scan*.
- 10** If you chose to list the files, an Inventory Detail Report is generated where you can move, copy, or delete files.
- 10a** Select one or multiple files in the list, then select one of the following actions:
- ♦ *Move the selected volumes to the other file tree.*
 - ♦ *Move the selected files to a specified path on the server.*
 - ♦ *Copy the selected files to a specified path on the server.*
 - ♦ *Delete the selected files.*
- 10b** Click *OK* to confirm the action.
- The action is performed on the selected files, then a confirmation list of the files and the number of files moved is displayed.

Volume Inventory



Moved: /media/nss/ARCVOL/hello~

Total files moved: 1

If you chose to move selected files from one volume to another, the files that meet the search criteria are automatically moved, then a confirmation list of the files and the number of entries moved is displayed.

Volume Inventory



Custom file move from Primary tree to Shadow tree

All files matching selected filter:

Moved: /media/nss/VOL1/dir1/hello

Moved: /media/nss/VOL1/dir2/hello

Moved: /media/nss/VOL1/hello

Moved: /media/nss/VOL1/hello~

Entries Moved: 4

- 11 If you view the inventory chart again after the move, you can see that the files that matched the specified criteria before the move are now reported on the other volume.

13 Configuring DST Shadow Volumes with Novell Cluster Services

Dynamic Storage Technology shadow volume pairs on Novell Open Enterprise Server (OES) 11 servers can be configured as cluster resources with Novell Cluster Services for Linux. This section describes two methods for configuring the cluster resource and how to manage the shadow volume in a cluster.

- ♦ [Section 13.1, “Planning for Using Shadow Volumes in a Cluster,” on page 139](#)
- ♦ [Section 13.2, “Preparing the Nodes to Support DST in a Cluster Environment,” on page 145](#)
- ♦ [Section 13.3, “Sample Load Script for a DST Shadow Volume,” on page 146](#)
- ♦ [Section 13.4, “Sample Unload Script for a DST Shadow Volume,” on page 146](#)
- ♦ [Section 13.5, “Configuring the DST Shadow Volume Cluster Resource with Two Cluster-Enabled Pools,” on page 147](#)
- ♦ [Section 13.6, “Configuring the DST Shadow Volume Cluster Resource with a Cluster-Enabled Pool and a Shared Pool,” on page 154](#)
- ♦ [Section 13.7, “Removing the Local Definition for a Cluster-Enabled Shadow Volume,” on page 162](#)
- ♦ [Section 13.8, “Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes,” on page 163](#)
- ♦ [Section 13.9, “Configuring Shadow Volume Policies for the Clustered Shadow Volume,” on page 164](#)
- ♦ [Section 13.10, “Removing the Shadow Relationship for a Clustered DST Shadow Volume,” on page 164](#)

13.1 Planning for Using Shadow Volumes in a Cluster

In addition to the requirements in [Chapter 6, “Planning for DST Shadow Volumes and Policies,” on page 45](#), your setup must meet the requirements in this section.

- ♦ [Section 13.1.1, “Requirements for Using DST in a Cluster,” on page 140](#)
- ♦ [Section 13.1.2, “DST Shadow Volume Cluster Resource,” on page 142](#)
- ♦ [Section 13.1.3, “Shadow Volume NCPCON Commands for Scripts,” on page 142](#)
- ♦ [Section 13.1.4, “Shadow Volume Configuration Information,” on page 143](#)
- ♦ [Section 13.1.5, “DST Global Policies in a Cluster,” on page 144](#)
- ♦ [Section 13.1.6, “DST Shadow Volume Policies in a Cluster,” on page 144](#)
- ♦ [Section 13.1.7, “Monitor Script for the DST Shadow Volume Cluster Resource,” on page 144](#)
- ♦ [Section 13.1.8, “Additional Volumes in the Primary Pool,” on page 145](#)

13.1.1 Requirements for Using DST in a Cluster

In addition to the installation requirements described in [Section 3.1, “Installation Requirements for Dynamic Storage Technology,” on page 25](#), consider the requirements in this section when setting up DST shadow volumes in a Novell Cluster Services cluster environment.

- ♦ [“Novell Open Enterprise Server 11” on page 140](#)
- ♦ [“Novell Cluster Services” on page 140](#)
- ♦ [“NCP Server and Dynamic Storage Technology” on page 140](#)
- ♦ [“Novell Storage Services File System” on page 140](#)
- ♦ [“NCP for Merged View Access” on page 140](#)
- ♦ [“Novell CIFS for Merged View Access” on page 141](#)
- ♦ [“Novell Samba and ShadowFS” on page 141](#)
- ♦ [“Novell Remote Manager for Linux” on page 142](#)

Novell Open Enterprise Server 11

Each node in the cluster that hosts DST shadow volumes must be running OES 11.

Novell Cluster Services

Ensure that each node is running Novell Cluster Services for OES 11 with the latest patches applied.

In a mixed-platform cluster with an OES 2 cluster (such as for rolling cluster upgrades), ensure that you specify only OES 11 nodes as failover candidates for the shadow volume cluster resources that you are cluster migrating to OES 11 nodes.

NCP Server and Dynamic Storage Technology

The NCP (NetWare Core Protocol) Server and the Dynamic Storage Technology software are not cluster aware. They must be installed on every node in the cluster where you plan to migrate or fail over the cluster resource that contains shadow volumes. You do not cluster NCP Server or DST services. You can cluster the DST shadow volume pair as a cluster resource.

Novell Storage Services File System

Dynamic Storage Technology supports shadow volumes created with pairs of shared Novell Storage Services (NSS) volumes. Install NSS on each node in the cluster. For information, see the [OES 11: NSS File System Administration Guide for Linux](#).

You must create the two NSS pools and volumes on separate shared disks before you create the shadow volume relationship for the two volumes. The primary pool must be cluster-enabled. You can cluster-enable the secondary pool, but its Cluster objects and IP address are not used while the two NSS volumes are in the shadow relationship.

NCP for Merged View Access

NCP Server allows NCP users to access a merged view of the clustered shadow volume. This is the default configuration.

Novell CIFS for Merged View Access

Novell CIFS allows CIFS users to access a merged view of the clustered shadow volume. You must install and configure Novell CIFS on every node in the cluster where you plan to give users CIFS access to the shared cluster resource. For information, see [OES 11: Novell CIFS for Linux Administration Guide](#).

You want Novell CIFS to be available on the node where the DST shadow volumes is active. To do this, you add Novell CIFS as an advertising protocol for the primary NSS pool resource as you cluster-enable it. This enables CIFS user access only for the primary NSS pool, and not the secondary NSS pool.

In the primary NSS pool cluster resource load script, the following command binds Novell CIFS to provide access to the shared resource through the virtual server IP address when the resource is mounted on a node.

```
novcifs --add --vserver=virtualserverFDN --ip-addr=virtualserverip
```

In the primary NSS pool cluster resource unload script, the following command unbinds Novell CIFS from the DST shadow volume cluster resource when the resource is failed over or cluster migrated to another node in the cluster.

```
novcifs --remove --vserver=virtualserverFDN --ip-addr=virtualserverip
```

In the primary NSS pool cluster resource monitor script, the CIFS monitor command helps to keep CIFS up and running.

```
exit_on_error rcnovell-cifs monitor
```

In addition, the following CIFS attributes are automatically added to the NCS:NCP Server object for the virtual server:

- ♦ nfapCIFSServerName (read access)
- ♦ nfapCIFSAttach (read access)
- ♦ nfapCIFSComment (read access)
- ♦ nfapCIFSShares (write access)

For information, see “[Configuring CIFS with Novell Cluster Services for an NSS File System](#)” in the [OES 11: Novell CIFS for Linux Administration Guide](#).

Novell Samba and ShadowFS

ShadowFS and FUSE (File System in User Space) can be used with Novell Samba to allow CIFS/Samba users to access a merged view of the clustered shadow volume. Novell Samba is an alternative to Novell CIFS; they cannot be used together on the same server. You must install and configure Novell Samba and ShadowFS for each node in the cluster. For information about setting up CIFS/Samba access on each node, see [Chapter 5, “Installing and Configuring ShadowFS for Novell Samba Users,”](#) on page 35.

Additional commands for managing FUSE for the resource must be added manually in the cluster load/unload scripts.

You must add the following lines in the load script of the primary NSS pool cluster resource to allow time for ShadowFS to start:

```
# If shadowfs is used, wait for shadowfs to start
for (( c=1; c<=10; c++ )) do
if [ ! -d /media/shadowfs/VOLUME/._NETWARE ]; then sleep 5; fi
done
```

You must add the following line to the unload script of the primary NSS pool cluster resource to unload the volume in FUSE:

```
#unload the volume in FUSE
ignore_error fusermount -u /media/shadowfs/VOLUME
```

Novell Remote Manager for Linux

When you use Novell Remote Manager for Linux to manage policies for the shadow volume, you typically connect to the IP address of the cluster resource for the primary storage location in the shadow volume. You can also connect to the IP address of the server node where the cluster resource is currently mounted.

13.1.2 DST Shadow Volume Cluster Resource

The devices and pools that contain the primary volume and secondary volume in a DST shadow volume must be marked as shareable for clustering. The primary pool must be cluster-enabled for Novell Cluster Services. You can cluster-enable the pool that contains the secondary volume, but its individual pool resource IP address and Cluster objects are not used in the load and unload scripts for the DST shadow volume. The devices, pools, and volumes that are used for the clustered DST shadow volume are managed in the primary pool cluster resource load script and unload script, which allows the two pools (and their volumes) to be failed over together.

The primary and secondary volumes must be able to fail over or cluster migrate together to other OES 11 nodes in the cluster. Thus, a single cluster resource is used to manage both volumes. The load script and unload script for the resource includes commands that manage both the primary and secondary devices, pools, and volumes.

13.1.3 Shadow Volume NCPCON Commands for Scripts

In a cluster environment, the shadow volume relationship between the two volumes exists only when the cluster resource is online. You configure the shadow volumes in the cluster load script so that it defines the NCP volume as it loads. The clustered shadow volume is not permanently defined in the `/etc/opt/novell/ncpserv.conf` files of each node. It is added to the server's `/etc/opt/novell/ncpserv.conf` file automatically when the DST shadow volume cluster resource fails over to a node, and the entry is automatically removed when the resource is taken offline.

Use the following `ncpcon mount` command in a cluster load script when the primary volume and the secondary volume are NSS volumes. Both NSS volumes must already exist and be mounted in NSS.

```
exit_on_error ncpcon mount primary_volumename=volID,SHADOWVOLUME=secondary_volumename
```

Replace *volID* with a value from 0 to 254 as the server volume ID to ensure that the volume has the same ID on all servers when it is mounted in a cluster resource. The volume ID must be unique across all servers in the cluster.

When the primary volume has a state of *Shadowed*, the volume ID that you assign as its NCP volume ID represents the DST shadow volume pair of volumes. The secondary volume does not have a separate volume ID while it is in the shadow relationship.

For example, the following command mounts the NSS volume named `VOL1` with a volume ID of 254. The primary volume is an existing NSS volume named `VOL1` (`/media/nss/VOL1`). The secondary volume is an existing NSS volume named `ARCVOL` (`/media/nss/ARCVOL`).

```
exit_on_error ncpcon mount VOL1=254,SHADOWVOLUME=ARCVOL1
```

Use the Clustering plug-in for iManager to modify the load scripts. You must combine information from the load scripts for the two cluster resources to create a single load script. This process is described in the following sections.

IMPORTANT: If the secondary volume is not available when the shadow volume pair is mounted, the cluster load script does not fail and does not provide a warning. The DST shadow volume is created and appears to be working when viewed from Novell Remote Manager. However, until the DST shadow volume is mounted, the files on the secondary volume are not available to users and appear to be missing in the merged file tree view. After the secondary volume has successfully mounted, the files automatically appear in the merged file tree view.

If you observe that the pools are slow to mount, you can add a wait time to the load script before the mount command for the shadow volume pair.

For example, you add a `sleep` command with a delay of a few seconds, such as:

```
sleep 10
```

You can increase the sleep time value until it allows sufficient time for the pools to be activated and the volumes to be mounted in NSS before continuing.

IMPORTANT: If wait times are added to the load script or unload script, ensure that you increase the script timeout settings accordingly. Otherwise, the script might time out while you are waiting for the action.

13.1.4 Shadow Volume Configuration Information

In a cluster, the `ncpcon mount` command is used in the cluster resource load script to define the shadow volume relationship as the volumes are mounted on a node. The two NSS volumes must be existing volumes. For information about the special mount commands for DST, see [Section A.3, “DST Commands for NCPCON for Use with Novell Cluster Services for Linux Clusters,”](#) on page 180.

When the primary volume has a state of *Shadowed*, the volume ID that you assign as its NCP volume ID represents the DST shadow volume pair of volumes. The secondary volume does not have a separate volume ID while it is in the shadow relationship.

Set up the shadow volume and its DST policies on the first node in the cluster, then do the following:

- If you cluster enable an existing shadow volume, you must remove the `SHADOW_VOLUME` line from the `/etc/opt/novell/ncpserv.conf` file on the server where you created the local shadow volume. This line is responsible for attempting to remount the DST shadow volume after a server is rebooted. In a cluster, you want the DST volume to be mounted and defined each time by the `ncpcon mount` command in the load script for the primary cluster resource.

```
SHADOW_VOLUME primary_volumename secondary_volume_path
```

For example:

```
SHADOW_VOLUME VOL1 /media/nss/ARCVOL1
```

- Copy the `EXCLUDE_VOLUME` line from the `/etc/opt/novell/ncp2nss.conf` file to the configuration file on each cluster node where you want to fail over the cluster resource. This line prevents the secondary NSS volume from being mounted in NCP.

```
EXCLUDE_VOLUME secondary_volumename
```

For example:

```
EXCLUDE_VOLUME ARCVOL1
```

You do not copy the entire file contents, because each server's configuration files contain information specific to the server and might also contain definitions for other shadow volumes that reside on or fail over to the server. For instructions, see [Section 13.2, "Preparing the Nodes to Support DST in a Cluster Environment," on page 145](#).

13.1.5 DST Global Policies in a Cluster

Ensure that the same global policies are configured on each node where you want to fail over the cluster resource. To manage a global DST policy for a given node, open Novell Remote Manager for Linux by using the IP address of the node, not the cluster resource. For information, see [Chapter 9, "Configuring DST Global Policies," on page 71](#).

IMPORTANT: Whenever you modify global policies on a given node in the cluster, you must make those same changes on the other nodes.

13.1.6 DST Shadow Volume Policies in a Cluster

When the shadow volume policies work with DST shadow volumes in a cluster, the policies need to be able to fail over with the volume. As a best practice, ensure that the policies you create for the clustered shadow volume apply only to the given shadow volume. If you want policies to apply to all DST shadow volumes on the nodes, you can use the *All Volumes* option when you create a policy, then copy the policy definitions to all nodes.

To manage shadow volume policies in a cluster, open Novell Remote Manager for Linux by using the IP address of the cluster resource. You can also open Novell Remote Manager by using the IP address of the physical node where the cluster resource is currently mounted if you know which node it is on.

Policies are stored in two locations:

- **Individual Volume:** If a policy applies to a specific volume, the policy information is stored in the `media/nss/<volumename>/._NETWARE/shadow_policy.xml` file. This file is stored on the volume itself and thereby automatically follows the volume as it is failed over or cluster migrated to a different node.
- **All Volumes:** If you select *All Volumes* when you create a policy, the policy applies to all volumes that are currently mounted on the server. The policy information is stored in the `/usr/novell/sys/._NETWARE/shadow_policy.xml` file. In order for this policy to be available on all nodes in the cluster, you must copy the file to all nodes where you plan to mount the volume. It applies to

13.1.7 Monitor Script for the DST Shadow Volume Cluster Resource

The monitor script should have a command to get information about the primary volume, but not one for the secondary volume. For example:

```
exit_on_error ncpcon volume primary_volume_name
```

When you create the DST volume, you turn off the NCP Accessible parameter for the secondary volume in *Manage NCP Services > Manage Shares > NCP/NSS Bindings*. Because the secondary volume is not accessible to NCP, the script cannot get information about it, and monitoring will fail with the configured failure action.

Ensure that you remove or comment out the following line from the resource monitoring script:

```
exit_on_error ncpcon volume secondary_volume_name
```

For example, if the secondary volume is named ARCVOL1, add a pound character (#) before the line to comment it out:

```
#exit_on_error ncpcon volume ARCVOL1
```

13.1.8 Additional Volumes in the Primary Pool

If you add a volume to the primary pool for a clustered DST shadow volume, the `mount` command is added twice in the primary pool's cluster load script, once after the primary pool's activation command and once after the secondary pool's activation command. You must manually delete the instance that occurs after the secondary pool's activation, then offline and online the primary pool cluster resource to apply the modified load script.

For information, see [“Adding a Volume to a Clustered Pool”](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

13.2 Preparing the Nodes to Support DST in a Cluster Environment

For each OES 11 server, perform the following tasks to prepare them for hosting DST shadow volume cluster resources in a cluster:

- ☐ Install NCP Server and Dynamic Storage Technology on each server. For information, see [Chapter 3, “Installing Dynamic Storage Technology,”](#) on page 25.
- ☐ Install and configure Novell Cluster Services for Linux. For information, see [“Installing and Configuring Novell Cluster Services on OES 11”](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.
- ☐ For each node, configure the same DST global policies by using Novell Remote Manager. For information, see [Chapter 9, “Configuring DST Global Policies,”](#) on page 71.
- ☐ If you are configuring access for CIFS clients, you can use Novell CIFS or Novell Samba to provide CIFS access to the merged view of the shadow volume.
 - ♦ **Novell CIFS:** Install Novell CIFS on each node in the cluster, then configure Novell CIFS as an advertising protocol when you cluster-enable the primary NSS pool. The command lines are automatically added to the scripts for the primary NSS pool. For information, see [“Novell CIFS for Merged View Access”](#) on page 141.
 - ♦ **Novell Samba and ShadowFS:** Install Novell Samba and set up ShadowFS on each node in the cluster. You must manually add command lines to the scripts for the primary NSS pool. For information, see [“Novell Samba and ShadowFS”](#) on page 141.
- ☐ If you cluster enable an existing shadow volume, you must remove the local definition from the `/etc/opt/novell/ncp2nss.conf` file. For information, see [Section 13.7, “Removing the Local Definition for a Cluster-Enabled Shadow Volume,”](#) on page 162.

13.3 Sample Load Script for a DST Shadow Volume

In the following sample load script for a shadow volume cluster resource, the lines in bold have been added to or modified from the original load script that was created for the primary pool cluster resource.

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

exit_on_error nss /poolact=ARCPool1
exit_on_error nss /poolact=POOL1 sleep 10 # Optional delay to ensure that the
pools are active before the shadow volume pair is mounted

exit_on_error ncpcon mount VOL1=254,shadowvolume=ARCVOL1

exit_on_error add_secondary_ipaddress 10.10.10.38

exit_on_error ncpcon bind --ncpservname=NCS1-POOL1-SERVER --
ipaddress=10.10.10.38

#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --add --vserver=virtualserverFDN --ip-addr=virtualserverip

# If shadowfs is used, wait for shadowfs to start #for (( c=1; c<=10; c++ )) do #
if [ ! -d /media/shadowfs/VOLUME/._NETWARE ]; then sleep 5; fi #done

exit 0
```

13.4 Sample Unload Script for a DST Shadow Volume

In the following sample unload script for a shadow volume cluster resource, the lines in bold have been added to or modified from the original unload script that was created for the primary pool cluster resource.

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --remove --vserver=virtualserverFDN --ip-addr=virtualserverip

#unload the volume in FUSE # Include the following line only if shadowfs is used
#ignore_error fusermount -u /media/shadowfs/VOL1

ignore_error ncpcon unbind --ncpservname=NCS1-POOL1-SERVER --
ipaddress=10.10.10.38

ignore_error del_secondary_ipaddress 10.10.10.38

ignore_error nss /pooldeact=POOL1 ignore_error nss /pooldeact=ARCPool1

exit 0
```

13.5 Configuring the DST Shadow Volume Cluster Resource with Two Cluster-Enabled Pools

One way to set up the DST shadow volume cluster resource is to cluster-enable both pools to create separate cluster resources, then combine the secondary pool resource scripts with the primary pool resource scripts in the proper order so that secondary resources are available first for the primary resource to use.

The advantage of creating two cluster pool resources is that you can copy and paste the lines of code you need from one script to the other. In a migration scenario, you can later remove the shadow relationship and start using the secondary pool immediately as an independent pool cluster resource. The disadvantage of this approach is that the static IP address that is assigned to the secondary cluster pool resource is consumed but not used while the pool is in the shadow relationship.

When working with the two volumes as a shadow volume, you must create combined load and unload scripts for the primary cluster pool resource that manages the two cluster resources together. The secondary cluster pool resource appears with a status of *Offline* while it is being managed by the primary scripts.

IMPORTANT: After you modify the primary cluster resource to be used for the shadow volume, you must not online the secondary cluster pool resource while its pool and volume are being managed by the primary pool resource.

Use the information in the following sections to set up the DST shadow volume cluster resource.

- [Section 13.5.1, “Overview of the Cluster Resource Setup,” on page 147](#)
- [Section 13.5.2, “Disable the NCP/NSS Bindings for the Secondary Volume,” on page 148](#)
- [Section 13.5.3, “Viewing the Load and Unload Scripts for the Two Pool Cluster Resources,” on page 148](#)
- [Section 13.5.4, “Configuring the Load and Unload Scripts for the Shadow Volume Cluster Resource,” on page 151](#)

13.5.1 Overview of the Cluster Resource Setup

For this method, you need two NSS volumes, each in its own clustered-enabled pool. For instructions for creating the clustered pools and the NSS volumes, see [Configuring Cluster Resources for Shared NSS Pools and Volumes](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

The cluster load scripts elsewhere in this section assume the following setup for NSS volumes in the clustered shadow volume. Ensure that you use the actual information from your setup.

Setup	Primary NSS Volume	Secondary NSS Volume
Server name for node 1	server38	server38
Cluster name for node 1	NCS1	NCS1
Cluster pool name	POOL1	ARCPPOOL1
Cluster resource virtual server name	NCS1-POOL1-SERVER	NCS1-ARCPPOOL1-SERVER

Setup	Primary NSS Volume	Secondary NSS Volume
Cluster resource IP address	10.10.10.38 You use the IP address for the primary pool's cluster resource for the shadow volume.	10.10.10.39 You use the secondary IP address only when managing the secondary NSS volume as an independent volume.
NSS volume name	VOL1	ARCVOL1
Volume ID on the cluster node	254	253 (not used in the script)

When the primary volume has a state of *Shadowed*, its NCP volume ID represents the DST shadow volume pair of volumes. A second NCP volume ID is not assigned to the secondary volume while it is in the shadow volume relationship. You use only the ID on the primary volume in the `ncpcon mount` command in the cluster resource load script.

IMPORTANT: In the cluster load and unload scripts, the `add_secondary_ipaddress` and `del_secondary_ipaddress` commands refer to the cluster resource's IP address that is "secondary" to the node's actual IP address. It is not related to the DST volume's terminology.

13.5.2 Disable the NCP/NSS Bindings for the Secondary Volume

- 1 Disable the NCP/NSS bindings for the secondary NSS volume as described in [Section 10.2.2, "Disabling the NCP/NSS Bindings for the Secondary Volume,"](#) on page 89.
- 2 Copy or add the `EXCLUDE_VOLUME` line to the `/etc/opt/novell/ncp2nss.conf` file on each node in the cluster where you want to run the primary cluster resource.
For information, see [Section 13.8, "Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes,"](#) on page 163.



13.5.3 Viewing the Load and Unload Scripts for the Two Pool Cluster Resources

Initially, you have a set of scripts for each of the two NSS pool cluster resources. To view the original load and unload scripts for the two pool cluster resources:




- 1 In iManager, select *Clusters*, then select *Cluster Manager*.
- 2 Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.

Clusters







Cluster Manager ?

Cluster:  

Epoch: 2

[server38](#) [server39](#) [server40](#)

Cluster State						
Online Offline Migrate Respond to Alert Refresh 5 Item(s)						
<input type="checkbox"/>	Type	Name	State	Location	Lives	Up Since
<input type="checkbox"/>		Master IP Address Resource	 Running	server38	1	Oct 18, 2007 4:37:54 PM
<input type="checkbox"/>		ARCPOOL1 SERVER	 Running	server38	1	Nov 5, 2007 2:09:41 PM
<input type="checkbox"/>		POOL1 SERVER	 Running	server38	1	Nov 5, 2007 2:06:33 PM

- On the Cluster Manager page, click the *Name* link of the primary cluster resource to go to the Cluster Pool Properties page, then view the load and unload scripts.

3a Click the *Scripts* tab to view the load script.

Clusters > Cluster Manager

Cluster Pool Properties: POOL1_SERVER ?

[Policies](#) | [Monitoring](#) | [Preferred Nodes](#) | [Scripts](#) | [Protocols](#) | [Business Continuity](#)

[Load Script](#) | [Unload Script](#) | [Monitor Script](#)

View or edit the load script for this cluster resource.

Script:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns
exit_on_error nss /poolact=POOL1
exit_on_error ncpcon mount VOL1=254
exit_on_error add_secondary_ipaddress 10.10.10.38
exit_on_error ncpcon bind --ncpservname=NCS1-POOL1-SERVER
--ipaddress=10.10.10.38
exit 0
```

Timeout:

For example, the following is a sample load script for the POOL1_SERVER resource for the primary clustered pool named POOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

exit_on_error nss /poolact=POOL1
exit_on_error ncpcon mount VOL1=254

exit_on_error add_secondary_ipaddress 10.10.10.38

exit_on_error ncpcon bind --ncpservname=NCS1-POOL1-SERVER --
ipaddress=10.10.10.38
```

```
#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --add --vserver=virtualserverFDN --ip-addr=virtualserverip

exit 0
```

- 3b** On the *Scripts* tab, click the *Unload Script* link to view the unload script.

For example, the following is a sample unload script for the POOL1_SERVER resource for the primary clustered pool named POOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --remove --vserver=virtualserverFDN --ip-addr=virtualserverip

ignore_error ncpcon unbind --ncpservername=NCS1-POOL1-SERVER --
ipaddress=10.10.10.38

ignore_error del_secondary_ipaddress 10.10.10.38
ignore_error nss /pooldeact=POOL1

exit 0
```

- 4** On the Cluster Manager page, click the *Name* link of the secondary cluster resource to go to the Cluster Pool Properties page, then view its load and unload scripts.

- 4a** Click the *Scripts* tab to view the load script.

For example, the following is a sample load script for the ARCPPOOL1_SERVER resource for the secondary clustered pool named ARCPPOOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

exit_on_error nss /poolact=ARCPPOOL1
exit_on_error ncpcon mount ARCVOL1=253
exit_on_error add_secondary_ipaddress 10.10.10.39

exit_on_error ncpcon bind --ncpservername=NCS1_ARCPPOOL1_SERVER --
ipaddress=10.10.10.39

exit 0
```

- 4b** On the *Scripts* tab, click the *Unload Script* link to view the unload script.

For example, the following is a sample unload script for the ARCPPOOL1_SERVER resource for the secondary clustered pool named ARCPPOOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

ignore_error ncpcon unbind --ncpservername=NCS1_ARCPPOOL1_SERVER --
ipaddress=10.10.10.39

ignore_error del_secondary_ipaddress 10.10.10.39
ignore_error nss /pooldeact=ARCPPOOL1

exit 0
```

- 5** Continue with [Section 13.5.4, “Configuring the Load and Unload Scripts for the Shadow Volume Cluster Resource,”](#) on page 151.

13.5.4 Configuring the Load and Unload Scripts for the Shadow Volume Cluster Resource

To combine information about both volumes into the primary volume's resource load and unload scripts:

- 1 Offline the primary and secondary cluster resources:
 - 1a In iManager, select *Clusters*, then select *Cluster Manager*.
 - 1b Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.
 - 1c Select the check boxes next to the primary and secondary cluster resources.
 - 1d Click *Offline*.
- 2 Copy information from the secondary resource's script into a text file:
 - 2a Click the name link of the secondary cluster resource to view its Cluster Pool Properties page, then click the *Scripts* tab.
 - 2b On the *Scripts > Load Scripts* page, copy the contents of the load script to a temporary text file.
 - 2c On the *Scripts > Unload Scripts* page, copy the contents of the unload script to a temporary text file.
 - 2d Save the temporary files.
 - 2e At the bottom of the *Scripts* page, click *Cancel* to return to the Cluster Manager page.
- 3 Modify the load script for the primary cluster resource.

Use the ["Sample Load Script for a DST Shadow Volume" on page 146](#) as a guide for where to add the lines for each of the items.

- 3a Click the name link of the primary pool cluster resource to view its Cluster Pool Properties page, then click the *Scripts* tab.
- 3b On the *Scripts > Load Script* page, add a line before the primary pool activation that will activate the secondary pool.

```
exit_on_error nss /poolact=ARCPPOOL1
```

- 3c (Optional) Add a `sleep` command after the pool activation commands to allow both pools time to be activated before you mount the shadow volume pair.

For example:

```
sleep 10
```

Vary the time (in seconds) according to what is needed for your system.

IMPORTANT: If wait times are added to the load script or unload script, ensure that you increase the script timeout settings accordingly. Otherwise, the script might time out while you are waiting for the action.

- 3d Comment out (or remove) the individual mount command for the primary NSS volume by placing a pound sign (#) at the beginning of the line.

For example:

```
#exit_on_error ncpcon mount VOL1=254
```

- 3e** Add the shadow volume mount command to the primary load script. This line provides the primary volume, and assigns the secondary volume to shadow the primary.

```
exit_on_error ncpcn mount VOL1=254,shadowvolume=ARCVOL1
```

- 3f** If you are using shadowfs to provide the merged file tree view for CIFS/Samba users or for Linux services like rsync, you must allow time in the load script after mounting the shadow volume to allow shadowfs to become active before continuing.

Use one of the following approaches to add a wait time:

- ♦ Add a `sleep 10` command after mount command, and vary it manually until it allows sufficient wait time for shadowfs to start.

```
# If shadowfs is used, wait for shadowfs to start
sleep 10
```

- ♦ Add a script that varies the wait time by checking to ensure that shadowfs is started.

For example:

```
# If shadowfs is used, wait for shadowfs to start
for (( c=1; c<=10; c++ )) do
  if [ ! -d /media/shadowfs/VOLUME/.NETWARE ]; then sleep 5; fi
done
```

IMPORTANT: If wait times are added to the load script or unload script, ensure that you increase the script timeout settings accordingly. Otherwise, the script might time out while you are waiting for the action.

- 3g** Click *Apply* to save your changes.

The changes do not take effect until the shadow volume cluster resource is brought online.

- 4** Modify the unload script for the primary cluster resource.

Use the [“Sample Unload Script for a DST Shadow Volume” on page 146](#) as a guide for where to add the lines for each of the items.

- 4a** Click the name link of the primary cluster resource to view its Cluster Pool Properties page, click the *Scripts* tab, then click *Unload Script*.

- 4b** On the *Scripts > Unload Script* page, copy the pool deactivation command from the secondary pool's unload script into the primary pool's unload script after the line to deactivate the primary pool.

```
ignore_error nss /pooldeact=ARCPPOOL1
```

IMPORTANT: Ensure that you deactivate the primary pool before deactivating the secondary pool.

- 4c** If you are using shadowfs to provide a merged file tree view to Samba users, you must unmount the FUSE-mounted file systems that are displayed in the `/media/shadowfs/VOLUME` directory. Add the following line just before the unbind command in the unload script:

```
#unload the volume in FUSE
# Include the following line only if shadowfs is used
ignore_error fusermount -u /media/shadowfs/VOLUME
```

- 4d** Click *Apply* to save your changes.


The changes do not take effect until the shadow volume cluster resource is brought online.

5 Online the primary load script:

- 5a In iManager, select *Clusters*, then select *Cluster Manager*.
- 5b Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.
- 5c Select the check box next to the primary cluster resource, then click *Online*.
- 5d Select the cluster node where you want the resource to load (such as server38), then click *OK*.










6 Verify that the primary cluster resource is running by going to the *Clusters > Cluster Manager* page.

The primary cluster resource is *Running*. The secondary cluster resource is reported as *Offline* because you are managing that cluster resource through the primary load script.


<input type="checkbox"/>		ARCPPOOL1_SERVER		Offline	1	
<input type="checkbox"/>		POOL1_SERVER		Running	server38	2 Nov 5, 2007 4:11:53 PM

7 Verify that the shadow volume (VOL1) is mounted in NCP and is shadowed:




- 7a On the first node in the cluster, log in to Novell Remote Manager for Linux as the `root` user.
- 7b Select *View File Systems*, then verify that the secondary pool ARCPPOOL1 and the NSS volume ARCVOL1 are listed under *File Systems*, but the secondary NSS volume is not listed under *NCP Volumes*.

File System Management			
File Systems			
Mounted Device	Mount Location		
 rootfs	/	(95% free)	
 udev	/dev	(99% free)	
	/dev/disk/by-id/scsi-36001c230c175cf000e70368e60a6e6fe-part2	/	
proc	/proc		
sysfs	/sys		
debugfs	/sys/kernel/debug		
devpts	/dev/pts		
securityfs	/sys/kernel/security		
adminfs	/admin		
 admin	/ admin	(100% free)	
	/dev/pool/POOL1	/opt/novell/nss/mnt/.pools/POOL1	
	/dev/pool/ARCPPOOL1	/opt/novell/nss/mnt/.pools/ARCPPOOL1	
 ARCVOL1	/media/nss/ARCVOL1	(99% free)	
 VOL1	/media/nss/VOL1	(99% free)	
NCP Volumes			
 SYS	/usr/novell/sys		
 ADMIN	/_admin		
 VOL1	/media/nss/VOL1		

- 7c** Select *View File Systems > Dynamic Storage Technology Options*, then verify that the primary volume is listed under *Volume Information*, and that its status is *Shadowed*.

Dynamic Storage Technology Options 

Dynamic Storage Technology allows you optimize the use of your storage by automatically moving data to storage best optimized for the data type or frequency of use. You can create one or more policies to manage, and optimize the use of your storage.

Volume Information		
Volume Name	Shadow Status	
 VOL1	Shadowed	Inventory View Log
 _ADMIN	No Shadow	Inventory
 SYS		Add Shadow Inventory

No Dynamic Storage Technology policies defined.

[Create a new policy](#)

Duplicate File Resolution Options

Broadcast conflict message to user: ☒

Action to be taken: Show duplicate shadow files


[Submit](#)

ShadowFS Configuration

☐ Load ShadowFS At Boot Time

[Submit](#)

- 7d** Select *Manage NCP Services > Manage Shares*, click *NCP/NSS Bindings*, then verify that the *NCP Accessible* parameter is turned off for the secondary volume, and turned on for the primary volume.

NCP / NSS Bindings 

Warning:
When a NSS Volume is changed to be not accessible via NCP, it will be dismounted immediately as a NCP share point

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input type="radio"/> No: <input checked="" type="radio"/>	ARCVOL1	/media/nss/ARCVOL1
Save Selection		
Yes: <input checked="" type="radio"/> No: <input type="radio"/>	VOL1	/media/nss/VOL1
Save Selection		

[Share Management Home](#)

13.6 Configuring the DST Shadow Volume Cluster Resource with a Cluster-Enabled Pool and a Shared Pool

An alternate way to set up the DST shadow volume cluster resource is to cluster-enable the primary pool, then create a shared pool that is not cluster-enabled as the secondary location. You manually modify the primary cluster pool resource load/unload scripts with the commands needed to load/unload the secondary device and pool and to mount/dismount the pair of volumes as a DST shadow volume.

The main advantage of this method is that a static IP address is not consumed for the secondary pool. It can also be useful in scenarios where you create a shadow relationship to be used temporarily to migrate data to the secondary location, and you later plan to use the new location as an unshared

pool. After you remove the shadow relationship between the primary and secondary volumes, you can mark the secondary pool's device as *Not Shareable for Clustering* to unshare the pool and volume on the device. There are no Cluster objects to clean up in this case. (Of course, this would also automatically unshare any other pools or volumes on the same device, which might not be desirable.)

There are some disadvantages:

- You must manually enter the lines of code in the load/unload scripts for the secondary device and pool.
- To create the shared pool without cluster-enabling it, you must perform some tasks out of the normal order.
- If you later decide to remove the shadow relationship and need to use the secondary pool as an independent cluster resource, the secondary pool must be cluster-enabled by using the Clusters plug-in in iManager.

IMPORTANT: After you modify the primary cluster resource to be used for the shadow volume, the shared pool and volume are managed by the primary pool resource.

Use the information in the following sections to set up the DST shadow volume cluster resource.

- [Section 13.6.1, "Overview of Cluster Resource Setup," on page 155](#)
- [Section 13.6.2, "Creating a Shared Pool That Is Not Cluster-Enabled," on page 156](#)
- [Section 13.6.3, "Disabling the NCP/NSS Bindings for the Secondary Volume," on page 157](#)
- [Section 13.6.4, "Viewing or Modifying the Cluster Load and Unload Scripts," on page 157](#)
- [Section 13.6.5, "Configuring the Load and Unload Scripts for a Shadow Volume," on page 159](#)

13.6.1 Overview of Cluster Resource Setup

For this method, you need two NSS volumes: one in a clustered-enabled pool and one in a pool that is shared, but not cluster-enabled. For instructions for creating the cluster-enabled pool and the primary NSS volume, see [Configuring Cluster Resources for Shared NSS Pools and Volumes](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

To create the secondary shared pool, see [Section 13.6.2, "Creating a Shared Pool That Is Not Cluster-Enabled," on page 156](#).

The cluster load scripts elsewhere in this section assume the following setup for NSS volumes in the clustered shadow volume. Ensure that you use the actual information from your setup.

Setup	Primary NSS Volume	Secondary NSS Volume
Server name for node 1	server38	server38
Cluster server name for node 1	NCS1	NCS1
Cluster pool name	POOL1	ARCPool1
Cluster resource virtual server name	NCS1-POOL1-SERVER	None
Cluster resource IP address	10.10.10.38	None
	You use the IP address for the primary pool's cluster resource for the shadow volume.	

Setup	Primary NSS Volume	Secondary NSS Volume
NSS volume name	VOL1	ARCVOL1
Volume ID on the cluster node	254	253 (not used in the resource)

When the primary volume has a state of *Shadowed*, its NCP volume ID represents the DST shadow volume pair of volumes. A separate NCP volume ID is not assigned to the secondary volume while the volume is in the shadow volume relationship. You use only the ID on the primary volume in the `ncpcon mount` command in the cluster resource load script.

IMPORTANT: In the cluster load and unload scripts, the `add_secondary_ipaddress` and `del_secondary_ipaddress` commands refer to the cluster resource's IP address that is "secondary" to the node's actual IP address. It is not related to the DST volume's terminology.

13.6.2 Creating a Shared Pool That Is Not Cluster-Enabled

- 1 On the server where the primary pool cluster resource is assigned, log in as the `root` user.
- 2 Open a terminal console, and enter `nssmu` to open the NSS Management Utility.
- 3 From the NSSMU main menu, select *Devices* to go to the Device Management page.
- 4 Ensure that the device you want to use as the secondary location is available but is not currently shared.

Do not mark the device as shareable at this time. If devices are present but not showing up for creating pools and volumes, you should initialize the disk.

- 5 From the NSSMU main menu, select *Pools* to go to the Pools Management page.
- 6 Create a pool on the device.

Because the device is not yet shared, the *Cluster Information* page is not part of the pool setup process.

- 7 From the NSSMU main menu, select *Volumes* to go to the Volumes Management page.
- 8 Create a volume on the pool.
- 9 Exit NSSMU.

- 10 In a Web browser, open Novell Remote Manager for the server, then log in as the `root` user.
- 11 In Novell Remote Manager, disable the NCP/NSS Bindings for the NSS volume you created in [Step 8](#).

For instructions, see [Section 10.4.1, "Disabling the NCP/NSS Bindings for an NSS Volume,"](#) on [page 93](#).

The NSS volume is removed from the list of volumes mounted in NCP. However, if you exit Novell Remote Manager and check the volume in NSSMU, you can see that it is still mounted by NSS.

- 12 Exit Novell Remote Manager.
- 13 In a terminal console, enter `nssmu` to open the NSS Management Utility.
- 14 In NSSMU, select *Devices* from the main menu.
- 15 Select the device that contains the NSS volume, then press F6 to mark the device as *Shareable for Clustering*.
This automatically changes the share status of all pools on the device to *Shareable for Clustering*.
- 16 In NSSMU, select *Pools* from the main menu.

- 17 Verify that the share status of the pool is *Shareable for Clustering*.
- 18 Exit NSSMU.

13.6.3 Disabling the NCP/NSS Bindings for the Secondary Volume

- 1 Disable the NCP/NSS bindings for the secondary NSS volume as described in [Section 10.2.2, “Disabling the NCP/NSS Bindings for the Secondary Volume,”](#) on page 89.
- 2 Copy or add the EXCLUDE_VOLUME line to the `/etc/opt/novell/ncp2nss.conf` file on each node in the cluster where you want to run the primary cluster resource. For information, see [Section 13.8, “Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes,”](#) on page 163.

13.6.4 Viewing or Modifying the Cluster Load and Unload Scripts

Initially, you have a load script and an unload script for the primary pool cluster resource. You modify these scripts to also manage the secondary shared pool so that the NSS volumes in the DST shadow volume pair can fail over or be cluster migrated together.




- 1 In iManager, select *Clusters*, then select *Cluster Manager*.
- 2 Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.

Clusters







Cluster Manager ?

cluster: 🔍 📄

Epoch: 2

[server38](#) [server39](#) [server40](#)

Cluster State						
Online Offline Migrate Respond to Alert Refresh▼						
5 Item(s)						
<input type="checkbox"/>	Type	Name	State	Location	Lives	Up Since
<input type="checkbox"/>		Master IP Address Resource	 Running	server38	1	Oct 18, 2007 4:37:54 PM
<input type="checkbox"/>		ARCPOOL1 SERVER	 Running	server38	1	Nov 5, 2007 2:09:41 PM
<input type="checkbox"/>		POOL1 SERVER	 Running	server38	1	Nov 5, 2007 2:06:33 PM

- 3 On the Cluster Manager page, click the *Name* link of the primary cluster resource to go to the Cluster Pool Properties page, then view the load and unload scripts.
- 3a Click the *Scripts* tab to view the load script.

Clusters > Cluster Manager

Cluster Pool Properties: POOL1_SERVER ?

Policies Monitoring Preferred Nodes **Scripts** Protocols Business Continuity

Load Script | Unload Script | Monitor Script

View or edit the load script for this cluster resource.

Script:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns
exit_on_error nss /poolact=POOL1
exit_on_error ncpcon mount VOL1=254
exit_on_error add_secondary_ipaddress 10.10.10.38
exit_on_error ncpcon bind --ncpservname=NCS1-POOL1-SERVER --ipaddress=10.10.10.38
exit 0
```

Timeout:

For example, the following is a sample load script for the POOL1_SERVER resource for the primary clustered pool named POOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

exit_on_error nss /poolact=POOL1
exit_on_error ncpcon mount VOL1=254

exit_on_error add_secondary_ipaddress 10.10.10.38

exit_on_error ncpcon bind --ncpservname=NCS1-POOL1-SERVER --ipaddress=10.10.10.38

#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --add --vserver=virtualserverFDN --ip-addr=virtualserverip

exit 0
```

- 3b On the *Scripts* tab, click the *Unload Script* link to view the unload script.

For example, the following is a sample unload script for the POOL1_SERVER resource for the primary clustered pool named POOL1:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuns

#This line is added if Novell CIFS is used as an advertising protocol
#novcifs --remove --vserver=virtualserverFDN --ip-addr=virtualserverip

ignore_error ncpcon unbind --ncpservname=NCS1-POOL1-SERVER --ipaddress=10.10.10.38
```

```
ignore_error del_secondary_ipaddress 10.10.10.38
ignore_error nss /pooldeact=POOL1

exit 0
```

- 4 Continue with [Section 13.6.5, “Configuring the Load and Unload Scripts for a Shadow Volume,” on page 159.](#)

13.6.5 Configuring the Load and Unload Scripts for a Shadow Volume

When you work with the two volumes as a shadow volume, you must modify the primary resource’s load and unload scripts in order to manage the volumes in a single resource.

- 1 In iManager, deactivate the shared pool.
 - 1a Select *Storage > Pools*.
 - 1b Click the *Object* browser, then locate and select the server where the secondary pool is located.
 - 1c Select the pool, then click *Deactivate*.

- 2 Modify the load script for the primary cluster resource.

Use the [“Sample Load Script for a DST Shadow Volume” on page 146](#) as a guide for what information to add and the order of the commands.

- 2a On the *Clusters > Cluster Options* page, click the name link of the primary pool cluster resource to view its Cluster Pool Properties page, then click the *Scripts* tab.
- 2b On the *Scripts > Load Script* page, add a line before the primary pool activation that will activate the secondary pool.

```
exit_on_error nss /poolact=ARCPPOOL1
```

- 2c (Optional) Add a *sleep* command after the pool activation commands to allow both pools time to be activated before you mount the shadow volume pair.

For example:

```
sleep 10
```

Vary the time (in seconds) according to what is needed for your system.

IMPORTANT: If wait times are added to the load script or unload script, ensure that you increase the script timeout settings accordingly. Otherwise, the script might time out while you are waiting for the action.

- 2d Comment out (or remove) the individual mount command for the primary NSS volume by placing a pound sign (#) at the beginning of the line.

For example:

```
#exit_on_error ncpcon mount VOL1=254
```

- 2e Add the mount command for the shadow volume to the primary load script.

```
exit_on_error ncpcon mount VOL1=254,shadowvolume=ARCVOL1
```

- 2f (Optional) If you are using *shadowfs* to provide the merged file tree view for CIFS/Samba users or for Linux services like *rsync*, you must allow time in the load script after mounting the shadow volume to allow *shadowfs* to become active before continuing.

IMPORTANT: Do not perform this step if you are using Novell CIFS to provide access to CIFS users.

Use one of the following approaches to add a wait time:

- ♦ Add a `sleep 10` command after mount command, and vary it manually until it allows sufficient wait time for shadowfs to start.

```
# If shadowfs is used, wait for shadowfs to start
sleep 10
```

- ♦ Add a script that varies the wait time by checking to ensure that shadowfs is started.

For example:

```
# If shadowfs is used, wait for shadowfs to start
for (( c=1; c<=10; c++ )) do
  if [ ! -d /media/shadowfs/VOLUME/._NETWARE ]; then sleep 5; fi
done
```

IMPORTANT: If wait times are added to the load script or unload script, ensure that you increase the script timeout settings accordingly. Otherwise, the script might time out while you are waiting for the action.

- 2g** Click *Apply* to save your changes.

The changes to the script do not take effect until the cluster resource is taken offline and brought online.

- 3** Modify the unload script for the primary cluster resource.

Use the [“Sample Unload Script for a DST Shadow Volume” on page 146](#) as a guide for what information to add and the order of the commands.

- 3a** Click the name link of the primary cluster resource to view its Cluster Pool Properties page, click the *Scripts* tab, then click *Unload Script*.

3b

```
ignore_error ncpcon unbind --ncpservername=NCS1-POOL1-SERVER --
ipaddress=10.10.10.38
```

- 3c** On the *Scripts > Unload Script* page, add the following command to dismount the shadow volume after the command to dismount the primary pool.

```
ignore_error nss /pooldeact=ARCPPOOL1
```

- 3d** (Optional) If you are using shadowfs to provide a merged file tree view to Samba users, you must unmount the FUSE-mounted file systems that are displayed in the `/media/shadowfs/VOLUME` directory.

IMPORTANT: Do not perform this step if you are using Novell CIFS to provide access to CIFS users.

Add the following line before the unbind command in the unload script:

```
#unload the volume in FUSE
ignore_error fusermount -u /media/shadowfs/VOLUME
```

- 3e** Click *Apply* to save your changes.

- 4** Offline the modified primary cluster resource:

- 4a** In iManager, select *Clusters*, then select *Cluster Manager*.

- 4b** Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.

- 4c** Select the check box next to the primary cluster resource.

- 4d** Click *Offline*.

- 5 Online the modified primary cluster resource:
 - 5a In iManager, select *Clusters*, then select *Cluster Manager*.
 - 5b Select the check box next to the primary cluster resource, then click *Online*.
 - 5c Select the cluster node where you want the resource to load (such as `server38`), then click *OK*.
 - 6 Verify that the primary cluster resource is running by going to the *Clusters > Cluster Manager* page.
- The primary cluster resource is *Running*.
- 7 Verify that the shadow volume (VOL1) is mounted in NCP and is shadowed:
 - 7a On the first node in the cluster, log in to Novell Remote Manager for Linux as the `root` user.
 - 7b Select *View File Systems*, then verify that the secondary pool ARCPPOOL1 and the NSS volume ARCVOL1 are listed under *File Systems*, but the secondary NSS volume is not listed under *NCP Volumes*.

File System Management ?

File Systems		
Mounted Device	Mount Location	
rootfs	/	(95% free)
udev	/dev	(99% free)
/dev/disk/by-id/scsi-36001c230c175cf000e70368e60a6e6fe-part2 /		
proc	/proc	
sysfs	/sys	
debugfs	/sys/kernel/debug	
devpts	/dev/pts	
securityfs	/sys/kernel/security	
adminfs	/admin	
admin	/_admin	(100% free)
/dev/pool/POOL1	/opt/novell/nss/mnt/.pools/POOL1	
/dev/pool/ARCPPOOL1	/opt/novell/nss/mnt/.pools/ARCPPOOL1	
ARCVOL1	/media/nss/ARCVOL1	(99% free)
VOL1	/media/nss/VOL1	(99% free)

NCP Volumes	
SYS	/usr/novell/sys
ADMIN	/_admin
VOL1	/media/nss/VOL1

- 7c** Select *View File Systems > Dynamic Storage Technology Options*, then verify that the primary volume is listed under *Volume Information*, and that its status is *Shadowed*.

Dynamic Storage Technology Options ?

Dynamic Storage Technology allows you optimize the use of your storage by automatically moving data to storage best optimized for the data type or frequency of use. You can create one or more policies to manage, and optimize the use of your storage.

Volume Information		
Volume Name	Shadow Status	
VOL1	Shadowed	Inventory View Log
_ADMIN	No Shadow	Inventory
SYS	Add Shadow	Inventory

No Dynamic Storage Technology policies defined.

[Create a new policy](#)

Duplicate File Resolution Options

Broadcast conflict message to user: ☒

Action to be taken: Show duplicate shadow files

[Submit](#)

ShadowFS Configuration

☐ Load ShadowFS At Boot Time

[Submit](#)

- 7d** Select *Manage NCP Services > Manage Shares*, click NCP/NSS bindings, then verify that the NCP Accessible parameter is turned off for the secondary volume, and turned on for the primary volume.

NCP / NSS Bindings ?

Warning:
When a NSS Volume is changed to be not accessible via NCP, it will be dismounted immediately as a NCP share point

Available NSS volumes		
NCP Accessible	Volume Name	Mount point
Yes: <input type="radio"/> No: <input checked="" type="radio"/>	ARCVOL1	/media/nss/ARCVOL1
Save Selection		
Yes: <input checked="" type="radio"/> No: <input type="radio"/>	VOL1	/media/nss/VOL1
Save Selection		

[Share Management Home](#)

13.7 Removing the Local Definition for a Cluster-Enabled Shadow Volume

If you cluster-enabled an existing shadow volume, you must remove the SHADOW_VOLUME line from the `/etc/opt/novell/ncpserv.conf` file that was added for the local shadow volume. The line is added automatically on a node when the resource is brought online, and removed automatically when the resource is taken offline.

- 1 Log in as the *root* user on the node where you created the shadow volume, then open a terminal console.
- 2 Offline the shadow volume cluster resource by entering

```
cluster offline resource_name
```

- 3 Open the `/etc/opt/novell/ncpserv.conf` file in a text editor.
- 4 Remove the SHADOW_VOLUME line from the file.

```
SHADOW_VOLUME primary_volumename secondary_volume_path
```

For example:

```
SHADOW_VOLUME VOL1 /media/nss/ARCVOL1
```

- 5 Save the file.
- 6 Restart the Novell eDirectory daemon by entering the following commands:

```
rcnssd stop  
rcnssd start
```

13.8 Copying the NCP/NSS Bindings Setting for the Secondary Volume to All Nodes

After you have created the shadow volume cluster resource, copy the NCP/NSS bindings settings for the secondary NSS volume to the `/etc/opt/novell/ncp2nss.conf` file on each node.

For each node in the cluster, do the following:

- 1 Log in to the node as the *root* user.
- 2 Open the `/etc/opt/novell/ncp2nss.conf` file in a text editor.
- 3 Copy or add the `EXCLUDE_VOLUME` line for the secondary volume to the file.

```
EXCLUDE_VOLUME secondary_volumename
```

For example:

```
EXCLUDE_VOLUME ARCVOL1
```

- 4 Save the file.
- 5 Restart the Novell eDirectory daemon by entering the following commands:

```
rcnssd stop  
rcnssd start
```

- 6 Restart the NCP/NSS IPC daemon to synchronize the changes you made to the `/etc/opt/novell/ncp2nss.conf` file. At the terminal console prompt, enter

```
/etc/init.d/ncp2nss restart
```

If the NCP/NSS IPC daemon restarts successfully, the following messages are displayed in the terminal console:

```
Shutting down Novell NCP/NSS IPC daemon...  
Exited  
Starting the Novell NCP/NSS IPC daemon.
```

13.9 Configuring Shadow Volume Policies for the Clustered Shadow Volume

After the load and unload scripts are created, and the shadow volume is online, you are ready to create policies for it. For planning information, see [Section 13.1.6, “DST Shadow Volume Policies in a Cluster,”](#) on page 144.

- 1 Create shadow volume policies for the clustered shadow volume as described in [Chapter 11, “Creating and Managing Policies for Shadow Volumes,”](#) on page 109.
- 2 If a shadow volume policy applies to all policies, copy the policy information to the `/usr/novell/sys/._NETWARE/shadow_policy.xml` file on each node.

13.10 Removing the Shadow Relationship for a Clustered DST Shadow Volume

Removing a clustered DST shadow volume removes the relationship between the primary and secondary storage area and uncouples the load and unload scripts for the clustered pools that contain the two volumes. It does not remove the underlying volumes themselves. The files remain on whichever storage area they are on at the time when you remove the shadow relationship.

- ♦ [Section 13.10.1, “Preparing to Remove a Shadow Volume,”](#) on page 164
- ♦ [Section 13.10.2, “Removing the Shadow Volume Relationship in the Cluster Resource,”](#) on page 165

13.10.1 Preparing to Remove a Shadow Volume

Before you remove a shadow volume relationship, use the following procedure to move data between the two volumes that make up the shadow volume, depending on where you want the data to reside after the DST shadow volume relationship is removed.

- 1 In Novell Remote Manager for Linux, log in as the `root` user.
- 2 Select *View File System > Dynamic Storage Technology Options*, locate the volume in the list, then click the *Inventory* link next to it.

View the volume inventory for the shadow volume to determine the space in use and the available space for both the primary and the secondary areas of the shadow volume. Ensure that there is sufficient free space available in either location for the data that you plan to move to that location.

- 3 Use any combination of the following techniques to move data between the two areas:
 - ♦ **Shadow Volume Policies:** Run an existing shadow volume policy by using the *Execute Now* option in the *Frequency* area of the policy. You can also create a new shadow volume policy that moves specific data, and run the policy by using the *One Time* and *Execute Now* options in the *Frequency* area of the policy.

For information about configuring policies to move data between the primary and secondary areas, see [Chapter 11, “Creating and Managing Policies for Shadow Volumes,”](#) on page 109.

- ♦ **Inventories:** Use the detailed inventory reports or customized inventories to move specific files to either area.

For information about using the volume customized inventory options to move data between the primary and secondary areas, see [Section 12.7, “Generating a Custom Inventory Report,” on page 136.](#)

13.10.2 Removing the Shadow Volume Relationship in the Cluster Resource

- 1 Log in to the master node of the cluster as the `root` user, then open a terminal console.
- 2 If the cluster pool resource for the shadow volume is not running on the master node, cluster migrate it to the master node. At the console prompt, enter

```
cluster migrate resource_name masternode_name
```

- 3 Offline the cluster pool resource that is managing the shadow volume.

```
cluster offline resource_name
```

This unloads the cluster resource and deactivates the cluster pools and their volumes so that the cluster is not controlling them.

- 4 Activate the shared pools and mount the two volumes:

- 4a At the console prompt of the master node, enter

```
nssmu
```

- 4b In the NSSMU menu, select *Pools*, then press Enter.

- 4c Select the primary pool, then press F7 to activate it.

- 4d Select the secondary pool, then press F7 to activate it.

- 4e Press Esc to return to the NSSMU menu, select *Volumes*, then press Enter.

- 4f Select the primary volume, then press F7 to mount it.

- 4g Select the secondary volume, the press F7 to mount it.

- 4h Press Esc twice to exit NSSMU.

- 5 Remove the shadow volume relationship between the two volumes:

- 5a In Novell Remote Manager for Linux, log in as the `root` user. to the master node.

- 5b Select *Manage NCP Services > Manage Shares* to go to the NCP Shares page.

- 5c On the NCP Shares page, locate the primary NSS volume in the *Active Shares* list, then click the *Unmount* button next to the share name.

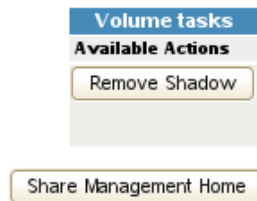


- 5d On the Manage Shares page, click the *Information* (i) icon next to the volume name of the NSS volume to access the *Remove Shadow Action Options*.



- 5e On the volume's Share Information page under *Volume Tasks > Remove Shadow Action Options*, click *Remove Shadow*.

VOL1 Share Information



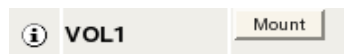
After the shadow volume is removed, the page refreshes to report a successful removal.

Remove Shadow from Volume VOL1

Volume task has completed successfully



- 5f Select *Share Management* to go to the NCP Shares page, locate the volume that was the primary volume in the *Active Shares* list, then click the *Mount* button next to it.



- 5g Verify that the shadow volume was removed by using one of the following methods:

- ♦ Select *View File System > Dynamic Storage Technology Options* to go to the Dynamic Storage Options page. The former primary volume now has an *Add Shadow* link next to it instead of a *Shadowed* link.

Volume Information		
Volume Name	Shadow Status	
① VOL1	Add Shadow	Inventory
① _ADMIN	No Shadow	Inventory
① SYS	Add Shadow	Inventory

- ♦ Select *Manage NCP Services > Manage Shares*, then click the *Information* icon next to the former primary volume's name. The *File System Shadow Path* field displays n/a (not applicable).

File system path	/media/nss/VOL1
File system shadow path	n/a

- 6 Enable the NCP/NSS Bindings on the volume that was used as the secondary volume (for example, ARCVOL) in order to mount the volume for NCP.

For information, see [Section 10.4.2, “Enabling the NCP/NSS Bindings for an NSS Volume,” on page 93](#).

- 7 In NSSMU, deactivate the pools for both the primary and secondary volumes.

This automatically unmounts the shared volumes. This allows the cluster resources to be managed by their respective cluster resources after you modify the load and unload scripts in the next steps.

7a At the console prompt of the master node, enter

```
nssmu
```

7b In the NSSMU menu, select *Pools*, then press Enter.

7c Select the primary pool, then press F7 to deactivate it.

7d Select the secondary pool, then press F7 to deactivate it.

7e Press Esc twice to exit NSSMU.

8 Modify the load script of the cluster pool resource that was managing the clustered shadow volume pair:

8a In iManager, select *Clusters*, then select *Cluster Manager*.

8b Click the *Object* browser, then locate and select the cluster server node to view a list of cluster resources.

8c On the Cluster Manager page, click the name link of the primary cluster resource to view its Cluster Pool Properties page, then click the *Scripts* tab.

8d On the *Scripts > Load Script* page, comment out the activation command for the secondary pool, the sleep command you added for the pool activation, and the mount command for the shadow volume:

```
#exit_on_error nss /poolact=ARCP00L1
#sleep 10
#exit on error ncpcon mount VOL1=254,shadowvolume=ARCVOL1
```

8e On the *Scripts > Load Script* page, uncomment the mount command for the primary pool's volume that you commented out when you set up the clustered shadow volume. For example:

```
exit_on_error ncpcon mount VOL1=254
```

8f Click *Apply* to save your changes.

The changes do not take effect until the cluster resource is brought online.

9 Modify the unload script of the cluster pool resource that was managing the clustered shadow volume pair:

9a On the *Scripts > Load Script* page, click the *Unload Script* link.

9b On the *Scripts > Unload Script* page, comment out or remove the deactivation command for the secondary pool:

```
#ignore_error nss /pooldeact=ARCP00L1
```

9c Click *Apply* to save your changes.

The changes do not take effect until the cluster resource is brought online.

10 Online the cluster pool resources for the two pools:

10a Select *Clusters*, then select *Cluster Manager* to view the list of cluster resources.

10b Select the check boxes next to the two cluster pool resources, then click *Online*.

IMPORTANT: If you deleted the pool cluster resource for the secondary volume when you merged information from the two scripts into one, you must first cluster enable the shared pool again to create a new cluster pool resource for it, then online it. For information, see [“Cluster-Enabling an Existing NSS Pool and Its Volumes”](#) in the *OES 11: Novell Cluster Services 2.0 for Linux Administration Guide*.

10c Select the cluster node where you want the resources to load (such as `server38`), then click *OK*.

11 Verify that the cluster resources are running by going to the *Clusters > Cluster Manager* page.

12 Verify that the two volumes (`VOL1` and `ARCVOL1`) are mounted independently in NCP:

12a On the first node in the cluster, log in to Novell Remote Manager for Linux as the `root` user.

12b Select *View File Systems*, then verify that the secondary pool `ARCPPOOL1` and the NSS volume `ARCVOL1` are listed under *NCP Volumes*.

12c Select *View File Systems > Dynamic Storage Technology Options*, then verify that both of the volumes are listed under *Volume Information*, and that they are no longer shadowed (the *Add Shadow* link is next to each one).

12d Select *Manage NCP Services > Manage Shares*, click *NCP/NSS Bindings*, then verify that the *NCP Accessible* parameter is enabled for both of the volumes.

14 Troubleshooting for DST

This section describes issues and possible workarounds for Dynamic Storage Technology (DST) for Novell Open Enterprise Server (OES) 11.

- ♦ [Section 14.1, “My NCP server information is set to: LOCAL_CODE_PAGE CP437. Why is it not using UTF-8?” on page 169](#)
- ♦ [Section 14.2, “A File is listed twice in a directory,” on page 169](#)
- ♦ [Section 14.3, “Users cannot see some files and directories,” on page 170](#)
- ♦ [Section 14.4, “Cross-protocol locking stops working,” on page 170](#)
- ♦ [Section 14.5, “Novell Remote Manager connection error when you are working on the DST Options page,” on page 170](#)

14.1 My NCP server information is set to: LOCAL_CODE_PAGE CP437. Why is it not using UTF-8?

All interaction with the Linux file system uses UTF-8. However, for backward compatibility with older Novell Clients, most of the NCPs use a server-defined local code page setting. The more recently defined Case 89 NCPs use UTF-8. We recommend that you configure your client to use them. If all of your clients are using the newer UTF-8 Case 89 NCPs, then there is no need to set the server's local code page.

14.2 A File is listed twice in a directory

If a file happens to be located in the same directory on both the primary and secondary storage, the file name is listed twice in the directory listing. However, all file operations are directed to the file on the primary system.

To resolve this problem, you can rename one instance of the file to make both versions of the file available under different names. Then open the files to determine which version to keep.

You can control how DST handles duplicate files by configuring global policies. For information, see [Section 9.3, “Resolving Instances of Duplicate Files,” on page 76](#).

14.3 Users cannot see some files and directories

If the secondary storage location becomes unavailable, it appears to users that some of their files and directories are suddenly missing. When the secondary storage location is back online, the files and directories are visible again.

Users might also observe that some files appear to be missing if NCP Server is having performance issues. Some tuning of NCP Server caching is recommended depending on the server RAM, volume size, number of files, and number of trustees accessing the volumes. For information about tuning issues for NCP Server, see *TID 7004888: NCP Performance Tuning on Open Enterprise Server 2 Linux* (<http://www.novell.com/support/>) in the Novell Knowledgebase.

14.4 Cross-protocol locking stops working

Cross-protocol locking allows CIFS/Samba users or Novell CIFS users to concurrently access files along with NCP users by allowing only one user at any time to open the file for write. Multiple users who are accessing via these protocols can open a file for read only.

WARNING: Allowing users who access files via different protocols to concurrently open a file for write can lead to data corruption.

NCP Server for Linux provides cross-protocol locking for NCP users, Novell CIFS users, and Linux CIFS/Samba users. Novell CIFS supports cross-protocol locking to coordinate with NCP.

If cross-protocol locking is enabled for NCP Server for Linux but stops working for DST shadow volume pairs—that is, multiple users can open a file for read and write—it is probably because ShadowFS needs to be restarted. To resolve this problem, stop the shadowfs process, then start shadowfs. For information, see [Section 5.11, “Starting and Stopping ShadowFS Manually,” on page 42](#).

14.5 Novell Remote Manager connection error when you are working on the DST Options page

When you are working on the Dynamic Storage Technology Options page, Novell Remote Manager returns the following connection error: The connection to the server was reset while the page was loading.

To resolve this issue, you must restart the Novell Remote Manager (httpstkd) and Apache (rcapache2) daemons.

15 Security Considerations

This section describes security issues and recommendations for Dynamic Storage Technology (DST) for Novell Open Enterprise Server (OES) 11. It is intended for security administrators or anyone who is using DST and is responsible for the security of the system. It requires a basic understanding of NetWare Core Protocol (NCP) Server and DST. It also requires the organizational authorization and the administrative rights to carry out the configuration recommendations.

- [Section 15.1, “Client Access,” on page 171](#)
- [Section 15.2, “Linux-Enabled eDirectory Users,” on page 171](#)
- [Section 15.3, “Using File System Trustees and Rights,” on page 172](#)
- [Section 15.4, “Server-to-Server Access,” on page 172](#)
- [Section 15.5, “Hidden Directories and Files,” on page 172](#)
- [Section 15.6, “Shadow Volumes Audit Logs,” on page 173](#)
- [Section 15.7, “Shadow File System Audit Logs,” on page 173](#)
- [Section 15.8, “NCP Server Auditing and Log Files,” on page 173](#)
- [Section 15.9, “Using Secure Remote Connections,” on page 173](#)

15.1 Client Access

NCP clients can access a merged view of data on the shadow volume through the normal NCP Server.

Novell CIFS clients can access a merged view of data on shadow volumes built with NSS volumes. Novell CIFS leverages the NCP Server cache.

Novell AFP does not support DST.

Linux CIFS/Samba clients can access a merged view of data on a shadow volume through ShadowFS and FUSE. These users must be Linux-enabled through Linux User Management.

Other client protocols such as FTP, HTTP, and NFS are not supported.

15.2 Linux-Enabled eDirectory Users

Dynamic Storage Technology requires that all users of the shadow volume be users that are defined in Novell eDirectory. For information, see the [Novell eDirectory 8.8 Administration Guide](#).

CIFS/Samba users must be enabled for Linux with Linux User Management. This is true for NCP volumes on Linux POSIX file systems (Ext3 and Reiser) and for NSS volumes on Linux and NetWare. The [OES 11: Novell Linux User Management Administration Guide](#) describes how to Linux-enable users for an OES 11 server.

15.3 Using File System Trustees and Rights

Dynamic Storage Technology requires that file system access control for data be managed by using the Novell Trustee Model for file system trustees and trustee rights.

For all NCP volumes (NSS and NCP on Linux POSIX volumes), the trustee information is obtained at volume mount time from the `._NETWARE/.trustee_database.xml` file. When trustee changes are made, this trustee database file is updated. Because this file is located on the volume, it follows the volume from node to node as it moves around the cluster.

NCP trustee information is synchronized with the NSS file system. When an NCP user makes a trustee change, the NCP Server informs NSS of the change. When NSS changes a trustee assignment, it generates an event that the NCP Server listens for so NCP can keep up to date on NSS changes. When DST is involved, events from the secondary NSS volume are also noted, and trustee changes are also synchronized with it.

IMPORTANT: For NCP volumes, ensure that the *Inherit POSIX Permissions* option is disabled (the default setting). When this setting is disabled, the local Linux environment access is restricted to the root user and the file owner or creator, which is the most secure configuration. For information, see [“Configuring Inherit POSIX Permissions for an NCP Volume”](#) in the *OES 11: NCP Server for Linux Administration Guide*.

Rights and trustee management across multiple file systems should all be managed with the NCP tools. There are rights model mapping problems with using a POSIX rights model on NCP volumes, and vice versa.

15.4 Server-to-Server Access

iSCSI is the only protocol supported for server-to-server access that allows a remote volume to be used as a primary or secondary storage area for a shadow volume.

15.5 Hidden Directories and Files

- ♦ [Section 15.5.1, “Trustee Database,” on page 172](#)
- ♦ [Section 15.5.2, “Available Space Trends,” on page 172](#)

15.5.1 Trustee Database

A copy of the trustee database is placed in the `._NETWARE` subdirectory in both the primary tree and the shadow tree.

15.5.2 Available Space Trends

An available space trend data file is placed in the `._NETWARE` directory in both the primary tree and the shadow tree. It is used by the volume inventory option in Novell Remote Manager for Linux.

15.6 Shadow Volumes Audit Logs

An audit log for a DST shadow volume is located in the `._NETWARE` directory at the root of the primary volume. For NSS volumes, the default file path for the log is `/media/nss/volumename/._NETWARE/volumename.audit.log`. All moves between the primary storage area and the secondary storage area are logged as events to the shadow volume's audit log.

For example, if the primary area is named `VOL1`, the audit file is `/media/nss/VOL1/._NETWARE/VOL1.audit.log`.

15.7 Shadow File System Audit Logs

Audit logs for the Shadow File System are located in the `/var/opt/novell/log/shadowfs.log` file.

15.8 NCP Server Auditing and Log Files

The following log files are located in the `/var/opt/novell/log` directory:

- ♦ `ncpserv.log`
- ♦ `ncp2nss.log`
- ♦ `ncptop.log`

Log files are managed by `logrotate`. For information on usage, see its man page (`man logrotate`).

The control files for `logrotate` are:

- ♦ `/etc/logrotate.d/novell-ncpserv-log`
- ♦ `/etc/logrotate.d/novell-ncpserv-audit`
- ♦ `/etc/logrotate.d/novell-ncp2nss-log`
- ♦ `/etc/logrotate.d/novell-ncp2nss-audit`

By default, the rollover size is 16 MB and 5 compressed copies are kept.

15.9 Using Secure Remote Connections

If the primary storage area or secondary storage area is connected across remote connections, the connection must be secure. For example, use a virtual private network (VPN) or a private WAN connection.

IMPORTANT: iSCSI is the only protocol supported for remote server-to-server connections.

Ensure that authentication, encryption, and data integrity are secure when accessing and transferring data across the network. For example, if sensitive data is written to the primary volume, that data might be written to the secondary volume, depending on shadow policies in place. If there is an anonymous NFS mount for the shadow volume, the data is transferred in the clear over the network, where it might be prone to attacks or capture. In this case, you want to ensure that only authenticated users are able to access the NFS mount and that the connection between the servers is secure.

A Commands and Utilities for Dynamic Storage Technology

This section describes commands and utilities for Dynamic Storage Technology (DST) for Novell Open Enterprise Server (OES) 11 for Linux.

- ♦ [Section A.1, “Using NCPCON for DST Commands,” on page 175](#)
- ♦ [Section A.2, “DST Commands for NCPCON,” on page 176](#)
- ♦ [Section A.3, “DST Commands for NCPCON for Use with Novell Cluster Services for Linux Clusters,” on page 180](#)
- ♦ [Section A.4, “Configuring Global DST Policies by Using the SET Command,” on page 182](#)
- ♦ [Section A.5, “DST Commands for /etc/opt/novell/ncpserv.conf,” on page 185](#)
- ♦ [Section A.6, “DST Commands for /etc/opt/novell/shadowfs.conf,” on page 187](#)
- ♦ [Section A.7, “DST EXCLUDE_VOLUME Command for /etc/opt/novell/ncp2nss.conf,” on page 187](#)
- ♦ [Section A.8, “DST Shadow Volume Information in /etc/NCPVolumes,” on page 188](#)
- ♦ [Section A.9, “DST ShadowFS Volume Information in /etc/mtab.shadowfs,” on page 188](#)

A.1 Using NCPCON for DST Commands

The NetWare Core Protocol (NCP) Console Command (NCPCON) utility provides an interface for issuing NetWare commands in a Linux environment. You can issue commands via the NCPCON in three modes:

- ♦ [Section A.1.1, “Interactive Mode,” on page 175](#)
- ♦ [Section A.1.2, “Command Line Mode,” on page 176](#)
- ♦ [Section A.1.3, “Scripting Mode,” on page 176](#)

A.1.1 Interactive Mode

Open a terminal console, log in as the `root` user, then enter

```
ncpcon
```

This opens the NCPCON interactive console in the terminal console, so you can enter the NCP Server console commands. Enter `exit` to stop interactive mode.

Escaping the quotation mark character (") is not required when you enter the command from the `ncpcon` prompt.

For example, enter the following commands from the `ncpcon` prompt:

```
mount sys
```

```
shift VOL1:"path\file name with spaces.txt" shadow
send "hello world" to all
```

A.1.2 Command Line Mode

For command line mode, issue an NCP Server command at a terminal console prompt by prepending the command with `ncpcon`:

```
ncpcon [command]
```

When you use `ncpcon` to issue commands directly from the console command prompt, you must escape the quotation mark character (") by preceding the character with a backslash (\), such as \".

For example, enter the following commands from the terminal console prompt:

```
ncpcon mount sys
ncpcon shift VOL1:\"path\file name with spaces.txt\" shadow
ncpcon send \"hello world\" to all
```

A.1.3 Scripting Mode

For scripting mode, issue the NCP Server command in the script by prepending the command with `ncpcon`, then placing quotation marks (") around the NCP Server command:

```
ncpcon "[command]"
```

If the command includes a field that must be contained in quotation marks (such as a file name), you must escape each internal quotation mark character (") with a backslash (\) character, such as \".

For example, place the following commands in a script file:

```
ncpcon "mount sys"
ncpcon "shift VOL1:\"path\file name with spaces.txt\" shadow"
ncpcon "send \"hello world\" to all"
```

A.2 DST Commands for NCPCON

The commands in this section can be used only with the NCP Console Command utility. You can issue the commands from the NCP Console interactive mode, or prepend the command with `ncpcon` when issuing it from a script or at a terminal console prompt as the `root` user. For information, see [Section A.1, "Using NCPCON for DST Commands," on page 175](#).

create shadow_volume <primary_volumename> <shadow_path>

Creates a non-clustered shadow association between a primary NSS volume and secondary NSS volume, and adds the SHADOW_VOLUME mount information to the `/etc/opt/novell/ncpserv.conf` file.

When you issue the command from the NCP Console, you do not need to restart `ndsd` in order for the changes to take effect. When you issue the command from a Linux prompt, you must restart `ndsd` in order for the changes to take effect.

OPTIONS

primary_volumename

Specifies the volume name for the primary NSS volume, such as VOL1.

shadow_path

Specifies the Linux path of the mount location for the secondary NSS volume, such as /media/nss/ARCVOL1.

EXAMPLES

create shadow_volume VOL1 /home/shadows/VOL1

Creates a shadow volume where VOL1 is the primary storage area and /home/shadows/VOL1 is its mount point as a shadow volume.

remove shadow_volume [/l] [/i] [/f] <primary_volumename>

Removes the non-clustered shadow relationship between a primary NSS volume and a secondary NSS volume, and removes the SHADOW_VOLUME command from the /etc/opt/novell/ncpserv.conf file. You must unmount the volume before you issue the command.

IMPORTANT: You can use this command as part of the process to unlink the primary and secondary volumes of a non-clustered DST shadow volume. For information, see [Section 10.12, “Removing the Shadow Relationship for a Non-Clustered DST Shadow Volume,”](#) on page 104.

Typically, you specify the /l option, which leaves the files in place on the primary volume and secondary volume, and removes the shadow relationship. This is equivalent to the *Volume Tasks > Remove Shadow Action Options > Remove Shadow* option in Novell Remote Manager.

When the /l option is not used, the command attempts to move all files on the secondary volume to the primary volume, and then removes the shadow relationship between the two volumes. Ensure that the primary volume has sufficient space to accommodate the files before you unmount the volume and issue the remove command. Moving the files can take some time, depending on how much data must be moved. If a file move fails, the unlinking of the shadow relationship also fails. You can use the /i option to ignore file move errors and allow the unlinking to succeed. After the files on the secondary volume have been moved to the primary volume, the shadow relationship is removed, and a summary report is created and displayed.

OPTIONS

primary_volumename

Specifies the volume name for the primary NSS volume, such as VOL1.

/l

Leaves the files in place on the two volumes and removes the shadow relationship.

/i

Ignores any file move errors that might occur if you issue the command without the /l option, and allows the unlinking of the shadow relationship to succeed.

For example, if there are duplicate files on the volumes, the duplicate instance on the secondary volume cannot be moved to the primary volume, and the shadow relationship cannot be unlinked. Using the /i option ignores the file move error and allows the relationship to be unlinked.

/f

Provides a full detail report of actions taken. Use this option to understand which file moves might be failing.

EXAMPLES

Issue the following commands from the NCP Console, or add ncpcon at the front of the command when issuing it from a script or at a terminal console prompt.

ncpcon remove shadow_volume /i /f VOL1

Removes the shadow relationship for shadow volume VOL1, and moves all files from the secondary storage area to the primary storage area. You must dismount VOL1 before you issue this command. File move errors are ignored. Full details of the actions taken are reported.

remove shadow_volume /l VOL1

Removes the shadow relationship for shadow volume VOL1, and leaves files where they currently are on the secondary storage area and the primary storage area. You must dismount VOL1 before you issue this command.

shadow <primary_volumename> operation=<lp | ls | mp | ms> [options]

Allows you to list files on the shadow volume, or to move files between the primary storage area and the secondary storage area based on specified criteria. All files on the selected shadow volume that match the criteria are moved. Use the command from within cron jobs to automate data partitioning.

OPERATION OPTIONS

lp

Lists primary files. Lists all files currently residing on the primary storage area.

ls

Lists shadow files. Lists all files currently residing on the secondary storage area.

mp

Moves files to primary. Moves files that match the specified criteria to the primary storage area from the secondary storage area.

ms

Moves files to shadow. Moves files that match the specified criteria to the secondary storage area from the primary storage area.

OPTIONS

primary_volumename

Specifies the volume name for the primary NSS volume, such as VOL1.

pattern="searchPattern"

Specifies the file pattern to match against.

owner="username.context"

Specifies the Novell eDirectory user name and context of the owner of the files to match against.

uid=uidValue

Specifies the Linux user ID to match against.

time=[time_field]

Specifies which time field to match against, where the *time_field* is:

[m][a][c]

- ♦ **m:** Last time modified (content)
- ♦ **a:** Last time accessed
- ♦ **c:** Last time changed (metadata)

range=[*time_period*]

Specifies which time period to match against, where the *time_period* is:

[a][b][c][d][e][f][g][h][i][j]

- ♦ **a:** Within last day
- ♦ **b:** 1 day to 1 week
- ♦ **c:** 1 week to 2 weeks
- ♦ **d:** 2 weeks to 1 month
- ♦ **e:** 1 month to 2 months
- ♦ **f:** 2 months to 4 months
- ♦ **g:** 4 months to 6 months
- ♦ **h:** 6 months to 1 year
- ♦ **i:** 1 year to 2 years
- ♦ **j:** More than 2 years

size=[*size_differential*]

Specifies the size differential to match against, where the *size_differential* is:

[a][b][c][d][e][f][g][h][i][j][k]

- ♦ **a:** Less than 1 KB
- ♦ **b:** 1 KB to 4 KB
- ♦ **c:** 4 KB to 16 KB
- ♦ **d:** 16 KB to 64 KB
- ♦ **e:** 64 KB to 256 KB
- ♦ **f:** 256 KB to 1 MB
- ♦ **g:** 1 MB to 4 MB
- ♦ **h:** 4 MB to 16 MB
- ♦ **i:** 16 MB to 64 MB
- ♦ **j:** 64 MB to 256 MB
- ♦ **k:** More than 256 MB

output="*filename*"

Outputs the search results to the specified file.

EXAMPLES

shadow VOL1 operation=ls pattern="*.exe"

Lists all files of type EXE that currently reside on the secondary storage area for the shadow volume VOL1.

shadow VOL1 operation=lp size=g

Lists all files of sizes between 1 MB to 4 MB that currently reside on the primary storage area for the shadow volume VOL1.

shadow VOL1 operation=ms time=m range=j

Moves all files on the primary storage area that have not been modified in more than two years from the primary storage area to the secondary storage area for the shadow volume VOL1.

shift "*primary_volumename*:*\path\filename*" [*primary* | *shadow*]

Returns the specified file's location as being on the primary storage area or secondary storage area. Specify the primary or secondary options to move the specified file from its current location to the specified storage area.

IMPORTANT: The `shift` command works only at the command line, and not in `ncpcon` interactive mode. Enter the command as the `root` user at a terminal console prompt.

OPTIONS

primary

Moves the specified file from the secondary storage area to the primary storage area. The file must be closed when you issue the command; otherwise, the command fails.

shadow

Moves the specified file from the primary storage area to the secondary storage area. The file must be closed when you issue the command; otherwise, the command fails.

EXAMPLES

Enter the commands as the `root` user at a terminal console prompt.

ncpcon shift VOL1:"path\textfile.txt"

Shows the specified file's storage area location in the shadow volume as primary (the primary storage area) or shadow (the secondary storage area) for the shadow volume `sys`.

ncpcon shift VOL1:"path\textfile.txt" primary

Moves the specified file's storage area location from the secondary storage area to the primary storage area for the shadow volume `sys`.

ncpcon shift VOL1:"path\textfile.txt" shadow

Moves the specified file's storage area location from the primary storage area to the secondary storage area for the shadow volume `sys`.

A.3 DST Commands for NCPCON for Use with Novell Cluster Services for Linux Clusters

NCPCON supports the commands in this section for use with Dynamic Storage Technology in combination with Novell Cluster Services for Linux clusters.

Use the syntax examples in this section in cluster load scripts to mount the volume in a cluster. With clustering, no changes are needed to the `ncpserv.conf` file for shadowing. The primary volume information should not be manually added to the `ncpserv.conf` file.

When the primary volume has a state of *Shadowed*, the volume ID that you assign as its NCP volume ID represents the DST shadow volume pair of volumes. The secondary volume does not have a separate volume ID when it is in the shadow relationship.

A.3.1 Scenario 1: Primary NSS and Shadow NSS

ncpcon mount volumename=volID,SHADOWVOLUME=shadow_volumename

Use this command in a cluster load script when the primary volume is an NSS volume and the secondary volume is an NSS volume. Both NSS volumes must already exist and be mounted in NSS.

Replace *volID* with a value from 0 to 254 as the server volume ID to ensure that the volume has the same ID on all servers when it is mounted in a cluster resource.

EXAMPLE

```
ncpcon mount VOL1=254,SHADOWVOLUME=ARCVOL1
```

Mounts the NSS volume named VOL1 with a volume ID of 254. The primary volume is an existing NSS volume named VOL1 (/media/nss/VOL1). The secondary volume is an existing NSS volume named ARCVOL1 (/media/nss/ARCVOL1).

A.3.2 Scenario 2: Primary Non-NSS and Shadow Non-NSS (Not supported)

```
ncpcon mount volumename=volID,SHADOWPATH=shadowpath,path=primarypath
```

Use this command when the primary volume is a non-NSS volume and the secondary volume is a non-NSS volume.

Replace *volID* with a value from 0 to 254 as the server volume ID to ensure that the volume has the same ID on all servers when it is mounted in a cluster resource.

EXAMPLE

```
ncpcon mount VOL1=254,SHADOWPATH=/media/ncpvolumes/ARCVOL1,path=/media/ncpvolumes/VOL1
```

Mounts the NCP volume named VOL1 with a volume ID of 254. The primary volume's path is /media/ncpvolumes/VOL1. The secondary volume's path is /media/ncpvolumes/ARCVOL1.

A.3.3 Scenario 3: Primary Non-NSS and Shadow NSS (Not supported)

```
ncpcon mount volumename=volID,SHADOWVOLUME=shadow_volumename,path=primarypath
```

Use this command when the primary volume is a non-NSS volume and the secondary volume is an NSS volume. The NSS volume must already exist on the system and be mounted in NSS.

Replace *volID* with a value from 0 to 254 as the server volume ID to ensure that the volume has the same ID on all servers when it is mounted in a cluster resource.

EXAMPLE

```
ncpcon mount VOL1=254,SHADOWVOLUME=ARCVOL1,path=/media/ncpvolumes/VOL1
```

Mounts the NCP volume named VOL1 with a volume ID of 254. The primary volume's path is /media/ncpvolumes/VOL1. The secondary volume is an existing NSS volume named ARCVOL1 (mounted at /media/nss/ARCVOL1).

A.3.4 Scenario 4: Primary NSS and Shadow Non-NSS (Supported for the Remote Secondary NSS Volume in the Technology Preview)

```
ncpcon mount volumename=volID,SHADOWPATH=shadowpath
```

Use this command when the primary volume is an NSS volume and the secondary volume is a non-NSS volume. The NSS volume must already exist on the system and be mounted in NSS. The remote server must reside in the same Novell eDirectory partition and tree as the DST server.

Replace *volID* with a value from 0 to 254 as the server volume ID to ensure that the volume has the same ID on all servers when it is mounted in a cluster resource.

EXAMPLE

```
ncpcon mount VOL1=254,SHADOWPATH=/media/ncpvolumes/ARCVOL1
```

Mounts an NSS volume named VOL1 with a volume ID of 254. The primary volume is an existing NSS volume named VOL1 (/media/nss/VOL1). The secondary volume is an NCP volume named ARCVOL1 that is mounted at /media/ncpvolumes/ARCVOL1.

A.4 Configuring Global DST Policies by Using the SET Command

DST provides several global parameters for the SET command that can be used to customize DST for a given server. These settings control how DST behaves for all shadow volumes on the server. Initially, the parameters and default settings are in force, but the parameters are not explicitly added to the /etc/opt/novell/ncpserv.conf file. After you modify its default setting, an entry for the parameter and its new setting are added to the file. The parameter entry remains in the file even if you modify the setting back to the default.

IMPORTANT: If you use DST shadow volumes in a cluster, ensure that you set the same global policies on each OES 11 node in the cluster where you plan to fail over the shared volumes.

- ♦ [Section A.4.1, “Understanding DST Parameters for the SET Command,” on page 183](#)
- ♦ [Section A.4.2, “Using Novell Remote Manager to Configure DST Parameters for the SET Command,” on page 184](#)
- ♦ [Section A.4.3, “Using the ncpcon set Command to Configure DST Parameters,” on page 185](#)

A.4.1 Understanding DST Parameters for the SET Command

Table A-1 lists the DST parameters for the SET command with their default values and valid options.

Table A-1 *Manage NCP Services > Manage Server > Server Parameter Information*

Parameter Name and Description	Default Value	Valid Values
DUPLICATE_SHADOW_FILE_ACTION Controls how duplicate files conflicts are handled. For information, see Section 9.3.1, “Understanding Conflict Resolution for Duplicate Files,” on page 77.	0	0 - Show duplicate shadow files (default) 1 - Hide duplicate shadow files 2 - Rename duplicate shadow files 3 - Delete duplicate files from shadow area 4 - Move duplicate shadow files to / ._DUPLICATE_FILES
DUPLICATE_SHADOW_FILE_BROADCAST Controls whether broadcast messages are sent to NCP users whenever duplicate files conflicts occur. For information, see Section 9.3.1, “Understanding Conflict Resolution for Duplicate Files,” on page 77.	1	0 - Disable 1 - Allow
REPLICATE_PRIMARY_TREE_TO_SHADOW Controls how the primary tree is replicated from the primary tree to the shadow tree. By default, it is disabled, and paths are replicated to the secondary storage area when data is actually moved from the primary location to the secondary location. If it is enabled, the entire tree is replicated even if no files in a path have been moved to the secondary storage location. For information, see Section 9.1, “Replicating Branches of the Primary File Tree in the Secondary File Tree,” on page 71.	0	0 - Disable 1 - Allow
SHIFT_MODIFIED_SHADOW_FILES Controls whether a file is moved from the secondary file tree to the primary file tree based on its modification time. For information, see “Shift Modified Shadow Files” on page 73.	1	0 - Disable 1 - Allow
SHIFT_ACCESSED_SHADOW_FILES Controls whether a file is moved from the secondary file tree to the primary file tree if it is accessed twice during a specific period of time. Use with SHIFT_DAYS_SINCE_LAST_ACCESS to specify the period of time. For information, see “Shift Accessed Shadow Files” on page 73.	0	0 - Disable 1 - Allow

Parameter Name and Description	Default Value	Valid Values
SHIFT_DAYS_SINCE_LAST_ACCESS	1	0 - Disable 1 to 365 (in days)
Specifies the number of days to use when determining if a file should be moved back to the primary storage area. When it is used with SHIFT_ACCESSED_SHADOW_FILES, the parameter sets the time when files are migrated back to the primary storage area after the second access within the specified elapsed time.		

A.4.2 Using Novell Remote Manager to Configure DST Parameters for the SET Command

You can configure the DST parameters for the SET command by using Novell Remote Manager for Linux.

- 1 In Novell Remote Manager for Linux, select *Manage NCP Services*, then select *Manage Server*.
- 2 In the *Set Parameter Information* table, locate the DST parameter you want to configure.

The following server parameters are available. The settings shown are the default values. For information, see [Section A.4.1, “Understanding DST Parameters for the SET Command,” on page 183](#).

DUPLICATE_SHADOW_FILE_ACTION	0
DUPLICATE_SHADOW_FILE_BROADCAST	1
REPLICATE_PRIMARY_TREE_TO_SHADOW	0
SHIFT_ACCESSED_SHADOW_FILES	0
SHIFT_MODIFIED_SHADOW_FILES	1
SHIFT_DAYS_SINCE_LAST_ACCESS	1

- 3 Modify settings by clicking the link for the value in the *Parameter Value* column to open a page where you can change the value.
- 4 In *New Value*, type the value for the parameter, then click *Change* to save and apply the setting.

Current Value	New Value
1	<input type="text" value="0"/> <input type="button" value="change"/>
<input type="button" value="Back"/>	

- 5 If you enabled DUPLICATE_SHADOW_FILE_BROADCAST, ensure that NCP Server is configured to support broadcast messages by verifying that the Disable Broadcast (DISABLE_BROADCAST) parameter for the SET command is disabled:
 - 5a In Novell Remote Manager for Linux, select *Manage NCP Services*, then select *Manage Server*.
 - 5b In the *Set Parameter Information* table, locate the DISABLE_BROADCAST parameter, then view the current value of the parameter. By default, the parameter is disabled (set to 0), which means that NCP Server supports broadcast messages.

DISABLE_BROADCAST	0
-------------------	-------------------

- 5c If the `DISABLE_BROADCAST` parameter is enabled (set to 1), click the link for the value in the *Parameter Value* column to open a page where you can change the value.

DISABLE_BROADCAST	1

- 5d In *New Value*, type 0, then click *Change* to save and apply the settings that disable the `DISABLE_BROADCAST` parameter, which enables broadcasting for NCP Server.

IMPORTANT: Messages are received only by logged-in users who are using Novell Client versions that are capable of receiving broadcast messages, and that are configured to receive them.

DISABLE_BROADCAST	
Current Value	New Value
1	<input type="text" value="0"/>
<input type="button" value="Change"/>	
<input type="button" value="Back"/>	

A.4.3 Using the `ncpcon set` Command to Configure DST Parameters

- 1 Open a terminal console on the Linux server, then log in as the `root` user.
- 2 At the terminal console prompt, enter

```
ncpcon set parameter_name=value
```

Replace *parameter_name* and *value* with the settings you want to change.

IMPORTANT: Ensure that you enter the commands in lowercase.

For example, the following commands set the DST parameters to their default values.

```
ncpcon set duplicate_shadow_file_action=0
ncpcon set duplicate_shadow_file_broadcast=1
ncpcon set replicate_primary_tree_to_shadow=0
ncpcon set shift_modified_shadow_files=1
ncpcon set shift_accessed_shadow_files=0
ncpcon set shift_days_since_last_access=1
```

If the `DUPLICATE_SHADOW_FILE_BROADCAST` parameter is enabled, ensure that the `DISABLE_BROADCAST` parameter is disabled in order to allow broadcasting for NCP Server. For example, enter

```
ncpcon set disable_broadcast=0
```

A.5 DST Commands for `/etc/opt/novell/ncpserv.conf`

Use the commands in this section for the NCP Server configuration file (`/etc/opt/novell/ncpserv.conf`). The `ncpserv.conf` file is read only at Novell eDirectory startup time. If you modify this file directly, you must restart `ndsd` in order for the changes to take effect.

SHADOW_VOLUME *volume_name shadow_area_path*

Identifies a volume as having a secondary storage area and specifies the path to that secondary volume. Any NCP volume can have a shadow. The root directory for the shadow area needs to already exist; the rest of the directories in the secondary file tree is automatically created as needed. The volume shadow area is available the next time the volume is mounted.

SHIFT_MODIFIED_SHADOW_FILES *value*

Enables a modified file to be moved from the secondary storage area to the primary storage area. The value can be either 0 (Disabled) or 1 (Allow). The default value is 1. When this parameter is on, and a file that is located in the secondary storage area is modified, the file is automatically moved back to the primary storage area when the file is closed.

SHIFT_ACCESSED_SHADOW_FILES *value*

Enables a file to be moved from the secondary storage area to the primary storage area if it is accessed as read-only a second time during a specified period of time. The value can be either 0 (Disabled) or 1 (Allow). The default value is 0. When this parameter is on, and a file that is located in the shadow area is accessed, if this is the second access within the configured **SHIFT_DAYS_SINCE_LAST_ACCESS**, the file is automatically moved back to the primary area when the file is closed.

SHIFT_DAYS_SINCE_LAST_ACCESS *value*

Specifies the number of days to use when determining if a file should be moved back to the primary storage area. The value may be 0 (Disable), or between 1 and 365 (in days). The default is 1. When it is used with **SHIFT_ACCESSED_SHADOW_FILES**, the parameter sets the time when files are migrated back to the primary storage area after the second access within the specified elapsed time.

DUPLICATE_SHADOW_FILE_ACTION *value*

Controls how duplicate files conflicts are handled. The default is 0.

- 0 - Show duplicate shadow files (default)
- 1 - Hide duplicate shadow files
- 2 - Rename duplicate shadow files
- 3 - Delete duplicate files from shadow area
- 4 - Move duplicate shadow files to / . _DUPLICATE_FILES

DUPLICATE_SHADOW_FILE_BROADCAST *value*

Enables a message to be broadcast to an NCP user when a duplicate copy of a file is located on both the primary volume and the secondary volume. Valid settings are 0 (Disabled) and 1 (Allow). The default is Allow. The Novell Client version in use must support receiving broadcast messages in order for the user to receive the message.

REPLICATE_PRIMARY_TREE_TO_SHADOW *value*

Controls how the primary tree is replicated from the primary tree to the shadow tree. Valid settings are 0 (Disabled) and 1 (Allow). By default, it is disabled, and paths are replicated to the secondary storage area gradually as data is moved from the primary location to the secondary location. If it is enabled, the entire tree is replicated even if no files in a path have been moved to the secondary storage location.

A.6 DST Commands for `/etc/opt/novell/shadowfs.conf`

Use the commands in this section for the Shadow File System configuration file (`/etc/opt/novell/shadowfs.conf`).

SHADOW *root_path primary_area_path shadow_area_path*

Defines a shadow volume for ShadowFS. A shadow volume that is defined by the NCP engine is automatically mounted by ShadowFS and does not need to be defined in this configuration file.

SHIFT_ON_MODIFY *value*

Enables a modified file to be moved from the secondary storage area to the primary storage area. The value can be either 0 (Off) or 1 (On). The default value is 1. When this parameter is on, and a file that is located in the secondary storage area is modified, the file is automatically moved back to the primary area when the file is closed.

SHIFT_ON_ACCESS *value*

Enables a file to be moved from the secondary storage area to the primary storage area if it is accessed a second time during a specified time period. The value can be either 0 (Off) or 1 (On). The default value is 0. When this parameter is on, and a file that is located in the shadow area is accessed, if this is the second access within the configured

SHIFT_DAYS_SINCE_LAST_ACCESS, the file is automatically moved back to the primary storage area when the file is closed.

SHIFT_DAYS_SINCE_LAST_ACCESS *value*

Specifies the number of days to use when determining if a file should be moved back to the primary storage area. The value may be 0 (Disable), or between 1 and 365 (in days). The default is 1. When it is used with **SHIFT_ON_ACCESS**, the parameter sets the time when files are migrated back to the primary storage area after the second access within the specified elapsed time.

A.7 DST EXCLUDE_VOLUME Command for `/etc/opt/novell/ncp2nss.conf`

Use the command in this section for the `/etc/opt/novell/ncp2nss.conf` file.

EXCLUDE_VOLUME *nss_volumename*

Prevents the named NSS volume from mounting in NCP Server. This command is added when you are using a specified NSS volume as the secondary storage area of a DST shadow volume.

An entry is automatically created in the `/etc/opt/novell/ncp2nss.conf` file by using Novell Remote Manager for Linux to set the *Manage NCP Services > Manage Shares > NCP/NSS Bindings > NCP Accessible* option to No for a given NSS volume that you want to use as a secondary storage location in a DST shadow volume. For instructions, see [Section 10.4, “Configuring the NCP/NSS Bindings for an NSS Volume,” on page 92](#).

In a cluster, you must manually copy the line to the `/etc/opt/novell/ncp2nss.conf` file on each node.

A.8 DST Shadow Volume Information in /etc/NCPVolumes

The `/etc/NCPVolumes` file is an XML file that contains an entry for each mounted volume. It lists the volume's name and the path for the volume's primary file tree (PRIMARY_ROOT). If the volume is a shadow volume, it also shows the path for the secondary file tree (SHADOW_ROOT). Using this data file, a backup utility can easily locate each mounted NCP volume and find its primary and secondary file trees.

For example, the following XML entry defines the DST shadow volume named VOL1:

```
<VOLUME>
  <NAME>VOL1</NAME>
  <PRIMARY_ROOT>/media/nss/VOL1</PRIMARY_ROOT>
  <SHADOW_ROOT>/media/nss/ARCVOL</SHADOW_ROOT>
</VOLUME>
```

A.9 DST ShadowFS Volume Information in /etc/mtab.shadowfs

The `/etc/mtab.shadowfs` file is an XML file that contains an entry for each shadow volume mounted by ShadowFS. It lists the mount point, the path for the primary file tree, and the path for the secondary file tree.

For example, the following XML entry defines the DST shadow volume for ShadowFS named VOL1:

```
<SHADOWFS_MOUNTPOINTS>
  <MOUNTPOINT>
    <PATH>/media/shadowfs/VOL1</PATH>
    <PRIMARY_TREE>/media/nss/VOL1</PRIMARY_TREE>
    <SHADOW_TREE>/media/nss/ARCVOL</SHADOW_TREE>
  </MOUNTPOINT>
</SHADOWFS_MOUNTPOINTS>
```

B RPM Files for Dynamic Storage Technology

The following RPM files are installed for Dynamic Storage Technology for Novell Open Enterprise Server (OES) 11.

`novell-ncp.i386.rpm`

This RPM contains the NCP Server shared library (`libncpengine.so`) that runs as part of Novell eDirectory. This is the software that handles all client NetWare Core Protocol (NCP) requests.

`novell-ncpserv-nrm.i386.rpm`

This RPM contains the Novell Remote Manager for Linux plug-in provided by the NCP team (`libnrm2ncp.so`).

`novell-ncpserv.i386.rpm`

This RPM contains `ncpcon` and `ncptop` tools to help administrators manage the NCP Server. It also contains daemons that connect the `ncpserv` engine to other services on the server: `ncp2nss` and `lum2ncp`.

`novell-nrm.i386`

This RPM contains `httpstk` and the shared library (`libnrm.so`) that creates Novell Remote Manager for Linux as an `httpstk` plug-in. It also contains other files used by Novell Remote Manager.

C Documentation Updates

This section contains information about documentation content changes made to the *OES 11: Dynamic Storage Technology Administration Guide* since the initial release of Novell Open Enterprise Server (OES) 11.

This document was updated on the following dates:

- ♦ [Section C.1, “August 6, 2012,” on page 191](#)
- ♦ [Section C.2, “July 20, 2012,” on page 192](#)
- ♦ [Section C.3, “May 30, 2012,” on page 192](#)
- ♦ [Section C.4, “April 30, 2012,” on page 193](#)
- ♦ [Section C.5, “January 18, 2012,” on page 193](#)

C.1 August 6, 2012

Updates were made to the following sections. The changes are explained below.

- ♦ [Section C.1.1, “Creating and Managing Policies for Shadow Volumes,” on page 191](#)
- ♦ [Section C.1.2, “What’s New,” on page 191](#)

C.1.1 Creating and Managing Policies for Shadow Volumes

Location	Change
“Subdirectory Restrictions” on page 113	A preceding forward slash (/) is required for subdirectory path entries. Specify the path relative to the root of the volume.

C.1.2 What’s New

Location	Change
“What’s New (July 2012 Patches)” on page 23	This section is new.

C.2 July 20, 2012

Updates were made to the following sections. The changes are explained below.

- ♦ [Section C.2.1, “Commands and Utilities for Dynamic Storage Technology,” on page 192](#)
- ♦ [Section C.2.2, “Configuring DST Shadow Volumes with Novell Cluster Services,” on page 192](#)

C.2.1 Commands and Utilities for Dynamic Storage Technology

Location	Change
“create shadow_volume <primary_volumename> <shadow_path>” on page 176	Use this command only for non-clustered shadow volumes. The / ClusterResource option is deprecated. For cluster shadow volumes, see Section A.3, “DST Commands for NCPCon for Use with Novell Cluster Services for Linux Clusters,” on page 180.
“remove shadow_volume [/i] [/f] <primary_volumename>” on page 177	Use this command only for non-clustered shadow volumes. Added definitions for the /i and /f options.

C.2.2 Configuring DST Shadow Volumes with Novell Cluster Services

Location	Change
“Novell CIFS for Merged View Access” on page 141	The CIFS monitor command is added to the monitor script for the primary pool cluster resource.

C.3 May 30, 2012

Updates were made to the following section. The changes are explained below.

- ♦ [Section C.3.1, “Installing and Configuring ShadowFS for Novell Samba Users,” on page 192](#)

C.3.1 Installing and Configuring ShadowFS for Novell Samba Users

Location	Change
“Enabling or Disabling ShadowFS” on page 41	Updated to reflect the renamed <i>Load ShadowFS</i> option.

C.4 April 30, 2012

Updates were made to the following section. The changes are explained below.

- ♦ [Section C.4.1, “Creating and Managing Policies for Shadow Volumes,” on page 193](#)

C.4.1 Creating and Managing Policies for Shadow Volumes

Location	Change
“Search Pattern” on page 115	You can specify file names with spaces in them.

C.5 January 18, 2012

The document format was updated to reflect newly revised corporate standards.

