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Hitachi TagmaStore®
Adaptable Modular Storage
and Workgroup Modular Storage

NAS Sync Image User's Guide

MK-95DF758-03

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- Deleted references to Internet Explorer 5.5 SP2, Netscape 6.2.3 and Mozilla 1.2.1, from Table 2.3 since these products are no longer supported.
- Changed graphics in Figure 1.1 Differential Data SnapShot Function Overview
- Changed graphics in Figure 1.3 Backing up Differential Data Overview
- Changed graphics in Figure 1.6 Using NAS Sync Image to Restore File System Data

- Changed graphics in Figure 3.6 Estimating Storage Device Capacity When File System is Less Than 32GB
- Changed graphics in Figure 4.7 Starting Snapshot Operations
- Changed graphics in Figure 4.9 Client Access to a Differential-Data Snapshot
- Changed graphics in Figure 4.10 Monitoring for Errors
- Added message id KAQS11185-E for File share creation unsuccessful error termination in Table 3.12 System Messages
- Changed synopsis and added options `-h` and `-nomsg` for `all snapshot operation` commands (section 5.4.1 through 5.4.9)
- Added step 2 and example in procedure for Setting Up a Storage Device (section 6.2)
- Added step 1 and example in procedure for Creating a Snapshot (section 6.3)
- Changed steps and added example in procedure for Deleting a Snapshot and Creating a New One (section 6.4)
- Added step 8 and example in procedure for Publishing a SnapShot for a Client (section 6.5)
- Added example in procedure for Viewing Status Information (section 6.6)
- Added example in procedure for Changing the Reserved Generations (section 6.7)
- Added example in procedure for Changing the Warning Threshold for Storage Devices (section 6.8)
- Added example in procedure for Expanding a Storage Device (section 6.9)
- Added example in procedure for Releasing a Storage Device (section 6.10)

Preface

This document describes and provides instructions for installing and using the NAS Sync Image feature of the Hitachi Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) storage systems.

This document assumes the following:

- The user is familiar with the operating system and web browser software on the system hosting the NAS Manager.
- The user is familiar with the Hitachi TagmaStore® AMS/WMS systems and has read and understands the appropriate *Storage Navigator User's Guide* listed in "Referenced Documents" on the next page.
- The user is familiar with network-attached storage (NAS).

Notes:

- In this document the term "Adaptable Modular Storage (AMS)" refers to all models of the TagmaStore AMS system, unless otherwise noted.
- In this document the term "Workgroup Modular Storage (WMS)" refers to all models of the TagmaStore WMS system, unless otherwise noted.
- The NAS Manager screens shown in this document were captured on a Windows® system with the Internet Explorer web browser. They may display differently on other operating systems and browsers.

Notice: The use of the NAS Sync Image software and all other Hitachi Data Systems products is governed by the terms of your agreement(s) with Hitachi Data Systems.

Software Version

This document revision applies to NAS OS version 4.2 and higher.

Release Notes

The Release Notes for this product (located on the installation CD) contain requirements and/or restrictions that may not be fully described in this document. The Release Notes may also contain updates and/or corrections to this document. Make sure to read the Release Notes before installation and use of the product.

Convention for Storage Capacity Values

Storage capacity values for hard disk drives (HDDs) on the AMS/WMS are calculated based on the following values:

1 KB = 1,000 bytes
1 MB = $1,000^2$ bytes
1 GB = $1,000^3$ bytes
1 TB = $1,000^4$ bytes

Storage capacity values for logical units (LUs) on the AMS/WMS are calculated based on the following values:

1 KB = 1,024 bytes
1 MB = $1,024^2$ bytes
1 GB = $1,024^3$ bytes
1 TB = $1,024^4$ bytes

Referenced Documents

- **Hitachi TagmaStore Adaptable Modular Storage and Workgroup Modular Storage:**
  - *NAS Backup Restore User's Guide* (MK-95DF759)
  - *NAS Error Codes* (MK-95DF760)
  - *NAS Manager User's Guide* (MK-95DF757)
  - *ShadowImage User's Guide* (MK-95DF709)
  - *Storage Navigator Modular Command Line Interface (CLI) User's Guide* (MK-95DF712)
  - *Storage Navigator Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)
  - *Storage Navigator Modular for Web User's Guide* (MK-95DF719)

Comments

Please send us your comments on this document. Make sure to include the document title, number, and revision. Please refer to specific section(s) and paragraph(s) whenever possible.

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Chapter 1 Overview of NAS Sync Image

This chapter describes the basic functions and features of the Hitachi NAS Sync Image program which allows you to protect data shared on a network-attached storage system.

- About NAS Sync Image (section 1.1)
- Overview of the Snapshot Function (section 1.2)
- Features of the Snapshot Function (section 1.3)

1.1 About NAS Sync Image

The NAS Sync Image program provides a function that creates snapshots of file systems shared in a NAS Modular system. If a client has changed data in a file system by mistake, this function can be used to view past data in the file system.

A *snapshot* is a duplicate copy of the data in a file system at a particular time. The system administrator can create a file share in the created snapshot. If a file share has been created, clients can view the data at the time the snapshot was created. Also, if a client has edited or deleted directories or files in a file system by mistake, the files can be restored by copying snapshot data to the file system.

You can create a snapshot by using the *differential-data snapshot function* provided by NAS Sync Image. Figure 1.1 shows an overview of this function.

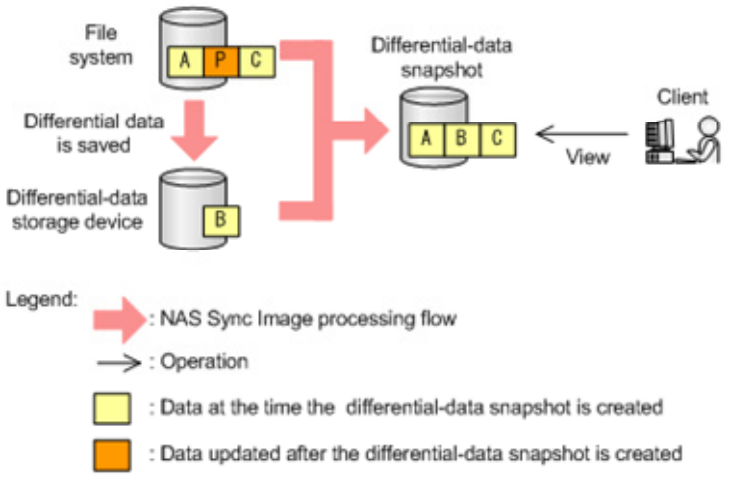


Figure 1.1 Differential-Data Snapshot Function Overview

Whenever the file system is updated, the differential-data snapshot operation saves the pre-update data into a volume within the same disk array. In NAS Sync Image, this volume to which data is saved is called the *differential-data storage device*.

You can create a snapshot from the data in the file system and from the data saved in the differential-data storage device. In NAS Sync Image, this snapshot is called a *differential-data snapshot*.

When you create a differential-data snapshot in advance, a client can refer to the data as it was when the differential-data snapshot was created. You can create a maximum of 124 differential-data snapshots for each file system.

You can create differential-data snapshots in two ways:

- Manually, using the GUI or commands
- Automatically, based on schedule settings.

You can also set the schedule so that snapshots are mounted and shared when they are created. For snapshots created automatically, a file share is created based on creation dates and times set in the schedule and the file share information for the creation-source file system. Once you notify clients of the information for file shares created for snapshots, the clients can view and copy data independently in the snapshots to restore data.

If you have set up a NAS Backup Restore license, you can use the backup and restore functions to back up data in a differential-data snapshot. You can also use the remote copy function to copy data from the file system and the differential-data storage device to a desired node.

Since the differential-data snapshot function in NAS Sync Image collects a snapshot at the file system level, the data is not synchronized with the application. The consistency of a snapshot at the application level is not secured if the snapshot was created while the client was using the file system's data with an application.

1.2 Overview of the Snapshot Function

This section explains the operation of the differential-data snapshot function; it also describes the system configuration that uses the differential-data snapshot function.

1.2.1 Basic Structure

A differential-data snapshot is a virtual volume that can reproduce a previous state of a file system by using the data in the file system and data saved in a differential-data storage device. The differential-data snapshot function is implemented with volume manager (LVM). This section explains the system operation when using the differential-data snapshot function.

1.2.1.1 Configuration

Before starting the differential-data snapshot operation, you must set up a differential-data storage device.

Figure 1.2 shows the configuration of a differential-data storage device.

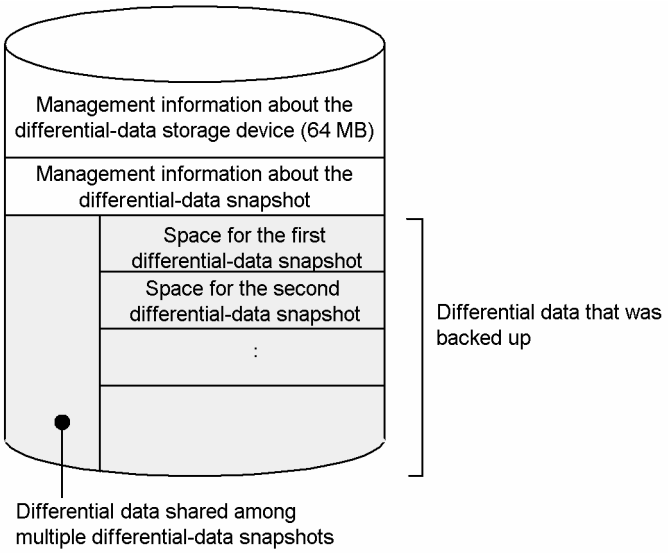


Figure 1.2 Differential-Data Storage Device Configuration

Management information for differential data is stored in the differential-data storage device. Approximately 64 MB of space is available in the storage device for storing management information about the storage device. The remaining space is used for storing management information about the snapshot, and for storing the differential data that is backed up when the file system is updated. The space for storing differential data consists of the space for storing differential data shared among multiple snapshots, and the space for storing differential data for each snapshot.

1.2.1.2 Backup Procedure

Once you have created the first differential-data snapshot, pre-update data accumulates in the storage device each time an update request is sent to the file system.

The following figure shows an overview of backing up differential data to the storage device when you send an update request to the file system.

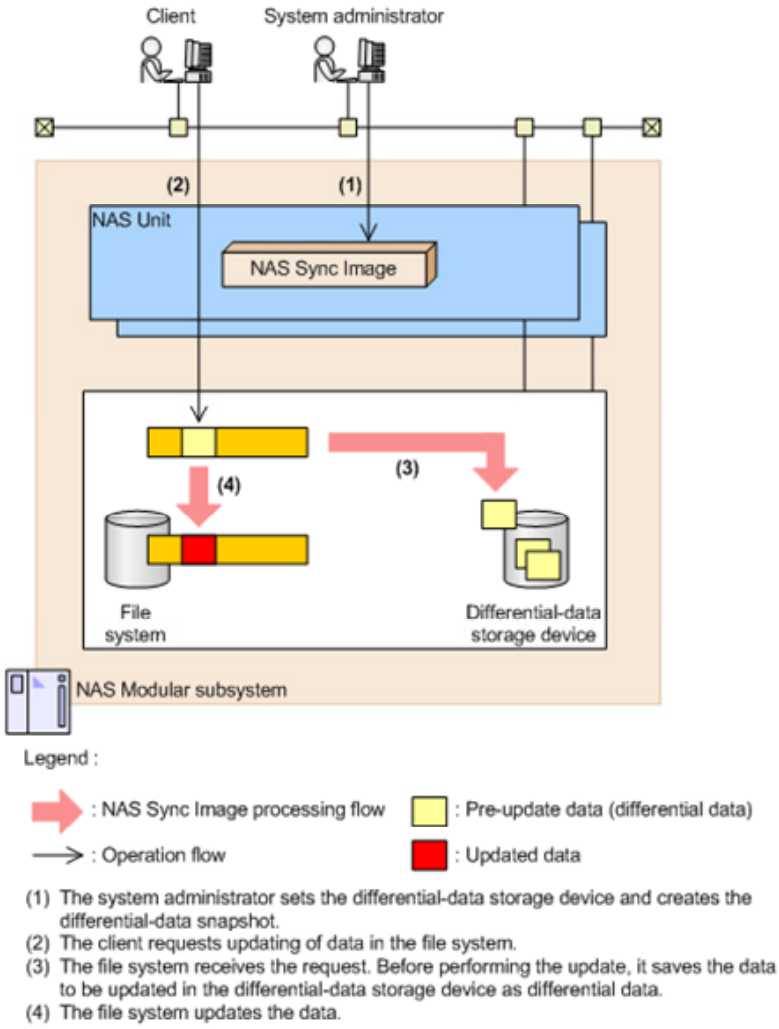


Figure 1.3 Backing up Differential Data Overview

When you send an update request to the file system, pre-update data (differential data) is backed up to the differential-data storage device, after which the data in the file system is updated.

Figure 1.4 shows the actual data flow when file system data is updated and differential data is backed up to a storage device.

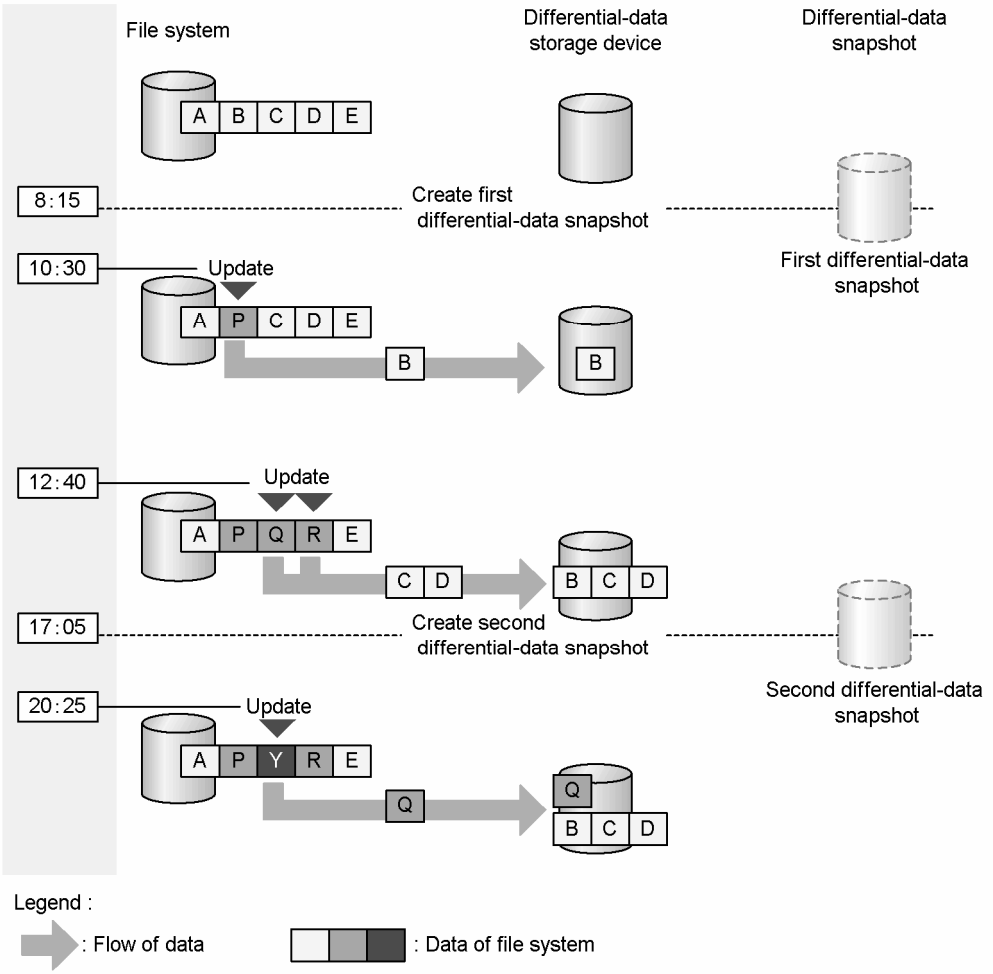


Figure 1.4 Differential Data Back-up Data Flow

In this example, the first differential-data snapshot is created at 8:15. After this, data from later updates is saved in the differential-data storage device each time an update request is sent to the file system.

When there is a request to update the file system data **B** to **P**, the source data **B** is backed up to the differential-data storage device. When there are requests to update the file system data **C** to **Q**, and **D** to **R**, the source data **C** and **D** is backed up.

Each time you create a differential-data snapshot, differential data is stored separately from the previously backed-up differential data.

As shown in the example, if there is a request to update the data **Q** to **Y** after you create the second snapshot at 17:05, **Q** is backed up to the storage device separately from **C**, which was backed up for the first snapshot.

When the same segment on the file system is updated several times, during the time from when the first differential-data snapshot is created to when the second differential-data snapshot is created, the data is backed up only when the data is first updated, as shown in the following figure.

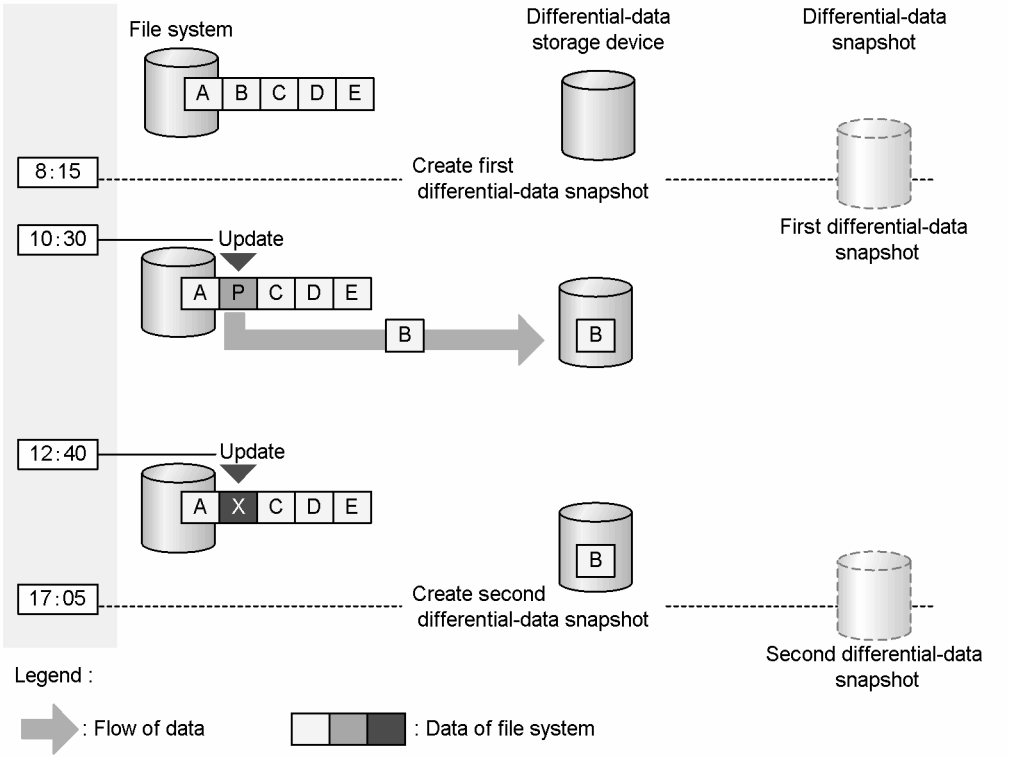


Figure 1.5 Same-Segment Update Request Data Flow

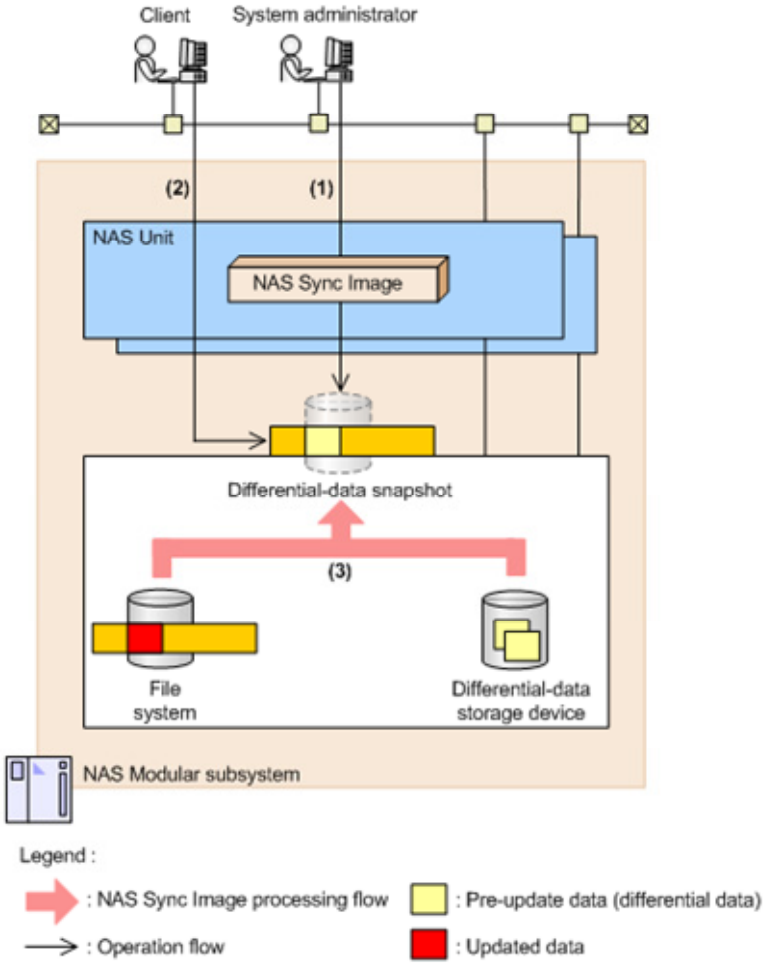
In this example, when there are requests to update the file system data **B** to **P** and then to **X**, only the source data **B** is backed up to the differential-data storage device. The data **P** is not backed up.

Pre-update data is accumulated in the differential-data storage device when the file system is updated.

1.2.1.3 Using NAS Sync Image to Reproduce a File System's Previous State

NAS Sync Image uses the file system data and differential data stored in the differential-data storage device to reproduce the past file system as a differential-data snapshot.

Figure 1.6 shows an overview of the procedure for using NAS Sync Image to reproduce the previous state of a file system.



(1) The system administrator creates a differential-data snapshot as a virtual volume at a desired time.
(2) The client accesses the differential-data snapshot.
(3) Based on the latest file system's data and the differential data, the file system's data that was backed up when the differential-data snapshot was created is restored.

Figure 1.6 Using NAS Sync Image to Restore File System Data

NAS Sync Image combines the file system data and differential data (backed up to the differential-data storage device) to reproduce the file system as it was when the snapshot was created.

Figure 1.7 shows the actual data flow when NAS Sync Image reproduces the previous state of a file system, based on the example in Figure 1.4.

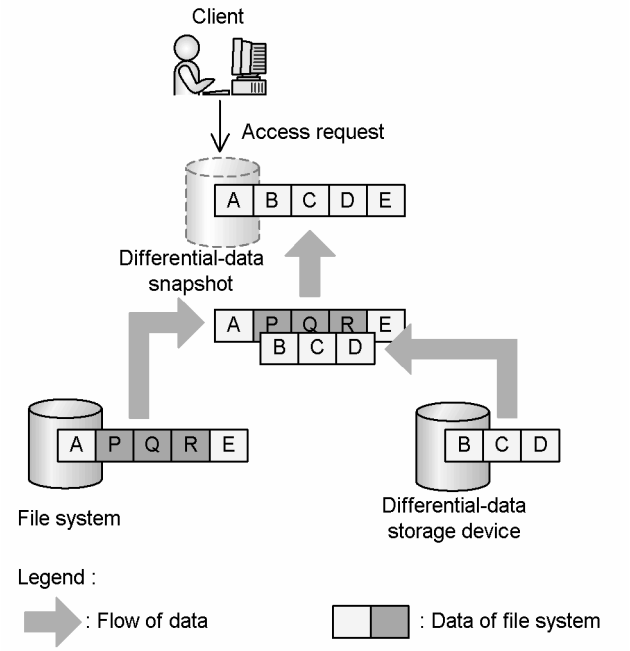


Figure 1.7 NAS Sync Image Data Flow

If there is a request from a client at 13:00 to access the snapshot created at 8:15 (as shown in the example in Figure 1.4), NAS Sync Image refers the client to the data items **B**, **C**, and **D**, which were backed up to the differential-data storage device, instead of the latest data items **P**, **Q**, and **R** in the file system.

As a result, the file system is reproduced in the state that it was in when the snapshot was created.

If necessary, you can also mount a snapshot to create an NFS share or CIFS share, expand a storage device, and delete unnecessary snapshots. If you delete a snapshot, only the differential data used solely by the differential-data snapshot is deleted. Differential data shared among multiple snapshots is not deleted.

1.2.2 System Configuration

This section explains the system configuration for using the differential-data snapshot function provided by NAS Sync Image. Figure 1.8 shows the system configuration for using the differential-data snapshot function.

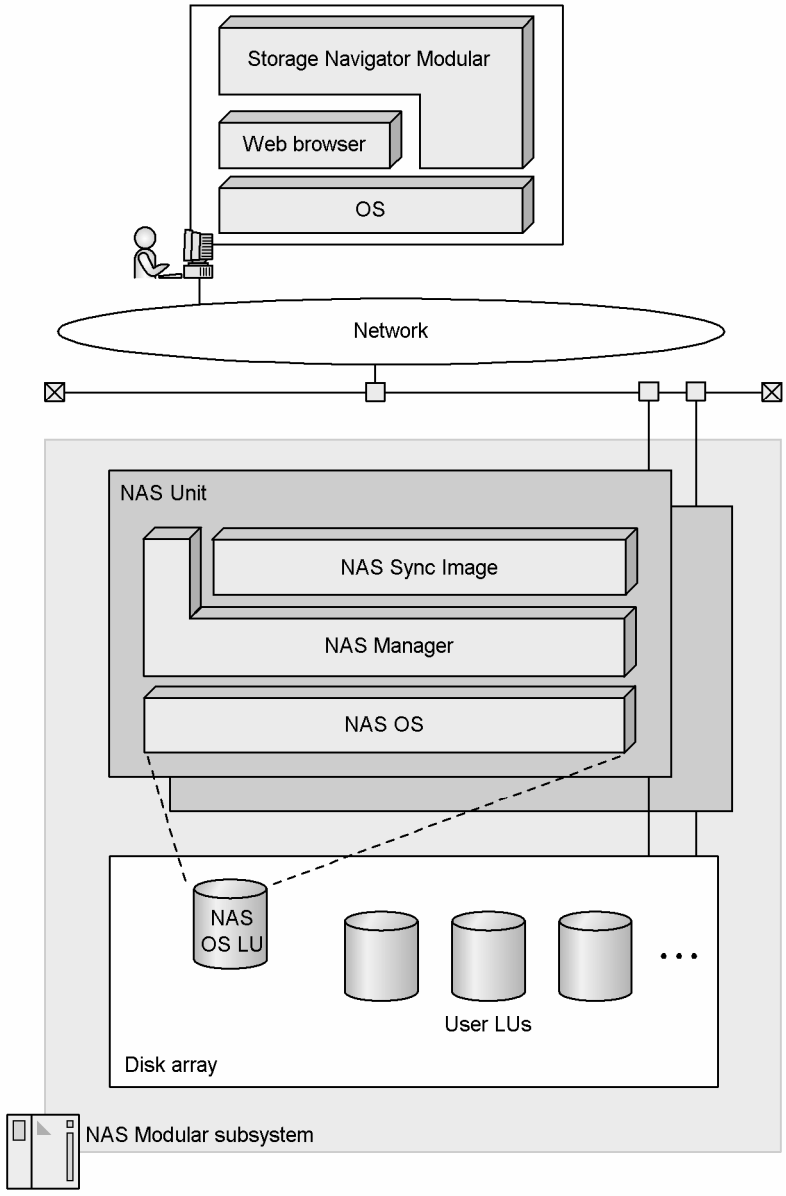


Figure 1.8 NAS System Configuration

1.3 Features of the Snapshot Function

NAS Sync Image accumulates differential-data in a differential-data storage device when a file system is updated, and then uses the accumulated data and the data of the file system to create a differential-data snapshot. You can set the capacity for a differential-data storage device to best match the usage patterns of file systems or differential-data snapshots. Depending on the usage pattern, you can keep the required capacity low.

The processing speed of the source file system will deteriorate, however, because differential-data snapshots must be backed up each time data is updated. In addition, the processing speed of the other file systems on the node containing the source file system might deteriorate when you set up, expand, or cancel a differential-data storage device, or create or delete a differential-data snapshot.

Therefore NAS Sync Image is not suited for environments in which large-scale data writing (such as streaming) or a certain response time is required.

NAS Sync Image is effective particularly in environments in which a small number of updates are performed and only small-scale recovery is needed. NAS Sync Image is suited to restore data using differential-data snapshots when users edit data by mistake in an environment where data is read frequently and changed in small amounts (such as in data management for websites).

Chapter 2 Requirements and Installation

This chapter describes the requirements and installation procedure necessary for using the NAS Sync Image software.

- Hardware Requirements (section 2.1)
- Software Requirements (section 2.2)
- Web Browser Requirements (section 2.3)
- Installing NAS Sync Image (section 2.4)

2.1 Hardware Requirements

Before installing NAS Sync Image, make sure your NAS unit meets the following hardware requirements.

Table 2.1 Hardware Requirements for NAS Sync Image

Hardware Requirement	Details
NAS unit	A NAS system that uses one of the following TagmaStore AMS or TagmaStore WMS disk systems: ▪ AMS200 ▪ AMS500 ▪ AMS1000 ▪ WMS100
LAN access for NAS unit	The NAS unit requires a board equipped with a gigabit Ethernet adapter and CPU.
Communication between the NAS unit and the disk system	A command device must be set up in the disk system, as described by your HDS representative.

2.2 Software Requirements

Before installing NAS Sync Image, make sure your NAS unit meets the following software requirements.

Table 2.2 Software Requirements for NAS Sync Image

Software Requirement	Details
NAS OS	The NAS operating system runs on the NAS unit and consists of the following programs: ▪ NAS Data Control ▪ NAS File Sharing
NAS Manager	Use this program to set up, operate, and manage the NAS system.
Storage Navigator Modular	Use this program to restart the NAS OS and to set up a license.
Web browser	Use a web browser to operate NAS Sync Image from any computer. See section 2.3.

2.3 Web Browser Requirements

Make sure that the computer from which you operate NAS Sync Image meets the following web browser requirements and settings.

- Enable cookies in the Web browser.
- Set the color depth of the screen to over 800 x 600 pixels, displaying the Web browser by over 65,000 colors (high color and 16 bit).

Table 2.3 Web Browser and Operating System Requirements

Operating System	Web Browser
Windows® 2000 Professional SP2 to SP4	Internet Explorer 5.5 SP2 or later
Windows® 2000 Professional SP2 to SP4 Windows® XP Professional Edition SP2 or earlier Windows® Server 2003 SP1 or later	Internet Explorer 6
Solaris™ 8	Netscape® 6.2.3 or Netscape® 7.0
Solaris™ 9	Mozilla 1.2.1 or Mozilla 1.4

Table 2.4 Font Settings for the Web Browser

Web Browser	Font Settings
Internet Explorer	Language script: Latin based Web page font: Times New Roman Plain text font: Courier New Text size: Smallest
Netscape® or Mozilla™	Fonts for: Western Proportional: Serif Size (pixels): 12 Serif: adobe-times-iso8859-1 Sans-serif: adobe-helvetica-iso8859-1 Cursive: -courier-iso8859-1 Fantasy: -courier-iso8859-1 Monospace: adobe-courier-iso8859-1 Size (pixels): 12

Note: If the browser user sets the text size or font to something other than those indicated above, the NAS Sync Image GUI might not be displayed properly.

Table 2.5 Cache Settings for the Web Browser

Web Browser	Cache Settings
Internet Explorer	Check for newer versions of stored pages: Every visit to the page
Netscape® or Mozilla™	Compare the page in the cache to the page on the network: Every time the page is viewed

2.4 Installing NAS Sync Image

You can use the NAS Manager GUI to install NAS Sync Image. For more information, see the *NAS Manager User's Guide*.

To install a regular version or corrected version of NAS Sync Image, specify the following file contained in the installation CD-ROM:

NAS_Sync_Image_version-number.deb

After the installation, you must use Storage Navigator Modular to set up a license. For more information, see *Storage Navigator Modular Graphical User Interface (GUI) User's Guide*, *Storage Navigator Modular Command Line Interface (CLI) User's Guide*, or the *Storage Navigator Modular for Web User's Guide*.

Chapter 3 Differential-Data Snapshot Operations

When you use NAS Sync Image, you can create differential-data snapshots of the file systems within the same node of a disk system. This chapter describes the snapshot operations you can perform with NAS Sync Image.

- Overview of Snapshot Operations (section 3.1)
- Preparing for Snapshot Operations (section 3.2)
- Managing a Storage Device (section 3.3)
- Setting up a Storage Device (section 3.4)
- Viewing File System and Storage Device Status (section 3.5)
- Creating a Snapshot (section 3.6)
- Viewing Status of a Snapshot (section 3.7)
- Mounting a Snapshot (section 3.8)
- Unmounting a Snapshot (section 3.9)
- Deleting a Snapshot (section 3.10)
- Releasing a Storage Device (section 3.11)

3.1 Overview of Snapshot Operations

You should perform snapshot operations as follows:

- Before backing up, set up one or more differential-data storage devices:
  - Determine the disk space required for the differential-data storage device.
  - Set up one or more differential-data storage devices.
- To back up data manually or automatically:
  - To back up as needed, create manual snapshots.
  - To back up automatically, set up scheduled backups.
  - Delete unnecessary snapshots periodically to ensure that there is adequate space on the differential-data storage device.
- To allow users to restore data from snapshots, do one or more of the following:
  - Allow users to view and access a snapshot by mounting the snapshot and setting up file sharing with NFS shares or CIFS shares.
  - Perform snapshot mounting and file share creation automatically, based on the schedule settings for differential-data snapshot creation.
  - When the client finishes tasks such as data recovery, delete the NFS share or CIFS share and unmount differential-data snapshots.
- Perform other tasks as needed:
  - Release the differential-data storage device
  - Check the status of the differential-data storage device
  - Expand differential-data storage devices
  - Change settings of differential-data storage devices.

3.2 Preparing for Snapshot Operations

Before performing differential-data snapshot operations, make sure of the following:

- The cluster and node that you are logged in to are running normally
- The resource group in the node that you are logged in to is running normally

Note: If these conditions are not satisfied, the differential-data snapshot operations might fail and an error might occur.

If a failover occurs, perform the following operations on the failover-destination node:

- Setting an automatic creation schedule
- Creating and deleting a differential-data snapshot
- Changing the settings for a differential-data storage device

For more information on how to view the status of the cluster, node, or resource group, or how to take action when an error occurs, see the *NAS Manager User's Guide*.

3.3 Managing a Differential-Data Storage Device

This section discusses setting up, changing the configuration of, or expanding a differential-data storage device.

3.3.1 File System Size

Once you set a differential-data storage device for a file system, you can no longer expand the size of that file system or delete that file system. To expand or delete such a file system, you must first release the storage device. This causes the snapshots to be automatically deleted.

Before setting up a storage device, you must make sure that sufficient capacity has been allocated to the source file systems. For more information about expanding a file system, see the *NAS Manager User's Guide*.

3.3.2 Device Files for the Differential-Data Storage Device

A SATA drive and an FC drive have different I/O performance levels and processing speeds.

For the differential-data storage device, you should use device files that have the same drive types as the device files for the file system. Use device files to which the controller for the local node is assigned as the default controller, as described in the following figure.

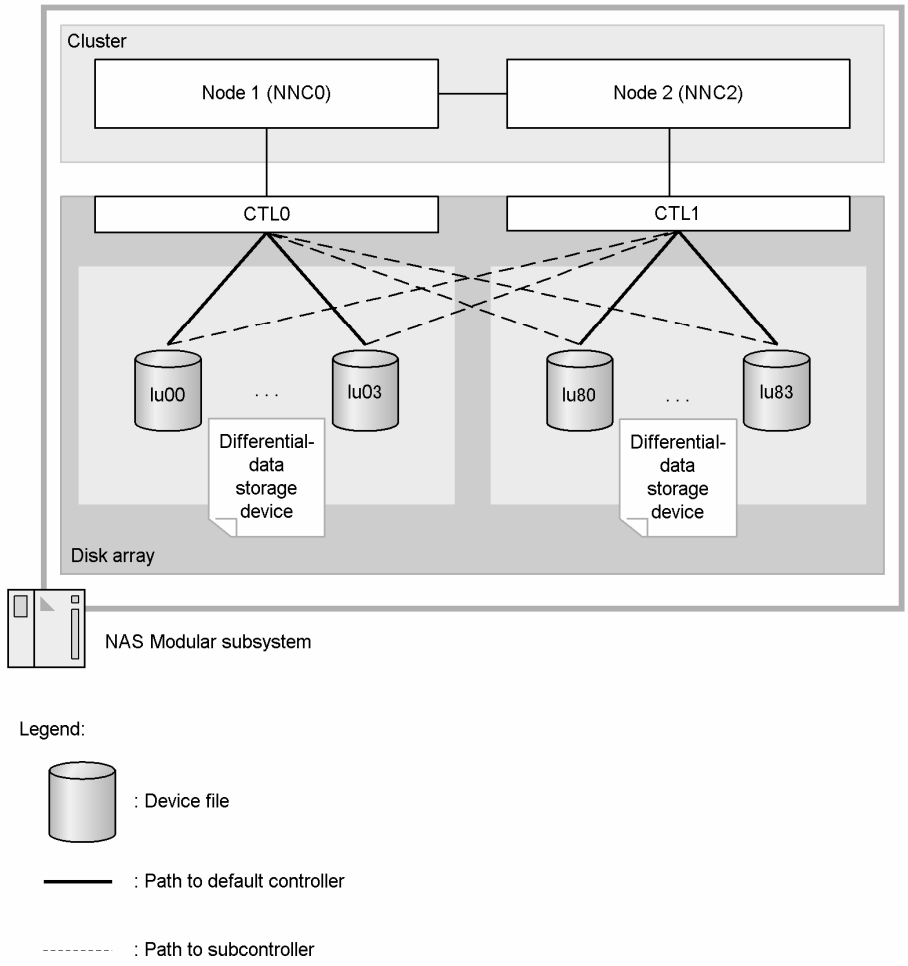


Figure 3.1 Assigning Device Files (for TagmaStore AMS 500)

For the storage device you are setting up in Node 1 (NNC0), use device files to which CTL0 is assigned as the default controller.

For the storage device you are setting up in Node 2 (NNC2), use device files to which CTL1 is assigned as the default controller.

If you use a device file that is assigned to the controller of the other node, the I/O performance and processing speed of the NAS Unit may decrease. Before setting up the differential-data storage device, use Storage Navigator Modular to check the default controllers of the device files to be used. For more information, see the *Storage Navigator Modular User's Guide*.

3.3.3 Number of Logical Volumes

Up to 4,096 logical volumes can be created per node.

When setting up or changing the configuration of a storage device, specify the number of snapshot reserved generations that are to be retained for the file system. Once the number of reserved generations is set, the number of logical volumes required for the storage device plus the specified number of reserved generations are set aside, on the node to which the file system belongs.

```
number-of-logical-volumes-to-be-set-aside = 1 + number-of-reserved-generations
```

For example, if you specify 124 for the number of snapshot reserved generations and set up a storage device, the number of logical volumes to be set aside is 125, which is the sum of the number of storage device (1) and the number of reserved generations (124).

Because of this, before setting up or changing the configuration of a storage device, examine the operation policy of the NAS system as a whole, and specify the number of reserved generations.

If the number of logical volumes in the node reaches the maximum, you cannot create a new file system by using LVM. Once operation starts, make changes as necessary to the number of snapshot reserved generations allocated to each file system.

3.3.4 Number of Snapshot Generations

The number of differential-data snapshot generations is managed based on the total number of the following differential-data snapshots per file system:

- Use either the NAS Sync Image GUI or commands to manually create snapshots (including snapshots created by executing simultaneous deletions and creations of snapshots)
- Set a schedule using NAS Sync Image GUI to create snapshots automatically
- Use the NAS Backup Restore online backup function to create a snapshot (You can only create a maximum of one snapshot with this method)

Adjust the number of snapshots created and stored by each method according to how they are used and operated.

If you only create snapshots manually, you can store as many snapshots as the number of reserved generations specified for the file system.

The number of differential-data snapshots that you can create and store automatically varies depending on the reserved generations, the total number of snapshots, and the maximum number of snapshots for automatic creation at the time the schedule is run, as the following formulas show.

G ≧ A + B + C

Number of automatically created differential-data snapshots that can be stored = A

G < A + B + C

Number of automatically created differential-data snapshots that can be stored = G - B - C

Legend:
G: Number of reserved generations
A: Maximum number of automatically created differential-data snapshots
B: Number of differential-data snapshots created manually
C: Number of differential-data snapshots created using online backup

In the following example, the number of reserved generations is set to 5, and the maximum number of automatically created snapshots is set to 3.

Figure 3.2 illustrates a breakdown of the number of reserved generations when you can automatically create and store snapshots up to the maximum number of snapshots for automatic creation.

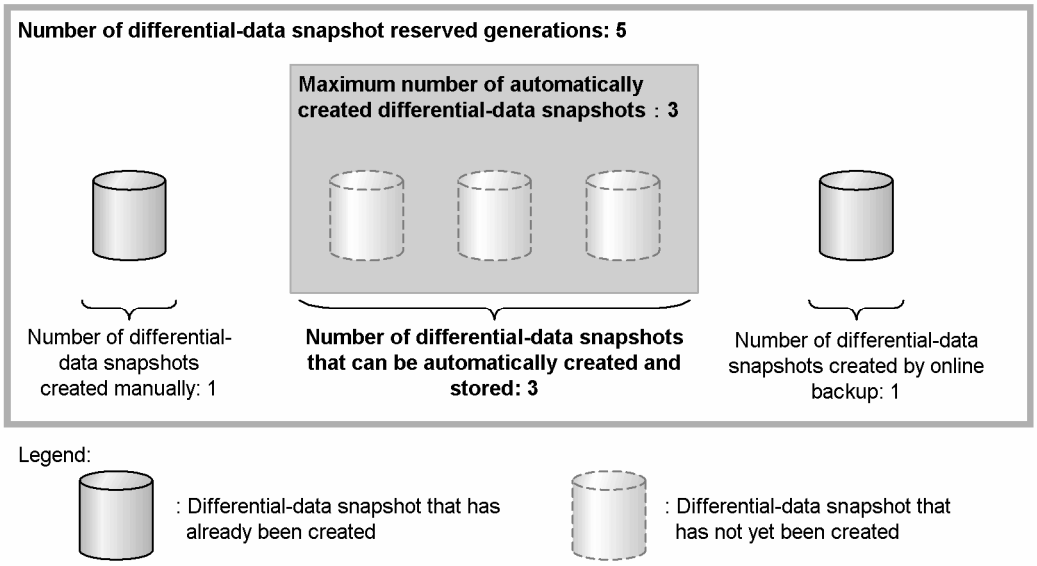


Figure 3.2 Specifying Reserved Generations for Automatic Snapshot Creation

When one manually created snapshot and one snapshot created with the online backup function exist, the number of snapshots that you can create and store automatically is 3, equal to the maximum.

Figure 3.3 shows a breakdown of the number of reserved generations when you cannot automatically create and store differential-data snapshots up to the maximum number of snapshots for automatic creation.

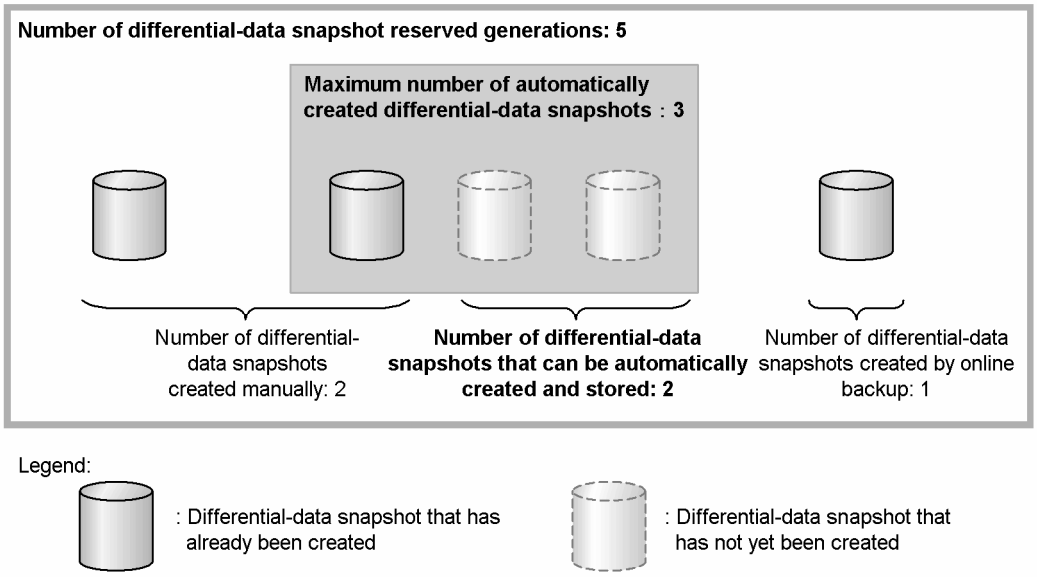


Figure 3.3 Specifying Maximum Number of Reserved Generations

When there are manually created snapshots and one snapshot created with the online backup function, the actual number of snapshots that you can create and store automatically is 2, even though the maximum is set to 3.

If the automatically created and stored snapshots have reached the maximum, or if the total number of created snapshots has reached the number of reserved generations, the oldest automatically created snapshot is deleted, and a new one is created in its place, as shown in Figure 3.4.

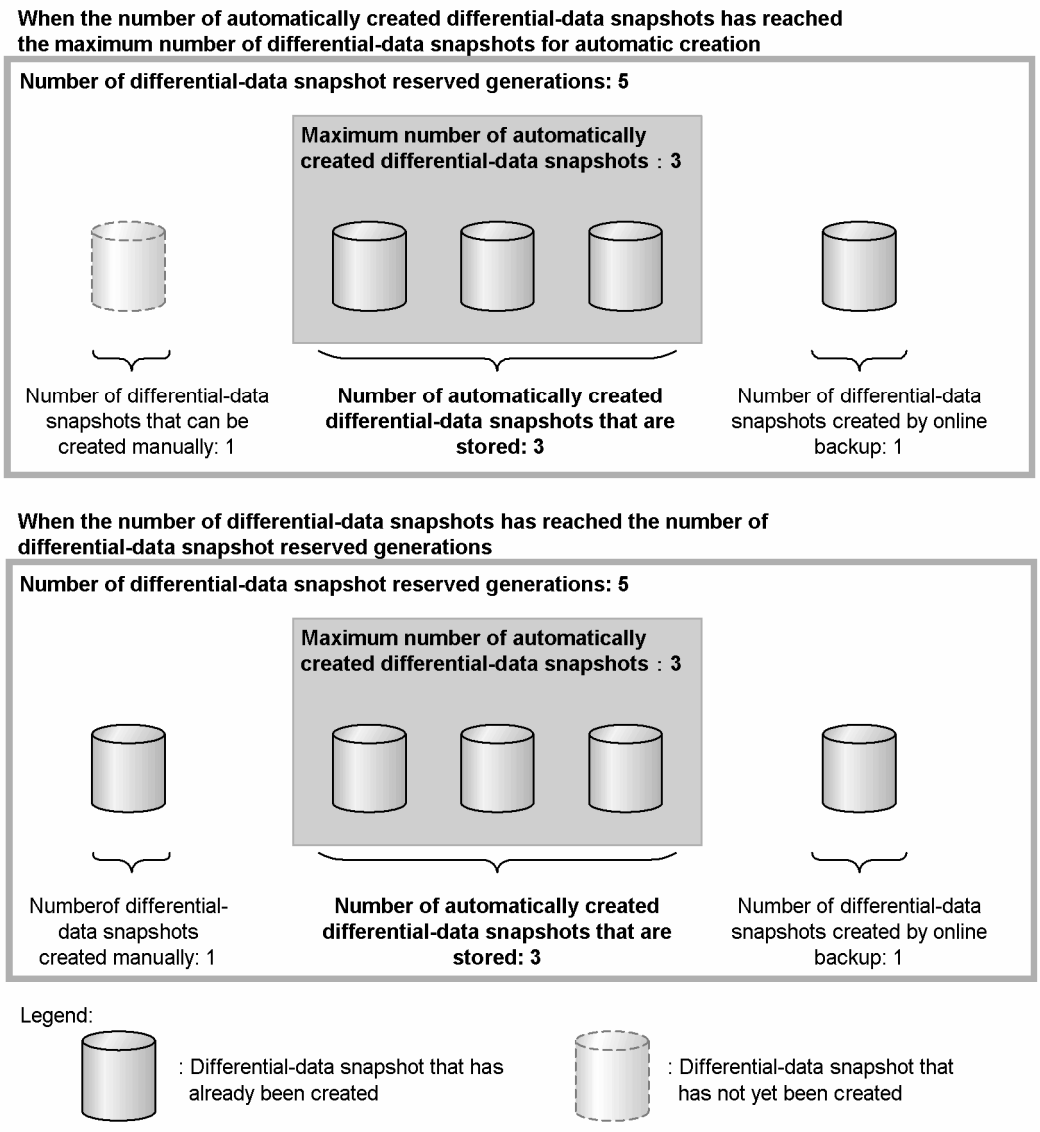


Figure 3.4 Automatically Created Snapshot Deletion Conditions

Note: During differential-data snapshot operations, even when the maximum number of automatically created snapshots is changed to a value less than the total number of created snapshots, the previously created snapshots are not deleted. The newly set maximum takes effect when you delete the automatically created snapshots, so that the total number of automatically created snapshots becomes less than or equal to the maximum that has been set.

3.3.5 Processing Time to Create and Delete Snapshots

When you create or delete a differential-data snapshot, background processing is used. You cannot create or delete a snapshot of a file system if the background processing for creating or deleting another snapshot is running.

The background processing time required for snapshot creation or deletion increases in proportion to the file system size. Under a low system load, it takes about 15 seconds when the file system space is 50 GB, and about 5 minutes when the file system space is 1 TB. Under a high system load, the background processing time might increase to about fifty times the time required when under a low system load.

When multiple snapshots are created or deleted in succession from one file system, use the command at appropriate intervals after taking into consideration the file system space and system load.

3.3.6 Setting Warning Messages

If the amount of free space of a differential-data storage device becomes insufficient during snapshot operation, all snapshots stored in the storage device become invalid.

You should allocate enough space to the storage device before starting snapshot operation. For more information about how to determine the space needed for a storage device, see section 3.3.11.

When the amount of free space for a storage device becomes insufficient, the KAQS19000-E message is output as a system message. To prevent a shortage of free space, you can set the KAQS19001-W message so that it displays as a system message when the usage rate of the storage device reaches a certain level.

In addition, setting SNMP in advance enables system messages to be issued through the SNMP trap. For more information on SNMP settings, see the *NAS Manager User's Guide*.

Once you start snapshot operation, check system messages and SNMP notifications periodically to determine the status of the snapshot device. If the amount of space of a storage device is about to become insufficient, delete any unnecessary snapshots, or expand the storage device.

3.3.7 Using the GUI Windows

In NAS Sync Image, you can perform differential-data snapshot operations by using the graphical user interface (GUI) windows or by using commands.

Figure 3.5 illustrates using the NAS Sync Image GUI windows to perform snapshot operations.

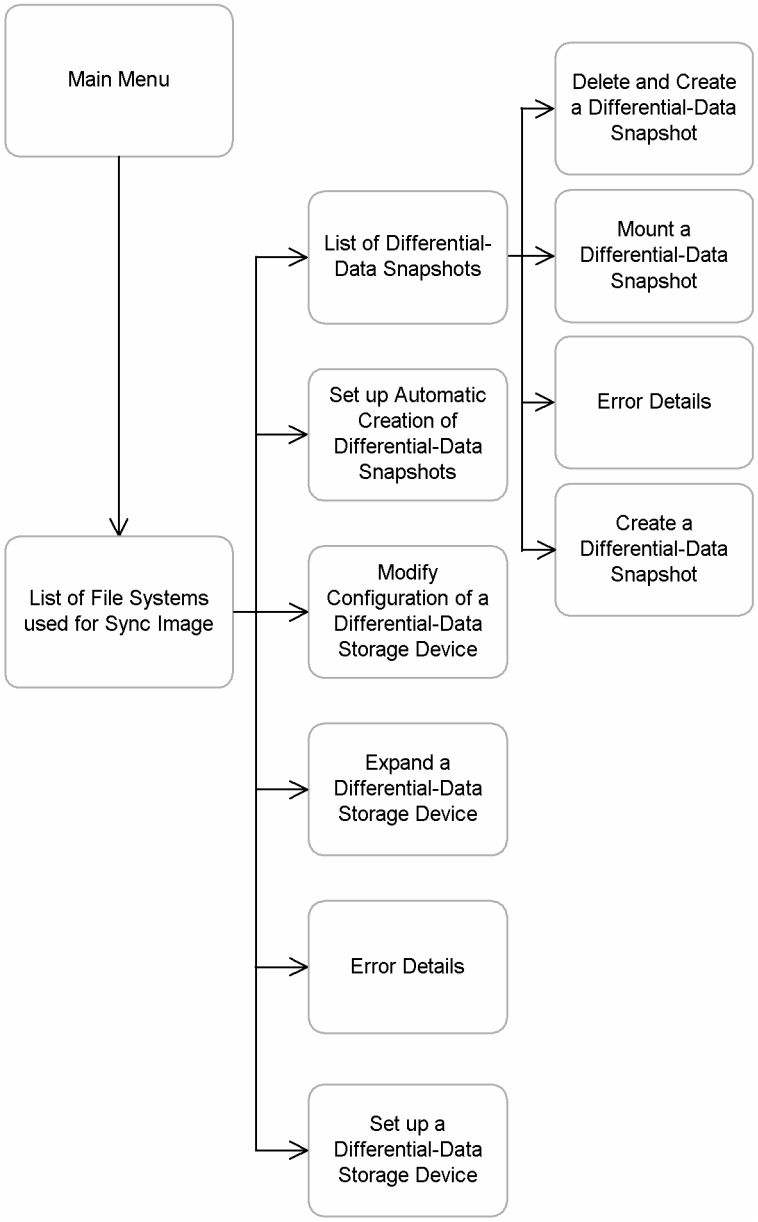


Figure 3.5 Using the NAS Sync Image GUI Windows

To use the snapshot function through the NAS Sync Image GUI, you must log in to the system by specifying, in a URL, the fixed IP address used for mng1 of a NAS Unit. To display the windows used during snapshot operations, click **Sync Image** in the Main Menu of NAS Manager.

You can use either the GUI or commands when operating clusters, file systems, and differential-data snapshots with NAS. You can start the following tasks from the GUI without waiting for the previous task to finish:

- Creating or mounting a file system (a NAS Manager operation)
- Creating an NFS file share (a NAS Manager operation)
- Creating a CIFS file share (a NAS Manager operation)
- Setting up a differential-data storage device

- Mounting a differential-data snapshot

A maximum of four tasks for the used operations are queued for each node and those tasks are used in the order in which they are queued. You can check the status of queued tasks by viewing the **Operating status** in the following windows:

- The List of File Systems window of NAS Manager
- The List of File Shares (List of NFS file shares) window of NAS Manager
- The List of File Shares (List of CIFS file shares) window of NAS Manager
- The List of File Systems used for Sync Image Modular window
- The List of Differential-Data Snapshots window

You must check the task results in each window listed above. If a task has ended abnormally, or if a warning message is displayed, click the **Error Details** button in each window, check the error details in the Error Details window, and take corrective action.

The maximum number of stored error information entries and queued tasks is a total of 64. If you perform an operation from the GUI when the maximum has been reached, the operation fails and an error message is displayed.

If the number of tasks queued in the NAS system has reached the maximum, an attempt to queue a new task from the GUI fails and an error message is displayed. Wait for a queued task to finish, and perform the task again.

3.3.7.1 Avoiding the Shift Key with a Wheel Mouse

When using a wheel mouse, do not rotate the wheel while pressing the **Shift** key. Doing so might cause the displayed window to change to another, and the running operation to end abnormally. If such an error occurs, you must log out by clicking **Close** in the menu area, and then log in again.

If **Close** is not displayed in the menu area, click the button (on the title bar) that closes the window, and then log in again. When you log in again, sometimes a window confirming the forced login appears. Click the **Login** button to forcibly log in.

3.3.7.2 Using the GUI Windows and Commands Separately

Use the GUI windows and commands separately. If you are using the GUI windows to operate the NAS system, do not perform operations using commands. If you are using commands to operate the NAS system, do not perform operations using the GUI windows.

3.3.8 Operations to Avoid with Snapshot Operations

Do not perform any of the following operations from NAS Manager concurrently with differential-data snapshot operations:

- Starting and stopping a cluster

- Performing a forced stop for a cluster
- Changing a cluster configuration
- Starting and stopping a node
- Performing a forced stop for a node
- Starting and stopping a resource group
- Performing a forced stop for a resource group
- Disabling and restarting resource group monitoring
- Changing the execution node of a resource group
- Mounting and unmounting a file system on which operations are to be performed

If you perform one of these operations from NAS Manager concurrently with a differential-data snapshot operation, the operation from NAS Manager or NAS Sync Image might fail and cause an error.

3.3.9 Writing Data into a File System

If you make data write requests that overwrite free space on a differential-data storage device set to file systems managed by NAS Sync Image, the size of the storage device might become insufficient.

If you decide to restore data to a file system that is managed by NAS Sync Image, you should first release the storage device. If you do not, a large amount of data might be written into the storage device, which might cause the size of the storage device to become insufficient and interrupt NAS Sync Image operations.

3.3.10 Snapshot Update Time and Reference Time

The differential-data snapshot update time and reference time is not changed from the creation time even if you mount the created snapshot, create a file share, or if the client references the file-shared snapshot.

3.3.11 Calculating Space Requirements for a Storage Device

This section explains how to calculate the space requirements for a differential-data storage device. Before setting up a storage device, you must determine an optimum size, depending on how the device will be used.

Before setting or expanding a storage device, you should estimate the amount of data to be written to the file system, depending on the use of the file system and the types of data stored in the file system. You should also determine an appropriate creation interval and the number of generations to be reserved.

You can estimate approximate space requirements for the storage device from the following two values:

- The size of the file system for which the differential-data storage device is set
- The amount of data updated for the file system between the time one snapshot and another are created

Depending on the data placement on the disk, the amount of data stored on the storage device might be larger than the amount of data updated for the file system. On the other hand, an update of the file system does not always cause a save to the differential-data storage device. For these reasons, based on the value calculated with the following equation, include a safety margin when setting the size of the storage device. The amount of data updated for the file system used in the formulas is on a per-hour basis.

Preconditions:

- Each of the device files in the storage device must have 160 MB or more.
- The sum of the values derived by subtracting 64MB from the size of each device file must be at least 1% of the file system capacity.
- The product of the amount of data updated per hour (B) and the snapshot creation interval (C) must be less than the capacity of the file system for which the storage device is set (A).

```
B x C < A
```

If this condition cannot be satisfied, check whether an appropriate value has been estimated as the amount of data updated per hour (B). If an appropriate value has been estimated, use the estimate formula shown in Figure 3.5 to obtain the capacity of the storage device.

Differential-data storage device size (MB)

$$= \left(\left\uparrow \frac{A}{4096} \right\uparrow + 1 \right) \times 32 + (B \times C + 6) \times D + 33 \times E$$

Legend:

⌈ ⌉ : Rounded up to an integer value
A : Capacity of the source file systems (Unit: MB)
B : Amount of data updated in the file systems (Unit: MB/hour)
C : Interval between creations of differential-data snapshots (Unit: hours)
D : Number of generations of differential-data snapshots to be created
E : Number of device files that constitute the differential-data storage device

Figure 3.6 Estimating Storage Device Capacity When File System is Less Than 32GB

Differential-data storage device size（MB）

$$= \left(\uparrow \frac{A}{4096} \uparrow + 1 \right) \times 32 + \left(B \times C + 5 + \uparrow \frac{A}{4096} \uparrow \div 16 \right) \times D + 33 \times E$$

Legend:

↑ ↑ : Rounded up to an integer value
A : Capacity of the source file systems (Unit: MB)
B : Amount of data updated in the file systems (Unit: MB/hour)
C : Interval between creations of differential-data snapshots (Unit: hours)
D : Number of generations of differential-data snapshots to be created
E : Number of device files that constitute the differential-data storage device

Figure 3.7 Estimating Storage Device Capacity When File System is 32GB or More

You should allocate a size that includes a safety margin so that the size of the storage device is large enough. Use the following calculation:

Differential-data storage device size（MB）

$$= 64 \times E + A \times (D + 0.01)$$

Legend:

A : Capacity of the source file systems (Unit: MB)
D : Number of generations of differential-data snapshots to be created
E : Number of device files that constitute the differential-data storage device

Figure 3.8 Estimating Storage Device Capacity with Safety Margin

For example, assume that NAS Sync Image is operated by using the following conditions:

- The file system stores home directories for 100 users.
- A home directory of 1 GB is allocated to each user.
- A user updates 10 MB of data every day.
- Differential-data snapshots are created twice a day.
- Differential-data snapshots are retained for 31 days after their creation.
- Device files of 14 GB capacity are used.

Under the above conditions, the values from A to E are determined as follows:

A = 1024 (MB/User) × 100 (Users) = 102400 (MB)
B = 10 (MB/User) × 100 (Users) ÷ 24 (hours) = 1000/24 (MB/hour)
C = 24 (hours) ÷ 2 (times) = 12 (hours)
D = 2 (generations/day) × 31 (days) = 62 (generations)
E = 3

Figure 3.9 Estimating Required Storage Device Capacity

As a result, the capacity required for the storage device is approximately 31.6 GB and the number of device files required for constructing the storage device is 3.

3.4 Setting up a Differential-Data Storage Device

You can use the NAS Sync Image GUI to set up a differential-data storage device.

You can also set up a storage device using the syncstart command (see sections 6.1.2 and 5.4.7).

You can set a storage device of up to 2,047.937 GB for a single file system. Depending on how you are performing snapshot operations, you set the amount of space for the storage device, the number of snapshots to be stored (*number of reserved generations*), and the usage rate for the storage device at which warning messages are output (*warning threshold*).

When you set up a differential-data storage device, you must specify the number of snapshot reserved generations and the warning threshold. You can store a maximum of 124 snapshots for each file system. If there are 3,972 or more logical volumes on the node on which the source file system for the storage device has been created, the number of snapshot reserved generations that can be specified is less than 124.

Each time you request an update, the existing data before the update operation is saved in the storage device. After starting the snapshot operation, expand the storage device or change the warning threshold or the number of snapshot reserved generations as necessary, according to the operation conditions of the storage device.

You can only set up one storage device for each file system. On each node, you can set up storage devices for up to 64 file systems.

Before you can set up a storage device, at least four logical volumes must exist on the node. In addition, the file system for which you are setting up a storage device must meet the following requirements:

- The file system must be created using the volume manager (LVM).
- No differential-data storage device must be set up for the file system.
- The file system is not a differential-data snapshot.

You can also set up an automatic creation schedule for differential-data snapshots at the same time you set up a differential-data storage device. When setup processing for a storage device and an automatic creation schedule completes, the automatic creation schedule starts.

You can also set up or change the automatic creation schedule independently once you have set up the storage device. For more information, see section 3.6.4.

If you use the NAS Backup Restore remote copy function for the file system after setting up the storage device, reconfigure the remote copy pair. For more information, see the *ShadowImage User's Guide* (MK-95DF709).

3.4.1 Steps for Setting Up a Storage Device

To set up a differential-data storage device:

1. Click **Sync Image** on the Main Menu window.

The List of File Systems used for Sync Image window appears.

2. Click **Setup**.

   The Set up a Differential-Data Storage Device window appears.

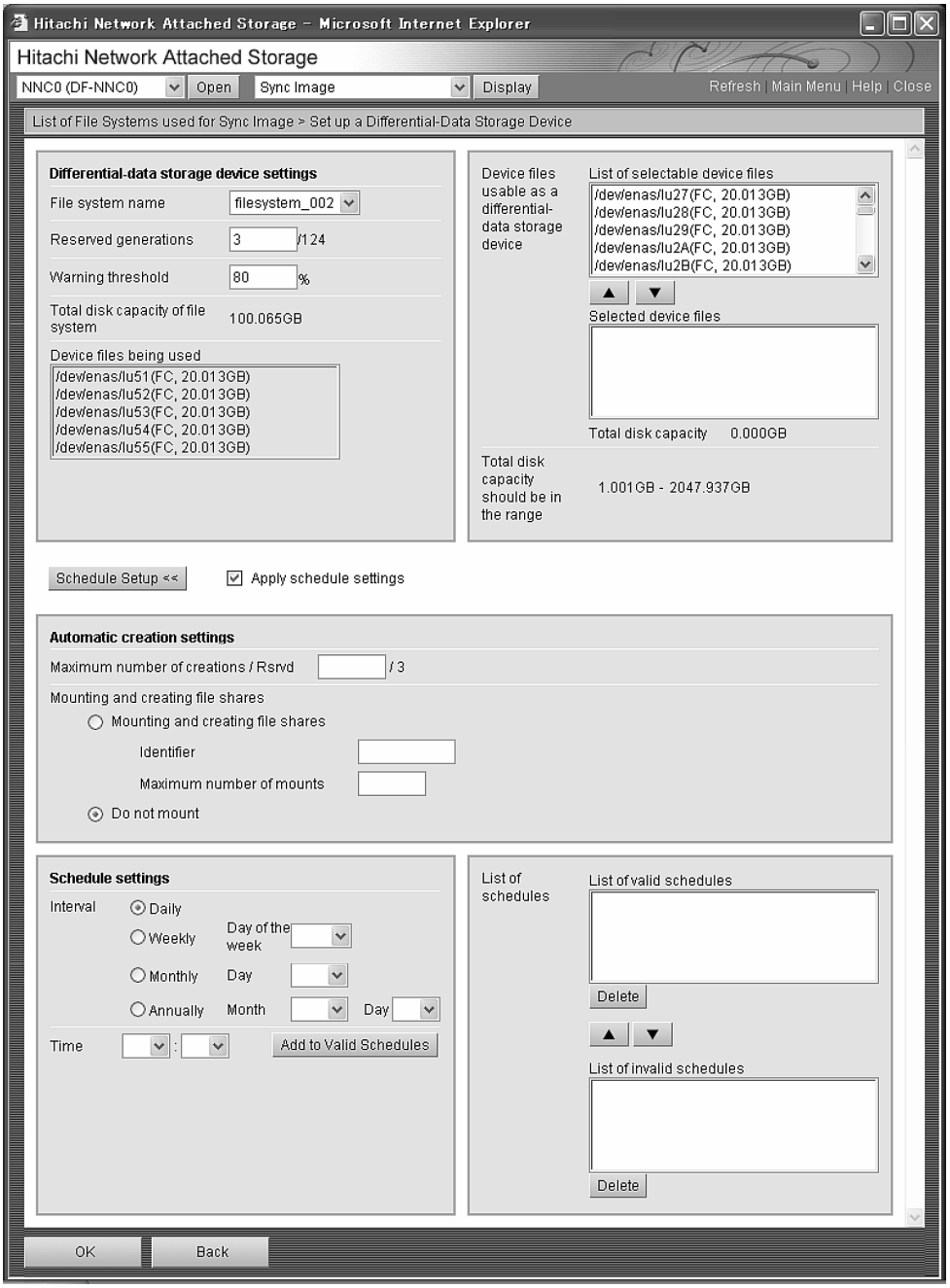


Figure 3.10 Set up a Differential-Data Storage Device Window

3. Type in required items and click **OK**.

   The set up process starts and the List of File Systems used for Sync Image window redisplays.

   To set up an automatic creation schedule at the same time, click **Schedule Setup >>** to display the **Automatic creation settings** area, and then type in the required information.

To hide the **Automatic creation settings** area, click **Schedule Setup<<**.

4. To check the processing results displayed for **Operating status**, click **Refresh** in the List of File Systems used for Sync Image window. If an error message displays for Operating Status, see section 3.4.1.1.

Table 3.1 lists the information items you specify in the Set up a Differential-Data Storage Device window.

Table 3.1 Setup a Differential-Data Storage Device Window

Item	Description
Differential-data storage device settings Specify information on the differential-data storage device.	
File system name	From the drop-down list, select the file system for which you want to set up a differential-data storage device.
Reserved generations	Specify the number of generations for differential-data snapshots (reserved generations), as an integer from 3 to 124. The default is 3. However, if there are 3,972 or more logical volumes on the node on which the source file system for the differential-data storage device has been created, the value that can be specified is less than 124.
Warning threshold	Specify the usage rate for the differential-data storage device at which a warning message is output (warning threshold), as an integer from 0 to 99. The default is 80. When 0 is specified, no message is output until the amount of free space of the differential-data storage device becomes insufficient.
Device files usable as a differential-data storage device	From the list box select device files to be used for the differential-data storage device. **List of selectable device files** Displays device files you can use for the differential-data storage device. Device files with a capacity less than 160 MB are not displayed. Select device files to be used for the differential-data storage device and click the ▼ button. The device files you selected are displayed in the **Selected device files** list box. **Selected device files** Displays device files to be used for the differential-data storage device. **Total disk capacity** displays the total size of the device files displayed in the **Selected device files** list box. Adjust the list so that the total size of the device files falls in the value range displayed in **Total disk capacity should be in the range**. You can select up to 128 device files. To delete device files from the **Selected device files** list box, select the desired device files and click the ▲ button.
Apply schedule settings To set up an automatic creation schedule at the same time as setting up the differential-data storage device, select this check box. An automatic creation schedule based on the information you specify in the **Automatic creation settings** area will be created only if you select this check box. This check box is automatically selected when you click the **Schedule Setup >>** button. However, it is not automatically cleared when you click the **Schedule Setup <<** button to hide the **Automatic creation settings** area. If you do not intend to set up an automatic creation schedule, manually clear this check box.	

Item	Description
Automatic creation settings Specify the maximum number of differential-data snapshots to be created automatically, and whether to mount differential-data snapshots and create file shares.	
Maximum number of creations / Rsrvd	Specify the maximum number of differential-data snapshots that you want to create automatically (maximum number for automatic creation), within the number of reserved generations (**Reserved generations**) to be set for the differential-data storage device. When one or more schedules are specified in the **List of valid schedules** list box, you can create differential-data snapshots up to the number specified in **Maximum number of creations / Rsrvd**. Specify a value that is less than the number of reserved generations for differential-data snapshots to be set for the differential-data storage device.
Mounting and creating file shares	Select one of the following to specify whether to mount a created differential-data snapshot and create file shares automatically. **Mounting and creating file shares** Select this if you want to mount a differential-data snapshot and create file shares at the same time as the differential-data snapshot is created. If you select **Mounting and creating file shares**, you must also specify the following items: **Identifier** Specify an identifier, from 1 to 5 characters, for a mount point name. You can specify alphanumeric characters and underscores (_). Specify the identifier taking into consideration other mount point names used in the cluster to ensure that the mount point name with the identifier will be unique in the cluster. In addition, specify the identifier so that you can identify (from the mount point name) which file system the mounted differential-data snapshot is for. **Maximum number of mounts** Specify the maximum number of differential-data snapshots to be mounted automatically (maximum number for automatic mounting). Specify a value that is less than or equal to the maximum number for automatic creation specified in **Maximum number of creations / Rsrvd**. If one or more schedules are listed in the **List of valid schedules** list box, differential-data snapshots are mounted automatically up to the number of mounts specified in **Maximum number of mounts**. Specify the maximum number for automatic mounting taking into consideration the number of created file systems and mounted snapshots in the cluster. **Do not mount** Select this if you do not want to mount differential-data snapshots and create file shares.

3.4.1.1 Steps to Take if Setup Terminates Abnormally

If setup processing for the differential-data storage device terminates abnormally, or a warning message is displayed after a task has been queued, you must check and clear the error information and set up the storage device and automatic creation schedule again.

If the differential-data storage device and the automatic creation schedule were set up at the same time, an error or warning message is displayed for each setup processing. When an error or warning message is output at setup processing for the storage device, setup processing for the schedule is not executed. Check the status of each setup processing and, if necessary, perform the setup again. For more information on setting up an automatic creation schedule, see section 3.6.4.

If you performed an operation for setting the storage device for the file system from the GUI immediately after the creation of the file system, and an error occurs, the cause of the error might be from the file system creation. After checking and clearing the error details of the setup for the storage device, check the results of the file system creation.

For more information on how to check the results of the file system creation, see the *NAS Manager User's Guide*.

To clear the error details:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Select the file system for which setup of the storage device terminated abnormally and click **Error Details**.

   The Error Details window appears.

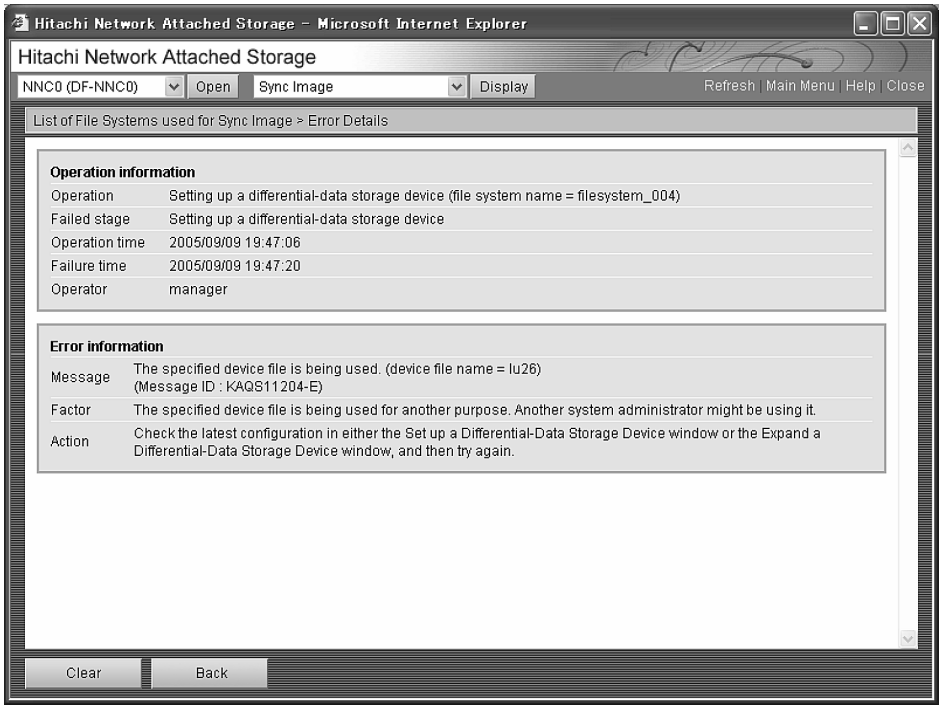


Figure 3.11 List of File Systems Error Details

3. Check the displayed information, such as the error message, cause of the error, and action to take, and click **Clear**.

   A dialog box displays asking you to confirm whether the error details can be cleared.

Table 3.2 lists the information items displayed in the Error Details window.

Table 3.2 Error Details Window

Item	Description
Operation	Displays information on operations that terminated abnormally.

Failed stage	Displays the stage of setup processing at which the processing terminated abnormally or the warning message was output.
	`Setting up a differential-data storage device`
	Displayed when setup processing for a storage device terminates abnormally or a warning message regarding the processing is output.
	Clear the error details, and then set up the storage device again.
	`Setting up automatic creation of differential-data snapshots`
	Displayed when the setup processing for an automatic creation schedule that was executed at the same time as the setup for the storage device terminates abnormally, or a warning message regarding the setup processing is output. The setup processing for the storage device has ended normally.
	Clear the error details, and set up the automatic creation schedule again.
	`Waiting for execution`
	Displayed when a NAS OS error or failover occurs or the resource group stops after the task for setting up the storage device and automatic creation schedule has been queued.
	`Starting execution`
	Displayed when an error occurs in the NAS OS immediately after setup processing for the storage device and automatic creation schedule starts.

Operation time	Displays the date and time the system administrator performed the operation.
Failure time	Displays the date and time the operation performed by the system administrator terminated abnormally.
Operator	Displays the user name of the system administrator who performed the operation that terminated abnormally.
Message	Displays an error message and its message ID.
Factor	Displays the cause of the error.
Action	Displays the action to take for the error.

4. Click **OK**.

   The error details are cleared and the List of File Systems used for Sync Image window displays again.

5. Take action according to the error details.

6. After completing the required action, try to set up the storage device again.

3.4.1.2 Setup Errors with Automatic Creation

If you try to set a schedule at the same time as setting up a storage device, an error can occur at either of the following two stages:

- At storage device setup:

  If an error occurs at this stage, neither the storage device nor schedule is set up, so you have to set them up again.

- At automatic creation set up:

  If an error occurs at this stage, the storage device is successfully set up, but the automatic creation is not, so you have to set up automatic creation only.

3.4.1.3 Changing Storage Device Settings

Use NAS Sync Image to change the settings for a storage device. You can change the number of snapshot reserved generations and the warning threshold of the storage device depending on the operation conditions.

You can also use the syncconfig command to change settings (see section 5.4.2).

3.4.1.4 Before Changing Settings

If you are operating an automatic creation schedule for differential-data snapshots and want to change the number of reserved generations, adjust the maximum number of snapshots to be created automatically and creation date as required.

Automatic creation schedule settings are not changed automatically even if you set a value that is less than the maximum number of snapshots to be created automatically for the number of reserved generations. Snapshots are created automatically based on the assumption that the newly set number of reserved generations is the maximum number for automatically created snapshots.

3.4.1.5 Steps for Changing Settings

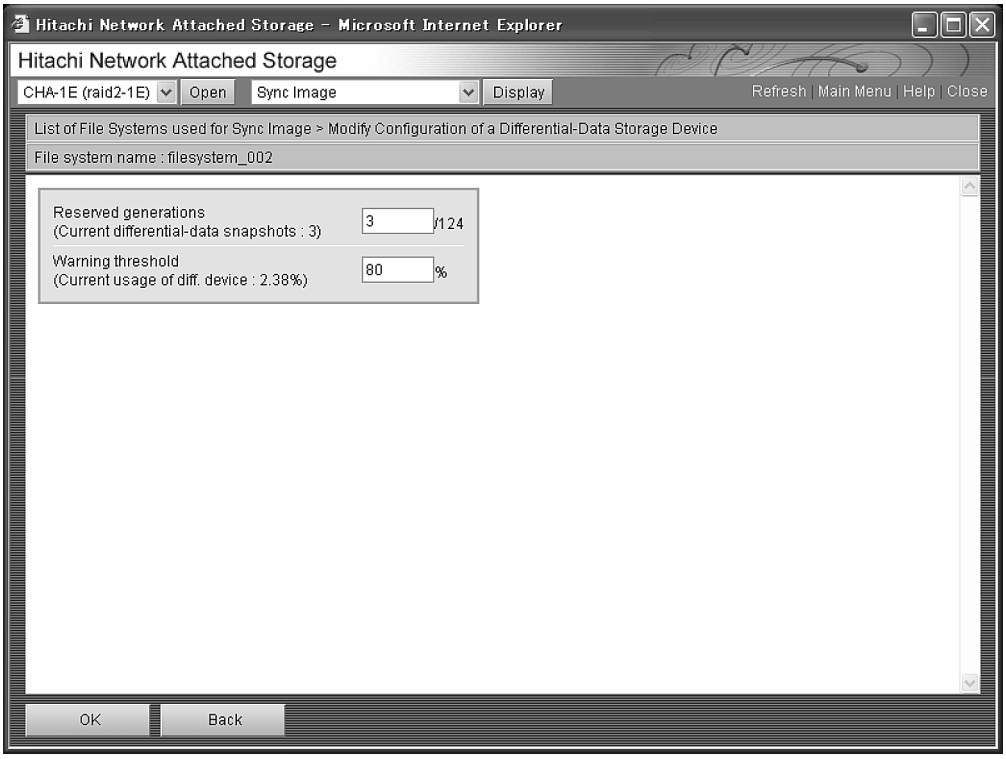
To change the settings for a differential-data storage device:

1. In the Main Menu window, click **Sync Image**.

   The List of File Systems used for Sync Image window appears.

2. Check the status of the storage device and make sure that:
   - **Operating status** is blank
   - **Diff-device status** is `Available` or `Busy`.
3. Select the file system for which the storage device is set, and click **Modify Configuration**.

The Modify Configuration of a Differential-Data Storage Device window appears.



4. Type in the setting information you are changing and click **OK**.

   The List of File Systems used for Sync Image window appears again.

Table 3.3 describes the setting information you can change.

Table 3.3 Changing Settings for a Storage Device Window

Item	Description
Reserved generations	Specify the number of generations for differential-data snapshots (reserved generations), as an integer from 3 to 124. The value must be greater than the number of snapshots already created. Specify the new number of reserved generations, based on the number of snapshots displayed for **Current differential-data snapshots.** If you subtract the number of the current reserved generations from the number of logical volumes on the node on which you have created the source file system for the storage device and this yields a resulting value that is greater than 3,972, the values you can specify is less than 124.
Warning threshold	Specify the usage rate for the differential-data storage device at which a warning message is output (warning threshold), as an integer from 0 to 99. If you specify 0, no message is output until the amount of free space of the storage device becomes insufficient. If the value you specify is less than the current usage rate of the storage device, a message is output as soon as the setting is changed. Specify the new value based on the usage rate displayed for **Current usage of diff. device.**

3.4.2 Expanding a Storage Device

Use NAS Sync Image to expand a differential-data storage device according to the device operation conditions. Do not restart the CIFS while expanding a storage device. This could prevent the CIFS client from accessing or writing data to the file system.

If the NAS Backup Restore remote copy function is used for the file system, reconfigure the remote copy pair after expanding the differential-data storage device. For more information on remote copy, see the *ShadowImage User's Guide*.

You can also use the syncexpand command to expand a storage device (see section 5.4.4).

To expand a differential-data storage device:

1. In the Main Menu window, click **Sync Image**.

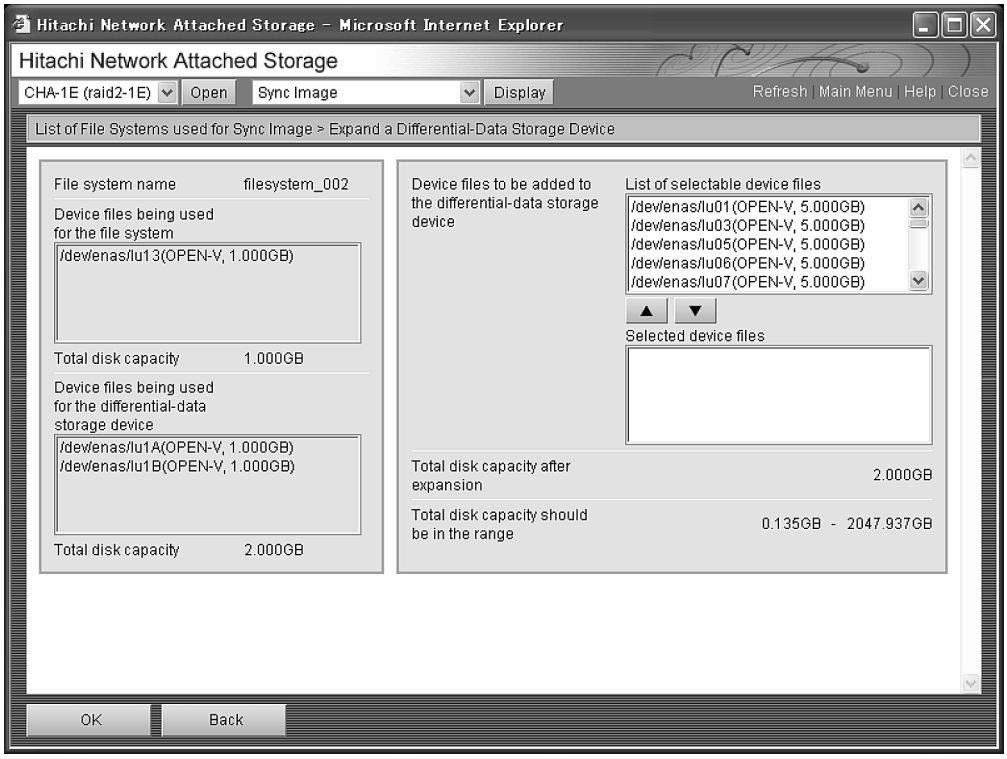
   The List of File Systems used for Sync Image window appears.

   Check the status of the storage device and make sure that:

   - **Operating status** is blank
   - **Diff-device status** is `Available` or `Busy`.

2. Select the file system for which the storage device is set, and click **Expand**.

   The Expand a Differential-Data Storage Device window appears.



3. Select the device files you are adding to the storage device, click the down arrow (▼), and click **OK**.

   The List of File Systems used for Sync Image window displays again.

Table 3.4 describes selecting the files to expand the storage device on the Expand a Storage Device Window.

Table 3.4 Expand a Differential-Data Storage Device Window

Item	Description
List of selectable device files	Displays device files you can add to the differential-data storage device. Device files with a size less than 160 MB are not displayed. Select device files to add to the storage device, and click the ▼ button. The selected device files display in the **Selected device files** list box.
Selected device files	Displays device files you are adding to a storage device. **Total disk capacity after expansion** displays the total size of the device files displayed in the **Device files being used for the differential-data storage device** list box and **Selected device files** list box. Adjust the list so that the total size of the device files falls in the value range displayed in **Total disk capacity should be in the range**. You can use a maximum of 128 device files for one storage device. To delete a device file from the **Selected device files** list box, select the desired device files and click the up arrow ▲ button.

4. Check the status of the device file and the storage device.

   Make sure that `Expanding` is not displayed for **Diff-device status** and **Status**.

   If `Expanding` displays, wait a moment and click **Refresh** to update the display.

   If the status does not change even after the update, an error might have occurred during processing. Follow the procedure described in the next section to recover from the error.

3.4.2.1 Performing a Recovery if Expansion Fails

If expansion for a differential-data storage device is canceled due to a failure, you must perform a recovery. Recovery allows the canceled processing to be completed, and the storage device to be expanded normally.

If expansion for a storage device is canceled when automatic creation schedules are enabled, the schedules are immediately disabled, and no more snapshots are automatically created. After performing a recovery, re-establish schedules.

To perform a recovery:

1. In the Main Menu window, click **Sync Image**.

   The List of File Systems used for Sync Image window appears.

2. Check the status of the storage device on which you are performing a recovery.

   Make sure that `Expanding` displays for **Diff-device status**.

3. Select the file system for which the storage device is set, and click the **Recover Expansion** button.

   Recovery processing is performed.

4. Follow the instructions in section 3.6.4 to re-enable each schedule.

For more information on using the syncexpand command to expand memory, see section 5.4.4.

3.5 Viewing File System and Differential-Data Storage Device Status

Use the NAS Sync Image GUI windows to view the status of a file system or differential-data storage device.

You can also view the status of a file system or storage device using the synclist command (see section 5.4.5).

To view file system and storage device status:

1. In the Main Menu window, click **Sync Image.**

   The List of File Systems used for Sync Image window appears.

2. Click **Refresh.**

   The window displays the current status of the file systems and storage device files.

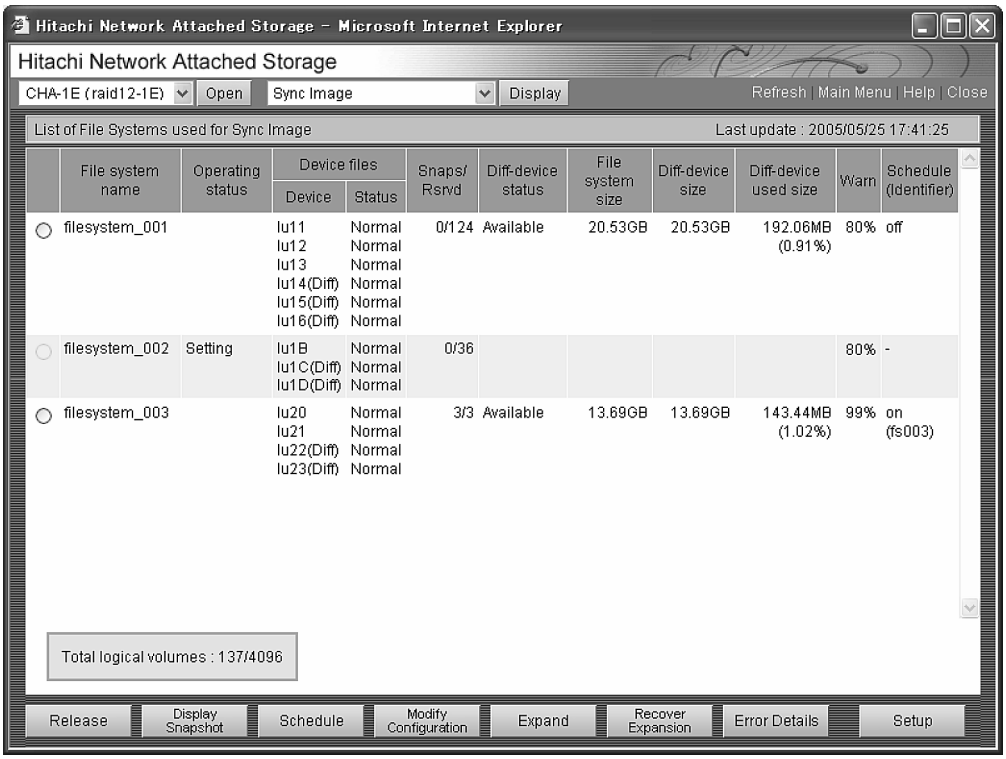


Table 3.5 describes items displayed in the List of File Systems used for Sync Image window.

Table 3.5 List of File Systems Used for Sync Image Window

Item		Description
Last update		Displays the date and time when the information displayed in the window was last updated.
File system name		Displays the names of file systems that are active in NAS Sync Image. If a resource group on another node in the cluster has failed over, this item displays the name of the file system created on that node in the cluster as follows: *file-system-name*(On other node)
Operating status		Displays the status of setup for the differential-data storage device. Setting Setup for the storage device is waiting for execution or is being used. Error Displays when setup for the storage device terminates abnormally after the task has been queued or when a warning message is displayed. Take action as described in section 3.4.1.1. If setup for the storage device terminated normally, nothing displays.
Device files	Device	Displays the names of device files that constitute the file system or the differential-data storage device. This item displays the names of device files that constitute the storage device as follows: *device-file-name*(Diff) If processing to expand the storage device is being performed, or an error occurred during the processing, device files to be added are also displayed.
	Status	Displays the status of device files that constitute the file system or the differential-data storage device: Normal The differential-data storage device is normal. Error Displays if an error might have occurred. Identify the cause of the error by following the procedure in section 7.2.6. Expanding Displayed when processing to expand the storage device is being performed, or an error occurred during processing. If an error occurred during processing, recover by following the procedure in section 3.4.2.1.
Snaps/Rsrvd		Displays the number of differential-data snapshots created for the file system and the number of differential-data snapshot reserved generations set up for the file system as follows: *number-of-created-differential-data-snapshots/number-of-reserved-generations* No value displays if **Diff-device status** is one of the following: ▪ Failed to get the VG information ▪ I/O error ▪ In processing or error ▪ Not available ▪ Offline ▪ System error

Item	Description

Diff-device status	Displays the status of the differential-data storage device. However, nothing displays if **Operating status** is `Setting` or `Error`.
	`Available`
	Displays when the differential-data storage device is normal.
	`Busy`
	Displays when a differential-data snapshot is being created or deleted.
	After this operation has finished, perform the next operation.
	`Deleting`
	Displayed when processing to simultaneously delete all the differential-data snapshots created for the file system is in progress, or an error occurred during processing.
	If an error occurred during processing, re-use the operation for simultaneously deleting all differential-data snapshots.
	`Expanding`
	Displayed when processing to expand a storage device is being performed, or an error occurred during processing.
	If an error occurred during processing, recover by following the procedure in section 3.4.2.1.
	`Failed to get the VG information`
	Displayed if the system failed to obtain the volume group information.
	Acquire the Sync Image log files and contact your HDS representative.
	`I/O error`
	Displayed if an error has occurred in device files that constitute the file system or the differential-data storage device.
	Identify the error source. If the error source is identified, see section 3.4.2.1.
	`In processing or error`
	Displayed when processing to set or release a differential-data storage device is in progress, or if an error occurred during the processing.
	If an error occurred during processing, release the storage device.
	`Not available`
	Displayed if a failure occurred in the file system or differential-data storage device, a failover occurred, or if the resource group has stopped.
	Identify the cause of the error as described in Chapter 6.
	`Offline`
	Displayed if the resource group has stopped.
	Start the resource group. For details, see the *NAS Manager User's Guide*.
	`Overflow`
	Displayed if the capacity of the differential-data storage device is insufficient.
	Take action as described in section 6.3.
	`System error`
	Displayed if a system error has occurred.
	Acquire the Sync Image log files and contact your HDS representative.

Item	Description
File system size	Displays the total space of the file system. No value displays if **Operating status** is `Setting` or `Error`, or if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`
Diff-device size	Displays the total space of the differential-data storage device. No value displays if **Operating status** is `Setting` or `Error`, or if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`
Diff-device used size	Displays the used capacity within the total capacity of the differential-data storage device. The value in parentheses indicates the percentage of the used space to the total space. `Error` displays if **Diff-device status** is `Deleting` or `Overflow`: No value displays if **Operating status** is `Setting` or `Error`, or if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`
Warn	Displays the warning threshold set for the differential data storage device. If - displays, no warning threshold has been set. No value displays if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`

Item	Description
Schedule (Identifier)	Displays information on automatic creation schedules of the differential-data snapshots that are set up for the file system. - Displayed if no automatic creation schedules are set up. On Displayed if automatic creation schedules are set up and at least one schedule is currently enabled. Off Displayed if automatic creation schedules are set up and all schedules are currently disabled. If automatic creation schedules are set up so that differential-data snapshot mounting and file share creation are performed automatically when differential-data snapshots are created, the identifier used in the mount point name displays (enclosed in parentheses). For example, when fs01 is set as the identifier: On fs01)
Total logical volumes	Displays the number of logical volumes created on the node you have logged into and the maximum number of logical volumes that can be created, as follows: *number-of-created-logical-volumes/maximum-number-of-logical-volumes-that-can-be-created*
Total logical volumes on other node	Displays the number of logical volumes created on the other node in the cluster and the maximum number of logical volumes that can be created, as follows: *number-of-created-logical-volumes/maximum-number-of-logical-volumes-that-can-be-created* This information displays when a resource group from the other node in the cluster is failed over to the node.

3.6 Creating a Differential-Data Snapshot

You can use NAS Sync Image to create a differential-data snapshot in the following ways:

- Create a snapshot by using the NAS Sync Image GUI windows
- Create a snapshot by using the syncadd command (see section 5.4.1)
- Delete a snapshot and create a new one in one operation by using NAS Sync Image GUI windows
- Create a snapshot automatically by setting up an automatic creation schedule.

3.6.1 Before Creating a Snapshot

Before you create a differential-data snapshot, make sure of the following:

- You have first set up a storage device for the file system, as described in section 3.4. The maximum number of snapshots you can create is equal to the number of reserved generations specified when the storage device was set. This includes the snapshots that are created by linking with the NAS Backup Restore online backup function.
- If you create or delete a differential-data snapshot, background processing is used. You cannot create a snapshot of a file system if the background processing for creating or deleting another snapshot is running. When multiple snapshots are created in succession from one file system, use the command at appropriate intervals after taking into consideration the file system space and system load.
- To avoid excessive I/O processing loads, do not create snapshots for multiple file systems concurrently. Creating such snapshots concurrently might take a long time.
- Do not restart the CIFS service while creating a snapshot. If you restart the CIFS service while creating a snapshot, the CIFS clients might not be able to access or write data to the file system.

If available space in the storage device is insufficient, or the number of the snapshots has reached the number of reserved generations, the attempt to create the snapshot fails. Once the first snapshot has been created, check the status of the storage device regularly, and perform the following operations as necessary:

- Deleting unnecessary snapshots (see section 3.10).
- Changing the number of snapshot reserved generations (see section 3.4.1.3).
- Expanding a storage device (see section 3.4.2).

You can mount a created snapshot and create NFS and CIFS shares as needed (see section 3.8). For more information on creating NFS and CIFS shares, see *NAS Manager User's Guide*.

3.6.2 Creating a Snapshot Using the GUI

To create a differential-data snapshot using the GUI:

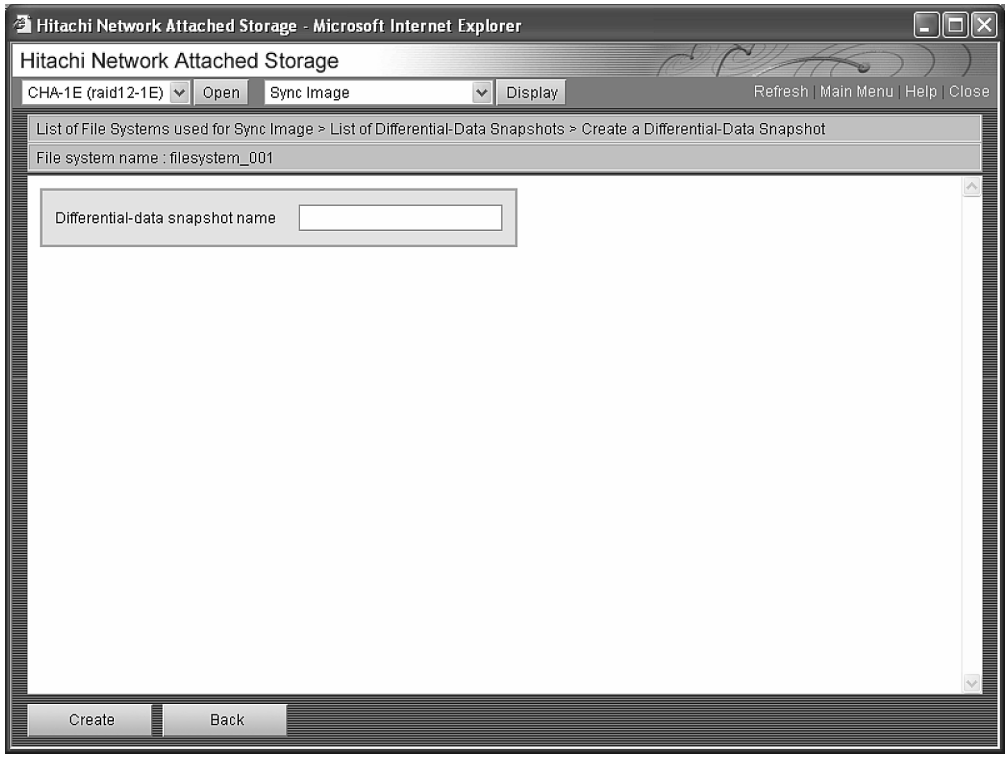
1. Click **Sync Image** on the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Check the status of the storage device for the file system for which you want to create a snapshot. Make sure that:
   - **Operating status** is blank
   - **Diff-device status** is `Available`.
3. Select the file system for which you want to create a snapshot and click **Display Snapshot**.

   The List of Differential-Data Snapshots window appears.
4. Click **Create**.

   The Create a Differential-Data Snapshot window appears.



5. Type in a differential-data snapshot name and click **Create**.

   The snapshot is created and the window returns to the List of Differential-Data Snapshots window.

Table 3.6 describes the snapshot name you enter.

Table 3.6 Create a Differential-Data Snapshot Window

Item	Description
Differential-data snapshot name	Enter the name of the new differential-data snapshot you are creating. The name must consist of 1-16 characters. Permitted characters are alphanumeric characters and underscores (_). You cannot use the following names: ▪ A name already used by another differential-data snapshot in the file system ▪ A name that begins with `auto-` ▪ A name that begins with `SyncBackup`

3.6.3 Deleting and Creating a New Snapshot in One Operation

To delete a differential-data snapshot and create a new one in one operation:

1. Click **Sync Image** on the Main Menu window.

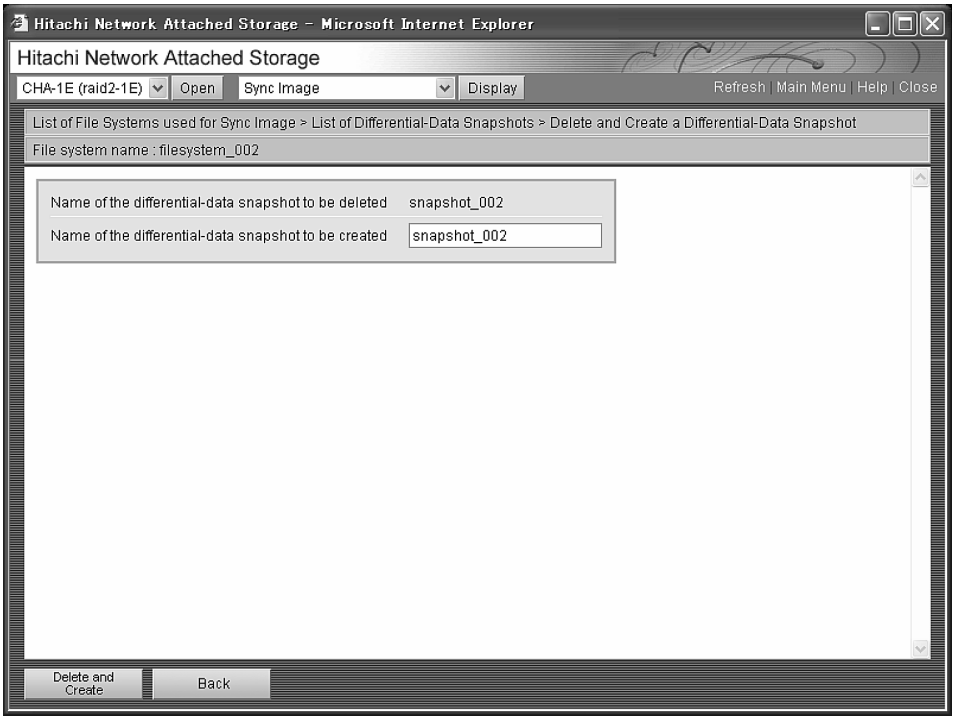
   The List of File Systems used for Sync Image window appears.

2. Check the status of the storage device for the file system for which you want to delete a snapshot and create a new one in one operation. Make sure that:
   - **Operating status** is blank
   - **Diff-device status** is `Available`.
3. Select the file system for which you want to delete a snapshot and create a new one, and click the **Display Snapshot** button.

   The List of Differential-Data Snapshots window appears.

4. Select the snapshot you want to delete, and click **Delete and Create**.

   The Delete and Create a Differential-Data Snapshot window appears.



5. Type in the name of the snapshot you are creating click **Delete and Create**.
6. Click **OK** in the dialog box.

   The snapshot is deleted and a new one created. The List of Differential-Data Snapshots window appears again.

   Table 3.7 describes the snapshot name you can enter.

Table 3.7 Delete and Create Differential-Data Snapshot Window

Item	Description
Name of the differential-data snapshot to be created	The name of the new snapshot you are creating. The name must consist of 1-16 characters. Permitted characters are alphanumeric characters and underscores (_). By default, the differential-data snapshot name selected in the List of Differential-Data Snapshots window displays. You cannot specify the following names: ▪ A name already used for another differential-data snapshot in the file system (not including those displayed for **Name of the differential-data snapshot to be deleted**) ▪ A name that begins with `auto-` ▪ A name that begins with `SyncBackup`

3.6.4 Creating Snapshots Automatically

You can use NAS Sync Image windows to set up a schedule for automatically creating snapshots. You can specify that snapshots be created on a daily or weekly basis or at a specific date and time. You can also set up schedules for each file system so that the snapshot is mounted, and its file share is created, when the snapshot is created. You can set up a maximum of 16 schedules for a file system.

3.6.4.1 Understanding File Names of Scheduled Snapshots

NAS Sync Image automatically assigns a name in the following format to each automatically created snapshot:

```
auto-<creation-interval><date-and-time-when-automatic-creation-was-started
(format: YYMMDDhhmm) >
```

According to the specified schedule, *creation-interval* is assigned as shown in Table 3.8:

Table 3.8 Automatic Creation Interval Variables

Variable	Description
D	Snapshot is created every day.
W	Snapshot is created every week on a specified day.
M	Snapshot is created every month on a specified date.
A	Snapshot is created every year on a specified date.

The following file name means that the snapshot is created automatically every year on January 1 at 14:00:

```
auto-A0601011400
```

When you set multiple schedules to create a snapshot for one file system at the same time, only one snapshot is created. The snapshot name is assigned based on the schedule with the longest execution interval.

For example, when a schedule specifies that a snapshot is to be created annually at 14:00 on January 1, and another schedule specifies that a snapshot is to be created on the first day of every month at 14:00, only one snapshot will be created at 14:00, 1 January 2006. The snapshot name `auto-A0601011400` will be assigned.

3.6.4.2 Automatic Mounting and File Sharing of Scheduled Snapshots

If you set up schedules so that differential-data snapshot mounting and file share creation are performed automatically at the same time as a snapshot is created, the created snapshot is mounted in read-only mode and a file share is created.

Except for the shared directory, access permission for the CIFS share, and CIFS share name, the same file share information that was set for the creation-source file system is set for the snapshot. The access permission for the CIFS share is always set to read-only. The mount point, shared directory, and CIFS share name are set in the following formats, based on the schedule settings and creation-source file share settings:

- Mount point:

  /mnt/<*identifier*><*creation-interval*><*date-and-time-when-automatic-creation-was-started*>

- Shared directory:

  /mnt/<*identifier*><*creation-interval*><*date-and-time-when-automatic-creation-was-started*>/<*subdirectory-name-of-file-share-for-creation-source*>

- CIFS share name:

  <*CIFS-share-name-of-creation-source*><*creation-interval*><*date-and-time-when-automatic-creation-was-started*>

For example, if you set `fs01` as the identifier and create a snapshot based on a schedule that creates a snapshot at 14:00 on January 1 every year, mounting and file share creation are performed under the settings shown in Table 3.9.

Table 3.9 Mounting and File Share Creation for Automatically Created Snapshot

Item	Creation Source File System	Created Differential-Data Snapshot
Name	`filesystem01`	`auto-A0601011400`
Mount point	`/mnt/filesystem01`	`/mnt/fs01A0601011400`
Shared directory for NFS share	`/mnt/filesystem01/dir1_nfs`	`/mnt/fs01A0601011400/dir1_nfs`
Shared directory for CIFS share	`/mnt/filesystem01/dir2_cifs`	`/mnt/fs01A0601011400/dir2_cifs`
CIFS share name	`dir2_cifs`	`dir2_cifsA0501011400`

You should notify, in advance, clients who are using the snapshots of the names of the shared directory and CIFS share to be created.

Once a snapshot has been mounted, you can also view information about it from NAS Manager by using the mount point name. You cannot perform any of the following operations on a mounted snapshot from NAS Manager:

- Deletion — Perform this operation from NAS Sync Image.
- Expansion
- Setting or changing the quota — The quota value set for the file system when it is created is applied to the snapshot. This setting cannot be changed.
- Mounting or unmounting — You must perform this operation from NAS Sync Image.

For more information on how to view the list of file systems, and how to check and edit file share information, see the *NAS Manager User's Guide*.

3.6.4.3 Auto-Deletion of Scheduled Snapshot Generations that Exceed the Maximum

When you set or change a schedule, specify the maximum number of snapshots to be automatically created (maximum number for automatic creation). If the number of automatically created snapshots reaches the maximum number for automatic creation, or if the total number of created snapshots reaches the number of reserved generations, the oldest snapshot, which begins with `auto-` and meets one of the following conditions, is deleted:

- Not mounted
- Mounted with the mount point name that conforms to the format for automatic mounting

For example, suppose you set the number of reserved generations to 5 and operate an automatic creation schedule. If the stored snapshots are in the state indicated in the following table when automatic creation processing started, the snapshot created at 12:00 on January 1, 2005 will be deleted.

Table 3.10 Snapshots Deleted When Automatic Creation Processing Starts

Creation Date and Time	Snapshot Name	Mount Point Name	Deletion Target
2006/01/01 00:00	`auto-Y0601010000`	`fs01_autoY0101`	No
2005/01/01 09:00	`snap01`	Not mounted	No
2006/01/01 12:00	`auto-D0601011200`	`fs01D0501011200`	Yes
2006/01/01 15:00	`auto-D0601011500`	Not mounted	No
2006/01/01 18:00	`snap02`	`fs01_snap02`	No

Note: If the resource group to which the creation-source file system belongs is failed over, the oldest of the automatically created snapshots that are not mounted is deleted. In the above example, the snapshot created at 15:00 on January 1, 2006 will be deleted.

If file shares have been created for the snapshot to be deleted, regardless of whether the file shares were created manually or automatically, all file shares are deleted and the snapshot is unmounted. If automatic deletion for a file share is used while a client is mounting that file share, the client can no longer reference that file share.

You should perform any of the following operations to protect snapshots that contain important data:

- Mount the snapshot manually.
- Back up data to a tape device by using the NAS Backup Restore function.
- Back up data to the other node by using the NAS Backup Restore remote copy function.

If all automatically created snapshots are mounted manually, an error occurs. An error also occurs if all automatically created snapshots are mounted when the resource group to which the creation-source file system belongs is failed over.

Remedial actions include changing the number of reserved generations (see section 3.3.4), changing the maximum number for automatic creation, and unmounting automatically created snapshots that are no longer necessary (see section 3.9).

When you set a schedule so that created snapshots are mounted and the file shares are created automatically, you set the maximum number of snapshots to be mounted (maximum number of automatic mounts). If automatic mount processing is performed when the number of automatically mounted snapshots has reached the maximum number of automatic mounts, the oldest snapshot that meets the following conditions is unmounted:

- The name begins with `auto-`
- Mounted with the mount point name that conforms to the format for automatic mounting

For example, suppose you set the maximum number of automatic mounts to `2` and operate an automatic creation schedule. If the snapshots are in the state indicated in the following table when automatic mount processing starts, the snapshot created at 12:00 on January 1, 2006 will be unmounted.

Table 3.11 Snapshots Unmounted When Automatic Mount Processing Starts

Creation Date and Time	Snapshot Name	Mount Point Name	Deletion Target
2006/01/01 00:00	auto-Y0601010000	fs01_autoY0101	No
2005/01/01 09:00	snap01	Not mounted	No
2006/01/01 12:00	auto-D0601011200	fs01D0501011200	Yes
2006/01/01 15:00	auto-D0601011500	Not mounted	No
2006/01/01 18:00	snap02	fs01_snap02	No

3.6.4.4 Guidelines for Setting Up Automatic Snapshot Creation

Keep the following guidelines in mind when setting up automatic snapshot creation, mounting, and file sharing.

- **Setting date and time:**

  Depending on the date and time to be set for a schedule, snapshots might not be automatically created at the time you intend. When setting a time for automatic creation, keep the following in mind:

  – The background processing time required for differential-data snapshot creation or deletion increases in proportion to the file system size. Under a low system load, it takes about 15 seconds when the file system space is 50 GB, and about 5 minutes when the file system space is 1 TB. Under a high system load, the background processing time might increase to about 50 times the time required when under a low system load. If you mount differential-data snapshots and create file shares at the same time as creating the differential-data snapshots, the processing time varies according to the number of file shares to be created.

    Considering the processing time for these operations, set a schedule interval that satisfies the following conditional expression:

$$I > A + 0.8 \times n + 1$$

Legend :
I : Interval for the automatic creation schedule (unit: minutes)
A : Background processing time required to create and delete differential-data snapshots (unit: minutes)
n : Total number of NFS and CIFS shares created for the creation source file system

Figure 3.12 Setting a Schedule Interval

- Automatic creation of snapshots might fail if other processing is being performed in the creation-source file system, or if online backup processing is being performed. Do not perform operations other than automatic creation of snapshots for the file system around the same time that automatic creation is being performed.
- If automatic creation schedules are set to run for multiple file systems at the same date and time, the system does not start a second creation process until the first creation process finishes. If this occurs, snapshot creation processes may not start at the times you set. Adjust the automatic creation schedule for each file system so that multiple processes for snapshot creation do not run concurrently.
- If a snapshot of the same name as the one to be created already exists, or if you change the time zone or switch to Daylight Saving Time when there are automatic creation schedules in effect, snapshots may not be created automatically. The scheduled creation of a snapshot might be skipped, and even if the scheduled creation is used, the snapshot creation might fail due to duplication of the name. Review the schedule before the time zone is changed or Daylight Saving Time starts, and make sure that the snapshot can be created at the desired time.

- **Automatic mounting of differential-data snapshots:**

  Automatic mounting of snapshots requires that system operations meet the following conditions. If any of these conditions is not met when mounting starts, creating a snapshot ends normally but mounting ends without being performed. Review the system operation status before starting automatic creation schedule operations. After starting, take into consideration the resource group status, the number of snapshots being mounted and the mount point names of file systems and snapshots, including the following:

  - The resource group to which the creation-source file system belongs is operating normally (is not failed over).
  - The creation-source file system has been mounted.
  - Mount point names are not duplicated in a cluster.
  - The total number of created file systems and mounted snapshots is 255 or less.

- **Automatic creation of file shares for differential-data snapshots:**

  The maximum number of NFS and CIFS shares you can create in a cluster is 256 for each share type. Before starting an automatic creation schedule operation, revise the file share information for the file system and differential-data snapshots so that the total sum of the existing file shares and automatically created file shares does not exceed the maximum.

  To automatically create NFS or CIFS shares for differential-data snapshots, some conditions must be met. The following shows the conditions for NFS shares and CIFS shares.

  Conditions under which NFS shares can be created (when NFS shares have been created for the creation-source file system):

- The absolute path of the shared directory for NFS shares created for the creation-source file system is 48 characters or less in length.

Conditions under which CIFS shares can be created (when CIFS shares have been created for the creation-source file system):

- The CIFS share name for the creation-source file system is 69 characters or less in length.
- The absolute path of the shared directory for CIFS shares created for the creation-source file system is 241 characters or less in length.
- CIFS share names set for differential-data snapshots do not exist in duplicate in a node.

If any of the automatically created file shares do not satisfy the corresponding conditions, those file shares cannot be created. (The differential-data snapshot creation processing and mount processing will be used.) For more information on how to check and edit file share information, see the *NAS Manager User's Guide*.

- **After an automatic creation schedule is set:**

  After setting an automatic creation schedule, note the following points for operation:

  - The NAS Cluster Management LU and NAS OS LUs manage the settings for mounting and file shares. If you mount snapshots and create file shares at the same time as creating snapshots, you should save the NAS Cluster Management LU and NAS OS LUs periodically in case of a failure. Make sure that the dates and times set in the automatic creation schedule do not overlap the saving time. For more information on how to save NAS Cluster Management LUs and NAS OS LUs, see the *NAS Manager User's Guide*.
  - If you change the maximum number for automatic creation to less than the total number of automatically created snapshots, the snapshots that were automatically created before the change are not automatically deleted down to the newly set maximum number. When the system administrator deletes automatically created snapshots manually and the total number of automatically created snapshots falls below the maximum number for automatic creation after the change, operation based on the newly set maximum starts.
  - If you disable automatic mounting when there are automatically mounted snapshots, they are not automatically unmounted. Similarly, if you disable automatic file share creation when there are automatically created file shares, they are not automatically deleted. In addition, even if you change the maximum number for automatic mounting to less than the total number of automatically mounted snapshots, the snapshots are not automatically unmounted down to the newly set maximum number. When the system administrator unmounts the automatically mounted snapshots manually and the total number of automatically mounted snapshots falls below the maximum number for automatic mounting after the change, operation is started based on the newly set maximum number.

– Even if you change the mount point identifier, the mount point names of automatically mounted snapshots are not changed. The new identifier is applied to mount point names for the next automatic mount processing. In the following situations, the snapshots mounted automatically based on the old identifier are also unmounted and deleted: when the number of automatically created snapshots reaches the maximum; when the total number of created snapshots reaches the number of reserved generations; or when the number of automatically mounted snapshots reaches the maximum for automatic mounting.

You can check if automatic creation of differential-data snapshots, mounting of differential-data snapshots, and creation of file shares were performed normally from system messages and SNMP traps. See Table 3.12.

Once you receive a system message or an SNMP trap notification indicating processing was performed normally, you can mount or unmount automatically created snapshots and create or delete file shares.

Table 3.12 lists messages output at termination of automatic creation of differential-data snapshots, mounting of differential-data snapshots or creation of file shares.

Table 3.12 System Messages

Status	Contents of Message	Message ID	SNMP Trap	
			Severity Level (eventTrapImportanceDeg(10) value)	Meaning
Normal termination	Creation successful	KAQS11112-I	0	Information
	Creation, mounting, and file share creation successful	KAQS11128-I	0	Information
	File share deletion and unmounting successful	KAQS11129-I	0	Information
Error termination	Creation unsuccessful	KAQS11090-E to KAQS11099-E KAQS11102-E to KAQS11108-E KAQS11110-E KAQS11113-E KAQS11115-E KAQS11120-E KAQS11126-E KAQS11127-E KAQS11153-E KAQS11165-E KAQS11167-E KAQS11175-E	20	Error
	Mounting unsuccessful	KAQS11130-E to KAQS11150-E KAQS11154-E KAQS11166-E KAQS11168-E KAQS11176-E KAQS11179-E	20	Error
	File share creation unsuccessful	KAQS11155-E to KAQS11164-E, KAQS11177-E, KAQS11180-E to KAQS11182-E, KAQS11185-E	20	Error
	Operation interrupted*	KAQS11111-E	20	Error
	*Disables automatic creation schedules and interrupts automatic creation operations.			

3.6.4.5 Setting Up or Changing an Automatic Creation Schedule

You can use differential-data snapshots created automatically by the scheduling function just as you would use those created manually. You can mount snapshots or create an NFS share or CIFS share on them.

To set up or change an automatic creation schedule for differential-data snapshots:

1. Click **Sync Image** on the Main Menu window.

   The List of File Systems used for Sync Image window appears.

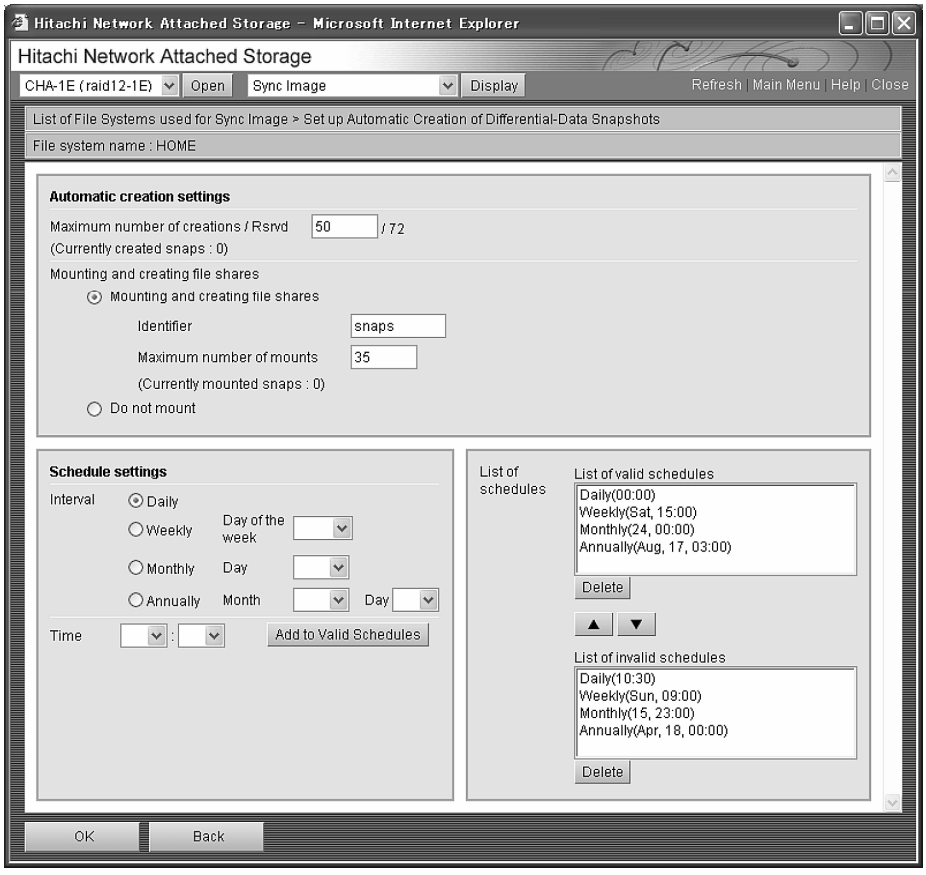
2. Check the status of the storage device for which you want to set or change the automatic creation schedule for snapshots.

   Make sure that **Operating status** is blank.

   You can set up or change automatic creation schedules for differential-data snapshots only when **Operating status** is blank.

3. Select the file system for which you want to set up or change an automatic creation schedule, and click **Schedule**.

   The Set up Automatic Creation of Differential-Data Snapshots window appears.



4. Type in or select the required information as described in Table 3.13 and click **OK**.

   The automatic creation schedule of snapshots is set up or changed for the file system and the window returns to the List of File Systems used for Sync Image window.

Table 3.13 Set Up Automatic Creation of Differential-Data Snapshots Window

Item	Description
Automatic creation settings Specify the maximum number of differential-data snapshots to be created automatically, and whether to mount snapshots and create file shares.	
Maximum number of creations / Rsrvd	Specify the maximum number of differential-data snapshots that you want to create automatically (maximum number for automatic creation), within the number of reserved generations set for the differential-data storage device. When one or more schedules are specified in the **List of valid schedules** list box, you can create differential-data snapshots up to the number specified in **Maximum number of creations / Rsrvd**. Specify a value that is less than the number of reserved generations set for the differential-data storage device. If a schedule has been set up, the current maximum value displays by default. The number of automatically created differential-data snapshots displays in **Currently created snaps.** To change the maximum number for automatic creation, specify a new maximum based on the number displayed in **Currently created snaps.**
Mounting and creating file shares	Specify whether to mount a created differential-data snapshot and create file shares automatically.
Mounting and creating file shares	**Identifier** Specify an identifier, from 1 to 5 characters, for a mount point name. You can specify alphanumeric characters and underscores (_). Specify the identifier, taking into consideration other mount point names used in the cluster to ensure that the mount point name with the identifier is unique in the cluster. In addition, specify the identifier so that you can identify (from the mount point name) which file system the mounted snapshot is for. **Maximum number of mounts** Specify the maximum number of snapshots to be mounted automatically (maximum number for automatic mounting). Specify a value that is less than or equal to the maximum number for automatic creation specified in **Maximum number of creations / Rsrvd**. If one or more schedules are listed in the **List of valid schedules** list box, snapshots are mounted automatically up to the number of mounts specified in **Maximum number of mounts**. Specify the maximum number for automatic mounting, taking into consideration the number of created file systems and mounted snapshots in the cluster. If a schedule has been set up, the current maximum value displays by default. The number of automatically mounted snapshots displays in **Currently mounted snaps**. To change the maximum number for automatic mounting, specify a new maximum number based on the number of snapshots displayed in **Currently mounted snaps.**
Do not mount	Select this if you do not want to mount differential-data snapshots and create file shares.
Schedule settings Specify the interval between creations of differential-data snapshots. Click the **Add to Valid Schedules** button to add the schedule to the **List of valid schedules** list box.	

Item	Description
Interval	**Daily** Select this if you want to create a differential-data snapshot on a daily basis. **Weekly** Select this if you want to create a differential-data snapshot on a specific day of the week. Select a day of the week from the **Day of the week** drop-down list. **Monthly** Select this if you want to create a differential-data snapshot on a specific day of the month. Select a day of the month from the **Day** drop-down list. If you select **End** in the **Day** drop-down list, a differential-data snapshot is created on the last day of each month and E displays for day. If you select **29**, **30**, or **31**, a differential-data snapshot is created only when that day exists in the applicable month. **Annually** Select this if you want to create a differential-data snapshot on a specific date every year. Select a month and a day on which you want to create a differential-data snapshot from the **Month** and **Day** drop-down lists. The entries displayed in the **Day** drop-down list vary depending on the entry you select in the **Month** drop-down list. If you select **Feb** in the **Month** drop-down list and **29** in the **Day** drop-down list, a differential-data snapshot is created only on February 29 of leap years.
Time	Select the time at which you want to create a differential-data snapshot. You can select a time value from 00:00 to 23:30 in increments of 30 minutes.
List of schedules Specify whether to enable the schedule specified in **Automatic creation interval**. Differential-data snapshots are created automatically based on the schedules displayed in the **List of valid schedules** list box. Each schedule displays in the following format: ▪ Daily(*time*) ▪ Weekly(*day-of-the-week*,*time*) ▪ Monthly(*day*,*time*)#1 ▪ Annually(*month*,*day*,*time*)	
List of valid schedules	Displays a list of valid schedules. To disable a schedule, select the desired schedule and click the ▼ button. The schedule is moved to the **List of invalid schedules** list box. To delete a schedule, select the desired schedule and click the **Delete** button.
List of invalid schedules	Displays a list of invalid schedules. To enable a schedule, select the desired schedule from the **List of invalid schedules** list box and click the ▲ button. The schedule is moved to the **List of valid schedules** list box. To delete a schedule, select the desired schedule and click the **Delete** button.

3.6.4.6 Processing Time and Failure Potential

When setting up or changing a schedule, specify the maximum number of automatically created differential-data snapshots. If the number of automatically created snapshots has reached the maximum, or the total number of snapshots already created has reached the number of reserved generations when the schedule is run, the oldest of the automatically created snapshots (whose names start with `auto-`) is deleted, and a new snapshot is created to replace it.

You should perform any of the following operations to protect snapshots that contain important data from being deleted.

- Mount the differential-data snapshots.
- Back up data to a tape device by using the NAS Backup Restore function.
- Back up data to another disk system or node by using the NAS Backup Restore remote copy function.

An error occurs if all automatically created snapshots are mounted. Either change the number of reserved generations or the maximum number of automatically created snapshots, or unmount the automatically created snapshots that are no longer necessary.

3.6.4.7 Important Restrictions When Setting Up an Automatic Creation Schedule

When setting times for automatic creation, note the following restrictions:

- The background processing time required for snapshot creation or deletion increases in proportion to the file system size. Under a low system load, it takes about 15 seconds when the file system space is 50 GB, and about 5 minutes when the file system space is 1 TB. Under a high system load, the background processing time might increase to a maximum of about thirty times the time required when under a low system load. Adjust the intervals between schedules, taking into consideration the capacity of the creation source file system and system load.
- During automatic creation of snapshots, automatic creation might fail if another snapshot function is being performed on the snapshot of the creation-source file system, or if online backup using the snapshot is being performed. To avoid this failure, during automatic creation, do not perform the following for the file system: operations on the snapshots, or online backup linked to NAS Backup Restore.
- Adjust the automatic creation schedule for each file system so that multiple processes for snapshot creation do not run concurrently. If multiple automatic creation schedules are set up within the same time zone, the system does not start a second creation process until it completes the first creation process. If this occurs, snapshot creation processes may not start at the times you set.
- If you change the time zone or switch to or from Daylight Savings Time, make sure the snapshot can be created at the desired time, or the snapshot may not be created automatically.
- Do not use a snapshot name that already exists, or the snapshot may not be created automatically.

3.7 Viewing Differential-Data Snapshot Status

Use the NAS Sync Image windows to view the status of differential-data snapshots.

You can also view the status of snapshots using the synclist command. See section 5.4.5.

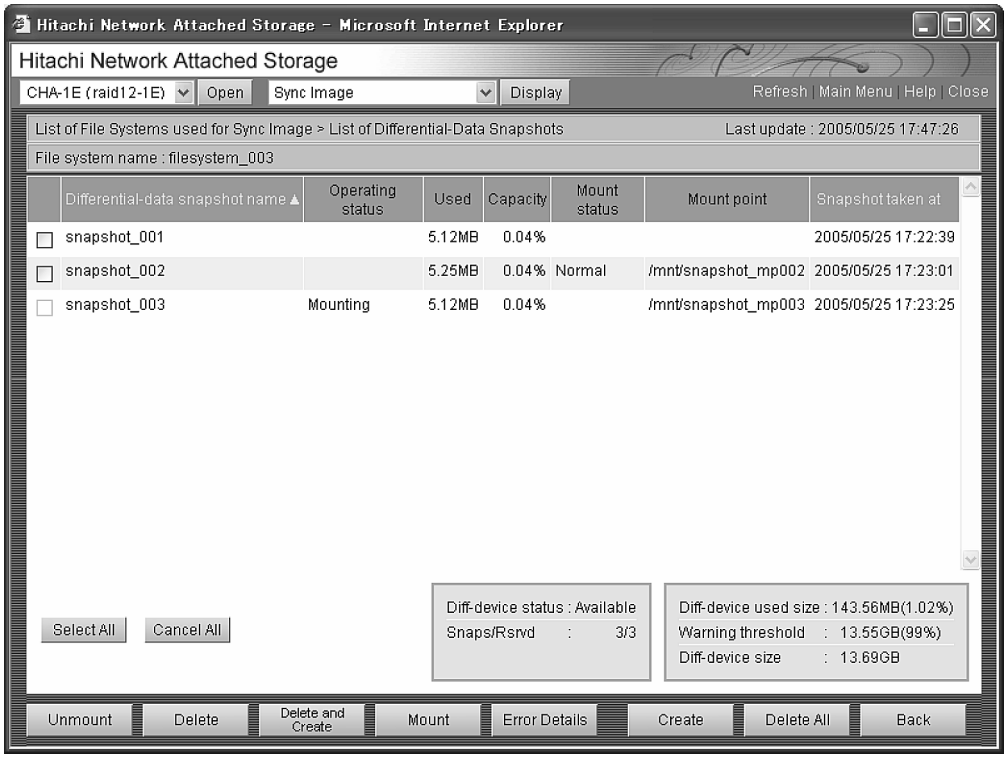
To view the status of differential-data snapshots:

1. Click **Sync Image** in the Main Menu.

   The List of File Systems used for Sync Image window appears.

2. Select the file system that is the creation source of snapshots whose status you want to view, and click **Display Snapshot**.

   The List of Differential-Data Snapshots window appears.



3. To display the current status, click **Refresh**. The window displays the following information (described in more detail in Table 3.14).

   - *Differential-data snapshot name* — The List of Differential-Data Snapshots window displays the information at the time when the operation is performed.
   - *Snapshot taken at* — Click this to display snapshots in ascending or descending order of creation date and time.

Table 3.14 lists the information items displayed in the List of Differential-Data Snapshots window.

Table 3.14 List of Differential-Data Snapshots Window

Item	Description
Last update	Displays the date and time when the information displayed in the window was last updated.
Differential-data snapshot name	Displays the name of a differential-data snapshot created for the file system.
Operating status	Displays the mount status of the differential-data snapshot. Mounting Displayed when mounting of the differential-data snapshot is waiting for execution or is being used. Error Displayed when mounting of the differential-data storage device terminates abnormally after the task has been queued or when a warning message for the mounting is output. Take action as described in section 3.8.1.
Used (***Note 1***)	Displays the capacity used exclusively by each differential-data snapshot, within the total capacity of the differential-data storage device. If the differential-data snapshot has failed with the status of insufficient capacity, or if NAS OS or a resource group has been restarted, `Invalid.` may display. See section 7.3 and take appropriate action. No value displays if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`
Capacity	Displays the capacity used exclusively by each differential-data snapshot, as a percentage of the total capacity of the differential-data storage device. No value displays if **Used** is `Invalid` or if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`

Item	Description

Mount status	Displays the mount status of the differential-data snapshot.
	A blank displays if **Operating status** is `Mounting`.
	`Normal`
	Displayed when the differential-data snapshot has been mounted and **Diff-device status** is one of the following:
	- `Available`
	- `Busy (`*progress*`% processed)`
	- `Expanding`
	`In processing or error`
	Displayed when processing to mount or unmount a differential-data snapshot is in progress, or an error occurred during the processing. If an error occurred during processing, unmount the differential-data snapshot.
	Displayed when the differential-data snapshot has been mounted and **Diff-device status** is not any of the following:
	- `Available`
	- `Busy (`*progress*`% processed)`
	- `Expanding`

Mount point	Displays the path of the differential-data snapshot mount point.
Snapshot taken at (***Note 2***)	Displays the date and time when creation of the differential-data snapshot finished. No value displays if **Diff-device status** is one of the following: ▪ `Failed to get the VG information` ▪ `I/O error` ▪ `In processing or error` ▪ `Not available` ▪ `Offline` ▪ `System error`

Item	Description

Diff-device status	Displays the status of the differential-data storage device.
	`Available`
	Displayed when that the differential-data storage device is normal.
	`Busy (`*progress*`% processed)`
	Displayed when background processing for creating or deleting a differential-data snapshot is running. The percentage of process progress displays in the parentheses.
	After the background processing has finished, perform the next operation.
	`Deleting`
	Displayed when processing to simultaneously delete all the differential-data snapshots created for the file system is in progress, or an error occurred during the processing. If an error occurs during processing, re-run the operation for simultaneously deleting all the differential-data snapshots.
	`Expanding`
	Displayed when processing to expand a differential-data storage device is in progress, or an error occurred during the processing. If an error occurs during processing, recover by following the procedure in 3.5.4.2
	`Failed to get the VG information`
	Displayed when the system failed to obtain the volume group information.
	Acquire the Sync Image log files and contact your HDS representative.
	`I/O error`
	Displayed when an error has occurred in device files that constitute the file system or the differential-data storage device.
	Identify the error source. If the error source is identified, take action as described in Chapter 6.
	`Not available`
	Displayed when a failure occurred in the file system or differential-data storage device, a failover occurred, or the resource group has stopped.
	Identify the cause of the error as described in Chapter 6.
	`Offline`
	Displayed when the resource group to which the differential-data snapshot belongs has stopped.
	Start the resource group. For more information on how to start the resource group, see the manual *NAS Manager User's Guide*.
	`Overflow`
	Displayed when the capacity of the differential-data storage device is insufficient.
	Take action as described in Chapter 6.
	`System error`
	Displayed if a system error has occurred.
	Acquire the Sync Image log files and contact your HDS representative.

Item	Description
Snaps/Rsrvd	Displays the number of differential-data snapshots created for the file system and the number of differential-data snapshot reserved generations set for the file system, as follows: *number-of-created-differential-data-snapshots*/*number-of-reserved-generations* - displays if an error has occurred in the differential-data storage device. A hyphen (-) displays if **Diff-device status** is one of the following: ▪ Failed to get the VG information ▪ I/O error ▪ In processing or error ▪ Not available ▪ Offline ▪ System error
Diff-device used size (***Note 1***)	Displays the size of the used part relative to the entire differential-data storage device space. The usage rate as a percentage of the total capacity of the differential-data storage device displays in parentheses. If the used capacity cannot be displayed, this item displays either of the following values. Error Displayed when **Diff-device status** is Deleting or Overflow. - Displayed when **Diff-device status** is one of the following: ▪ Failed to get the VG information ▪ I/O error ▪ In processing or error ▪ Not available ▪ Offline ▪ System error
Warning threshold	Displays the size for the warning threshold set for the differential-data storage device. The percentage for the total capacity displays in parentheses. If - displays, no warning threshold has been set.
Diff-device size	Displays the total space of the differential-data storage device. A hyphen (-) displays if **Diff-device status** is one of the following: ▪ Failed to get the VG information ▪ I/O error ▪ In processing or error ▪ Not available ▪ Offline ▪ System error

Note: Only the information on mounted differential-data snapshots displays if **Diff-device status** is one of the following:

- `Failed to get the VG information`
- `I/O error`
- `In processing or error`
- `Not available`
- `Offline`
- `System error`

If a differential-data snapshot is unmounted, the information on it is not displayed in the list.

Differential-data snapshots with a name that begins with `SyncBackup` are those that were created automatically when an online backup is performed. These snapshots are deleted automatically when online backup ends normally.

Note 1: A differential-data storage device is divided into an area that stores differential data shared by multiple differential-data snapshots, and an area that stores the differential data for each differential-data snapshot. Therefore, the sum of used size values of all differential-data snapshots will not equal the total amount of space used by the differential-data storage device. If the List of Differential-Data Snapshots window displays when the differential-data storage device has insufficient space, the command displays the information that was valid before the device ran short of space. The sum of the displayed usage rates may not add up to 100%, even when the capacity of the differential data shared by multiple snapshots is small.

Note 2: The date and time set up in an automatic creation schedule is the point when the system starts creation process for a differential-data snapshot. The date and time displayed for **Snapshot taken at** in the List of Differential-Data Snapshots window might differ from the date and time set for the automatic creation schedule.

3.8 Mounting a Differential-Data Snapshot

Use the NAS Sync Image windows to mount a differential-data snapshot. You can mount a differential-data snapshot as read-only data or mount automatically created differential-data snapshots.

The maximum number of created file systems and mounted differential-data snapshots that can be registered in a cluster is 256.

To mount a differential-data snapshot:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Check the status of the storage device for the file system that is the creation source of the snapshot you want to mount. Make sure that `Available` or `Busy` displays in **Diff-device status**.

   If `Available` or `Busy` is not displayed in **Diff-device status**, snapshot creation will fail.

3. Select the file system that is the creation source of the snapshot you want to mount, and click **Display Snapshot**.

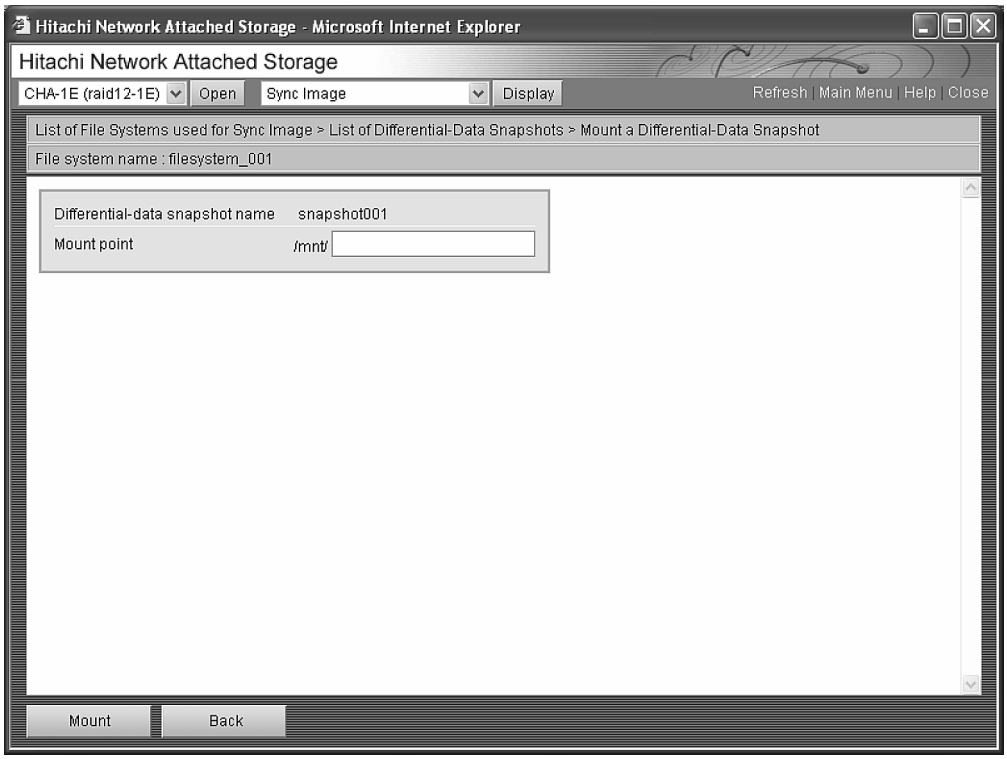
   The **List of Differential-Data Snapshots** window appears.

4. Check the status of the differential-data snapshot that you want to mount.

   Make sure that Operating status is blank.

   You can mount a differential-data snapshot only when **Operating status** is blank.

5. Select the differential-data snapshot you want to mount, and click the **Mount** button. The **Mount a Differential-Data Snapshot** window appears.



6. Type in the name of the Mount point as described in Table 3.15 and click **Mount**. The List of Differential-Data Snapshots window appears again and `Mounting` is displayed for **Operating status**.
7. Click **Refresh** in the List of Differential-Data Snapshots window to check the processing results displayed for **Operating status**. If Error displays for **Operating status**, the task terminated abnormally.

Table 3.15 Mount a Differential-Data Snapshot Window

Item	Description
Mount point	Specify the name of the differential-data snapshot mount point. Enter from 1-16 alphanumeric characters and underscores (_). The specified name must be unique in the cluster. If snapshots are set so that they are mounted automatically in the cluster, specify a mount point name in a format other than the format for automatic mount processing. Snapshots mounted with a mount point name in the format for automatic mount processing are treated as automatically created snapshots. If mount point names are duplicated when snapshots are mounted automatically, automatic mount processing ends with an error.

3.8.1 More about Mounting Snapshots

The maximum number of created file systems and snapshots, and mounted differential-data snapshots that can be registered in one cluster is 256.

A differential-data snapshot is always mounted at the following location:

```
/mnt/mount-point-directory-name
```

NAS Manager registers and manages mounted differential-data snapshots as file systems. Once a snapshot has been mounted, you can view information about it by referring to its mount point name in the List of File Systems window in NAS Manager. You cannot use any of the following operations on a mounted differential-data snapshot from NAS Manager:

- Deletion. You must use this operation from NAS Sync Image.
- Expansion
- Setting or changing the quota. The quota value set for the file system when it is created is applied to the snapshot. This setting cannot be changed.
- Mounting or unmounting. You must use this operation from NAS Sync Image.

When the differential-data snapshot is created, the settings for the file system are copied to the differential-data snapshot. You can check the copied settings by using the enas_fsctl command in NAS Manager. Copied settings cannot be changed. For more information about this command, see the *NAS Manager User's Guide*.

Immediately after performing a mount operation for a differential-data snapshot, if you created an NFS or CIFS share for the same differential-data snapshot from the GUI, and it resulted in an error, the file share creation has also failed. After checking and clearing the error details of the mounting of the differential-data snapshot, check and clear the error details of the NFS or CIFS share creation. For more information, see the *NAS Manager User's Guide*.

3.8.2 Action to Take if Mounting Terminates Abnormally

If mounting of a differential-data snapshot terminates abnormally or a warning message is displayed after the task had been queued, you must check the error details, clear them, and mount the snapshot again.

If you create an NFS or CIFS share for the same snapshot from the GUI immediately after performing a mount operation, and it results in an error, the file share creation has also failed. Check the error details of the mounting of the snapshot and clear them. Then check the error details of the NFS or CIFS share creation and clear them.

For more information on how to check and clear the error details for creating an NFS or CIFS share, see the *NAS Manager User's Guide*.

To clear the error details:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Select the file system for which the mounting of a differential-data snapshot has terminated abnormally, and click **Display Snapshot**.

   The List of Differential-Data Snapshots window appears.

3. Select the differential-data snapshot for which the mounting terminated abnormally, and click **Error Details**.

   The Error Details window appears.

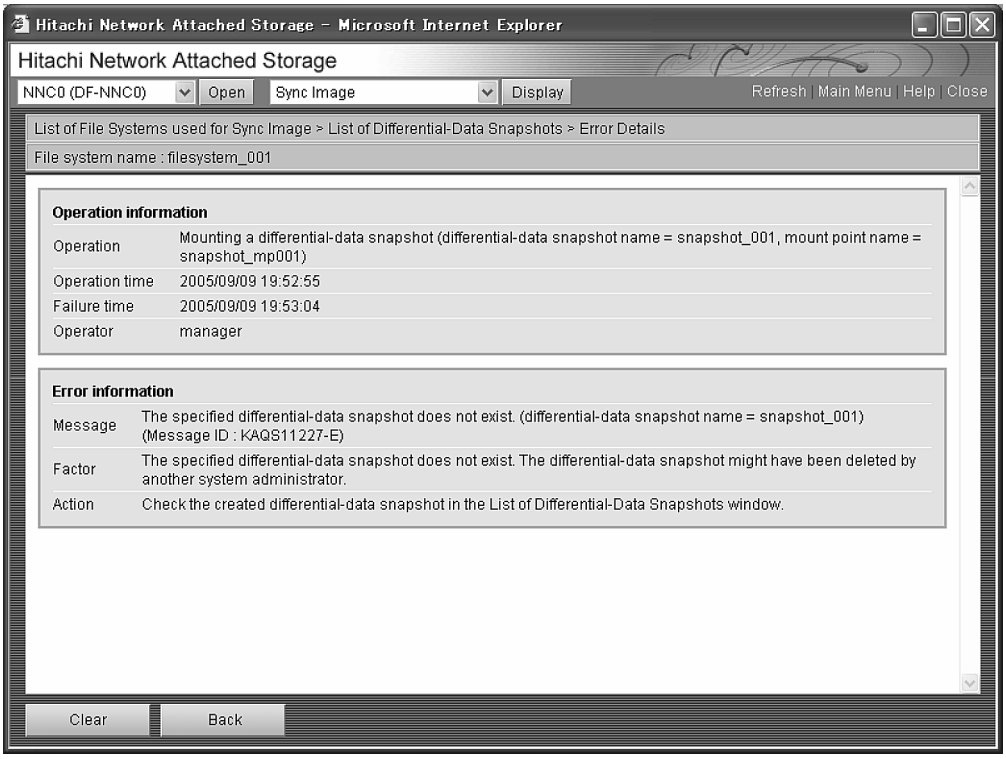


Figure 3.13 Mounting a Snapshot Error Details

The following table shows the information displayed in the Error Details window.

Table 3.16 Mounting a Snapshot Error Details Information

Item	Description
Operation Information Displays information about the operation that terminated abnormally or for which a warning message was output.	
Operation	Displays the operation that terminated abnormally or for which a warning message was output.
Operation time	Displays the date and time the system administrator performed the operation.
Failure time	Displays the date and time when the operation performed by the system administrator terminated abnormally or when a warning message regarding the operation was output.
Operator	Displays the user name of the system administrator who performed the operation that terminated abnormally or that a warning message was output for.
Error information Displays information about the error or warning message.	
Message	Displays a message and its message ID.
Factor	Displays the cause of the error or warning.
Action	Displays the action to take for the error or warning.

4. Check the displayed information, such as the error message, cause of the error, and action to take, and click **Clear**.
5. Click **OK** in the message window.

   The error details are cleared and the List of Differential-Data Snapshots window displays again.
6. Take action according to the displayed error information and try to mount the snapshot again.

3.9 Unmounting a Differential-Data Snapshot

You can use NAS Sync Image windows to unmount a differential-data snapshot.

You can also unmount a snapshot using the syncunmount command. See section 5.4.9.

Notes:

- Before unmounting, you must delete any NFS or CIFS shares that have been created. For more information, see the *NAS Manager User's Guide*.
- If you unmount a differential-data snapshot while a client is accessing it, the client is disconnected automatically.

To unmount a differential-data snapshot:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Select the radio file system that is the creation source of the snapshot you want to unmount, and click **Display Snapshot**.

   The List of Differential-Data Snapshots window appears.

3. Check the status of the snapshot that you want to unmount.

   Make sure that **Operating status** is blank.

   You can unmount a differential-data snapshot only when **Operating status** is blank.

4. Select the snapshot you want to unmount, and click **Unmount**. You can only select snapshots for which Operating Status is not mounting. Click **Select All** to select all snapshots for which **Operating Status** is not mounting. Click **Cancel All** to clear the selection.

5. Click **OK** in the message window.

   The snapshot is unmounted and the List of Differential-Data Snapshots window displays again.

3.10 Deleting Differential-Data Snapshots

Use NAS Sync Image to delete differential-data snapshots, including automatically created snapshots.

You can also delete a snapshot using the syncdel command. See section 5.4.3.

Use the following methods to delete differential-data snapshots of a file system:

- Delete all snapshots at the same time.
- Delete a specific snapshot.

Notes:

- If you create or delete a snapshot, background processing is used. You cannot delete a snapshot of a file system if background processing for creating or deleting another snapshot is running. When multiple snapshots are deleted in succession from one file system, use the command at appropriate intervals after taking into consideration the file system space and system load.
- To avoid excessive I/O processing loads, do not delete snapshots for multiple file systems concurrently**.**
- You must unmount any mounted snapshots before deleting them. See section 3.10.

3.10.1 Deleting All Differential-Data Snapshots

You can delete all differential-data snapshots created for a file system concurrently. This includes the displayed snapshots and snapshots created by another system administrator or automatic creation schedule.

To delete all snapshots created for a file system in one operation:

1. Click **Sync Image** in the Main Menu window.

   The **List of File Systems used for Sync Image** window appears.

2. Check the status of the storage device for the file system that is the creation source of the snapshot you want to delete.

   You can only delete a snapshot when:

   - **Operating status** is blank
   - **Diff-device status** is `Available, Busy, Deleting,` or `Overflow`.

3. Select the file system that is the creation source of the snapshot you want to delete, and click **Display Snapshot**.

   The **List of Differential-Data Snapshots** window appears.

   Check the status of all snapshots. Make sure that **Operating Status** is blank. You can delete a differential-data snapshot only when **Operating status** is blank.

4. Click **Delete All**.
5. Click **OK** in the dialog box.

   All the snapshots created for the file system are deleted and the List of Differential-Data Snapshots window displays again.
6. Check the status of the storage device. Make sure that **Diff-device status** is not `Deleting`. If it is `Deleting`, wait a few minutes and click **Refresh** to update the display. If the status does not change, an error might have occurred during processing. Re-use the operation for deleting all snapshots.

3.10.2 Deleting a Specific Differential-Data Snapshot

To delete a specific differential-data snapshot:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.
2. Check the status of the storage device for the file system that is the creation source of the snapshot you want to delete.

   You can only delete a snapshot when:

   - **Operating Status** is blank
   - **Diff-device status** is `Available`.
3. Select the file system that is the creation source of the snapshot you want to delete, and click **Display Snapshot**. The List of Differential-Data Snapshots window appears.
4. Check the status of the snapshot you want to delete. Make sure that Operating Status is blank. You can delete a differential-data snapshot only when **Operating status** is blank.
5. Select the snapshot you want to delete, and click **Delete All**.
6. Click **OK** in the dialog window. The snapshot is deleted and the List of Differential-Data Snapshots window displays again.

3.11 Releasing a Differential-Data Storage Device

Use NAS Sync Image windows to release a differential-data storage device. When you release a storage device, the storage device is deleted and all snapshot data for the file system becomes unavailable.

You can also release a storage device using the syncstop command. See section 5.4.8.

Notes:

- If a storage device is released when automatic scheduling is in use, the schedule information set for the file system is deleted.
- You must unmount all snapshots for the file system before releasing the storage device.
- If the NAS Backup Restore remote copy function is used for the file system, reconfigure the remote copy pair after releasing the storage device. For more information on remote copy, see the *ShadowImage User's Guide*.

To release the setting of a differential-data storage device:

1. Click **Sync Image** in the Main Menu window.

   The List of File Systems used for Sync Image window appears.

2. Check the status of the file system for which you want to release the storage device setting. You can release the setting of a differential-data storage device only when Operating status is blank.
3. Select the file system for which you want to release the setting, and click **Release**.
4. Click **OK** in the dialog window.

   The storage device setting is released and the List of File Systems used for Sync Image window displays again.

Chapter 4 Sample Snapshot Operations

This chapter describes sample differential-data snapshot operations using the NAS Sync Image windows. Use these examples to help you perform snapshot operations effectively. The chapter includes the following sections:

- System Configuration Used in Sample Operations (section 4.1)
- Before Performing Snapshot Operations (section 4.2)
- Setting Up Capacity and Schedule (section 4.3)
- Starting an Operation (section 4.4)
- Client Operations (section 4.5)
- Monitoring the Operating Status (section 4.6)
- After Performing Snapshot Operations (section 4.7)

4.1 System Configuration Used in Sample Operations

The sample operations described in this chapter use the following system configuration:

- The service IP address is set to `172.16.2.34`.
- The `HOME` and `DOCUMENT` file systems in the cluster are managed by using NAS Sync Image.
- The `HOME` file system is used as a server for storing application data, and, on average, 10 GB of data is updated per day.
- In the `HOME` file system, the NFS and CIFS file shares are created in the `/mnt/HOME/UNIT01` directory.
- The `DOCUMENT` file system is used as a site for downloading document templates (such as application forms and reports) and currently stores 100 MB of data.
- An SNMP server has been set up to monitor the operation status, and SNMP has been set in NAS Manager.

This configuration is illustrated in Figure 4.1.

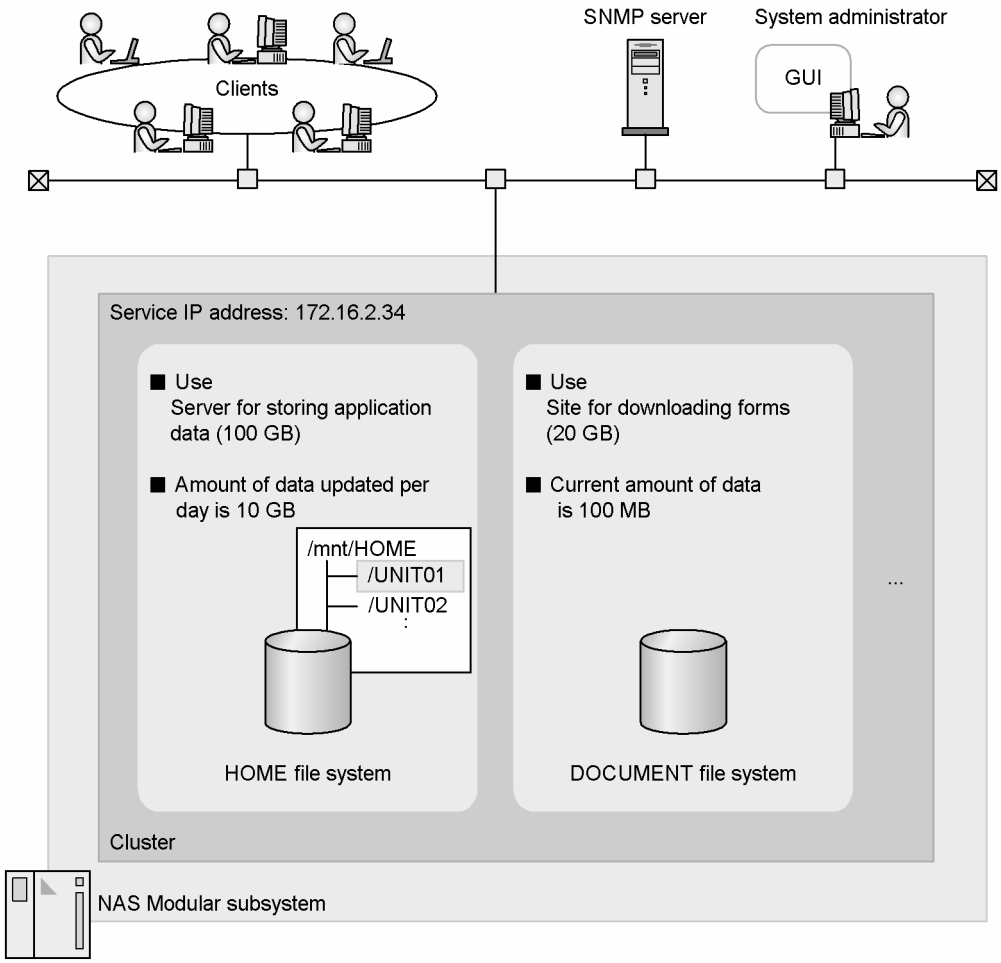


Figure 4.1 System Configuration Used in Sample Snapshot Operations

4.2 Before Performing Snapshot Operations

Before you perform snapshot operations, you should consider the following:

- How the file systems will be used
- How much data will be updated
- The number of generations to be stored
- The creation interval
- The creation method for differential-data snapshots

4.2.1 Performing Snapshot Operations for the HOME File System

In the HOME file system, a small amount of data, averaging 427 MB per hour, is updated. Taking this into account, set a schedule that creates a snapshot twice a day at predefined times and stores them for a month (up to 62 generations). Set the reserved generations so that a maximum of 10 extra generations can be created and stored (separately from the regularly created 62 generations). These extra generations can be created before regular maintenance of the hardware in the NAS Modular system or at the user's request.

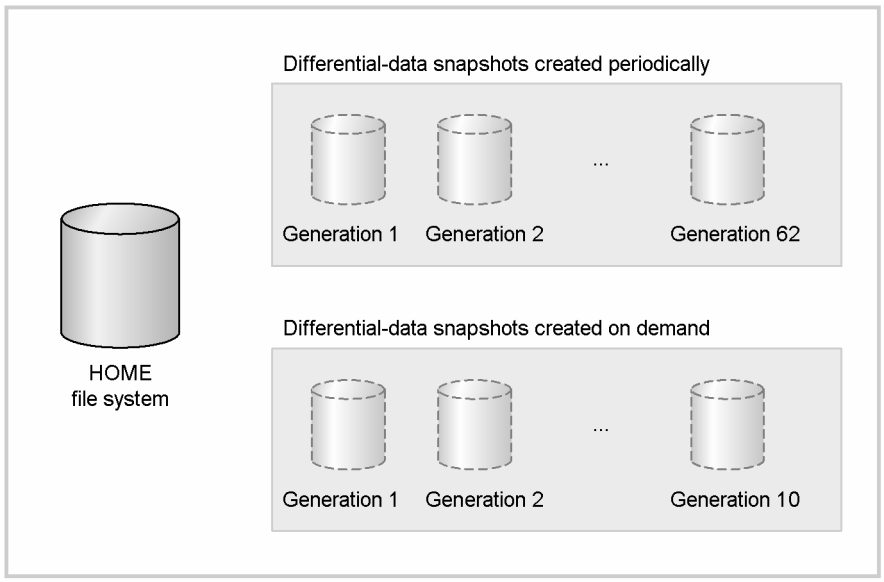


Figure 4.2 Sample Snapshot Operation for HOME File System

To prevent adverse operations from a shortage of free space, set the warning threshold so that you are notified when the usage rate of the storage device reaches 75% of total capacity.

Table 4.1 Sample Storage Device Settings for HOME File System

Item	Setting
Number of reserved generations	72
Warning threshold	75%
Disk space required for the differential-data storage device. For more information, see section 3.1.1.	361.7 GB

Regularly created snapshots are created automatically according to a schedule set from the GUI. When creating this schedule, specify the identifier to be added to mount point names, the maximum number of snapshots that can be mounted, and the snapshot creation interval.

Set the schedule so that a snapshot is created at 02:00 and 17:30 every day. At these times, snapshot creation will have relatively little effect on other day-to-day operations.

Consider the use of other file systems and snapshots existing in the cluster and set the schedule so that the last 14 generations (total snapshots for one week) are automatically mounted and shared. Set `HOME` as the identifier to be added to mount point names so that clients can identify the snapshots for the `HOME` file system.

Table 4.2 Sample Schedule Settings for HOME File System

Item	Setting
Maximum number of snapshot generations that can be created automatically	62 generations
Creation time	▪ 02:00 every day ▪ 17:30 every day
Maximum number of automatic mounts	14 generations
Identifier	`HOME`

With these schedule settings specified, a differential-data snapshot is mounted when it is created, and file shares can be created automatically in the same directory structure as the target file system. Because NFS and CIFS file shares have been created in the `/mnt/HOME/UNIT01` directory in the `HOME` file system, NFS and CIFS file shares for the created snapshots are also created in the `UNIT01` directory immediately below the mount point directory.

For example, for the snapshot created at 02:00 on September 30, 2005, file shares are created with the settings shown in the following table.

Table 4.3 File Shares Created for HOME File System

Item	File System	Differential-Data Snapshot
Name	HOME	auto-D0509300200
Mount point	/mnt/HOME	/mnt/HOMED0509300200
Shared directory for an NFS share	/mnt/HOME/UNIT01	/mnt/HOMED0509300200/UNIT01
Shared directory for a CIFS share	/mnt/HOME/UNIT01	/mnt/HOMED0509300200/UNIT01
CIFS share name	UNIT01	UNIT01D0509300200

4.2.2 Performing Snapshot Operations for the DOCUMENT File System

The DOCUMENT file system stores various document forms. The main purpose of this file system is for clients to view (download) data. If a form on the file system must be revised as office rules change, the person in charge updates the form. In response to a client request, you can manually take a differential-data snapshot before and after the form is revised. Assuming that a form revision occurs about once a month, set 15 generations as the number of reserved generations to keep the snapshots for one year.

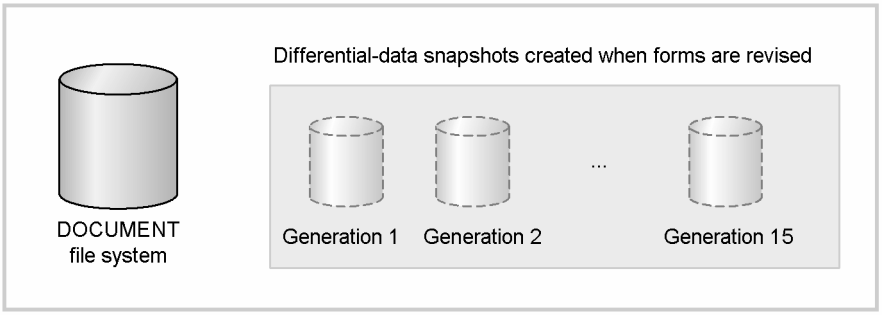


Figure 4.3 Sample Snapshot Operation for DOCUMENT File System

In this example, assume that the amount of data updated per revision is small and that insufficiency of free space in the storage device will have little effect on day-to-day operations. Set the warning threshold so that you are notified when the storage device reaches 80% of its total capacity.

Table 4.4 Sample Storage Device Settings for DOCUMENT File System

Item	Setting
Number of reserved generations	15
Warning threshold	80%
Disk space required for the differential-data storage device For more information, see section 3.1.1.	1.65 GB

4.3 Setting Up Storage Device Capacity and Schedule

After you have considered your particular operations and requirements, you can set up a storage device capacity and a schedule for automatically creating snapshots.

To setup up storage device capacity, use the Set up a Differential-Data Storage Device window, shown in Figure 4.4.

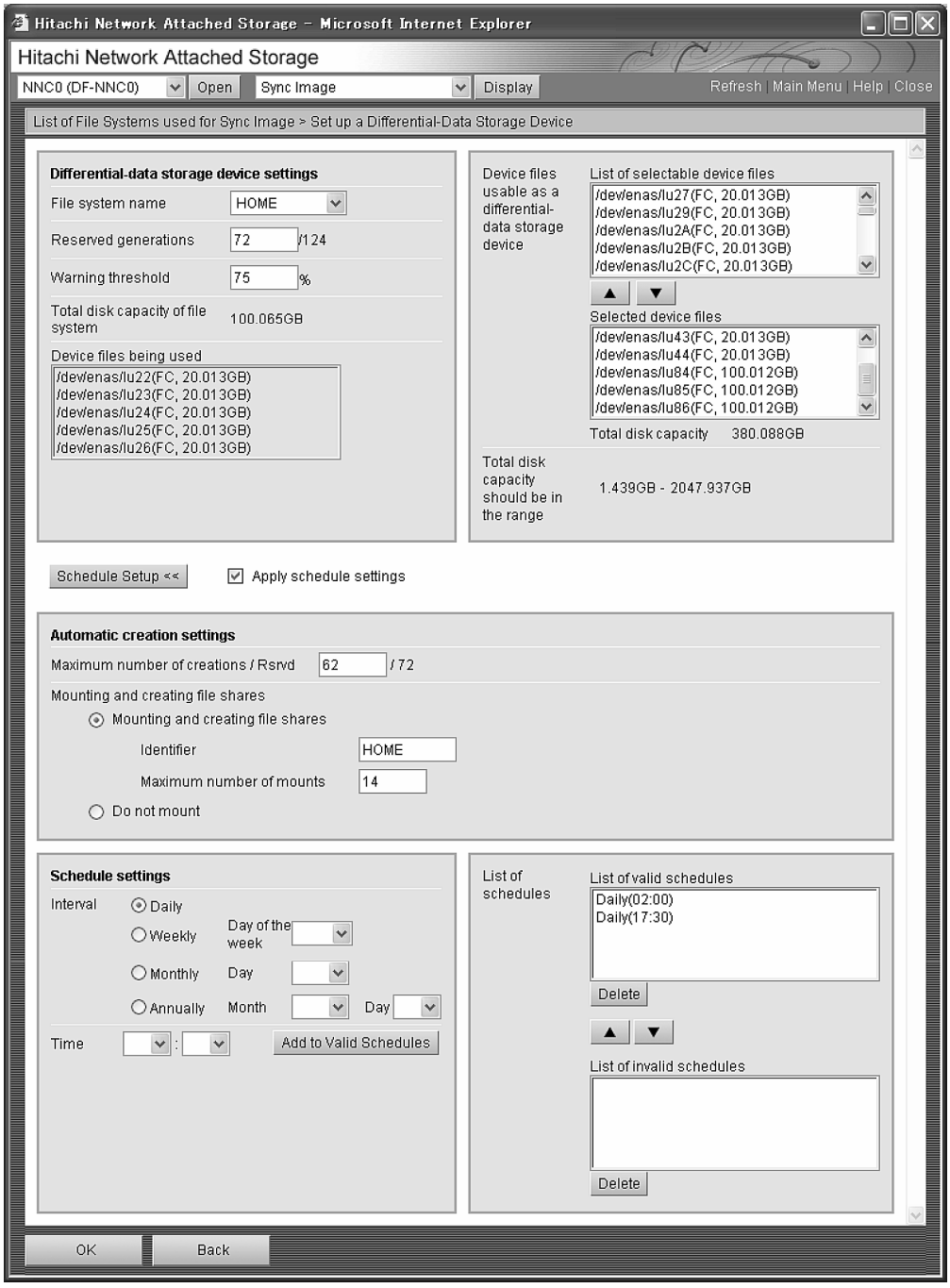


Figure 4.4 Setting Up Storage Device Window for HOME File System

To set up an automatic snapshot creation schedule, use the Set up Automatic Creation of Differential-Data Snapshots window, shown in Figure 4.5.

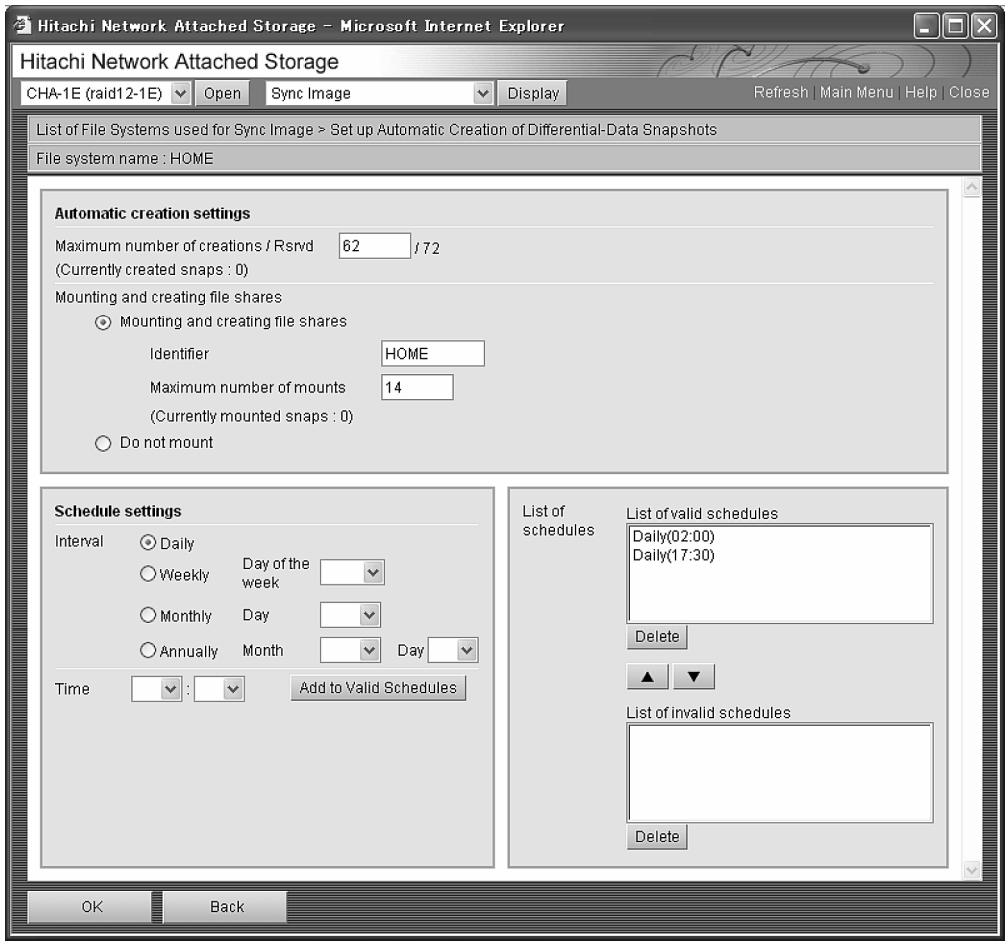


Figure 4.5 Setting Up Automatic Creation of Differential-Data Snapshots

Once you have set the differential-data storage device and automatic creation schedule, conduct an operation test in the environment in which clients are actually using the file system. This test checks whether the amount of data updated for the file system matches the estimate, and whether snapshots have been created correctly.

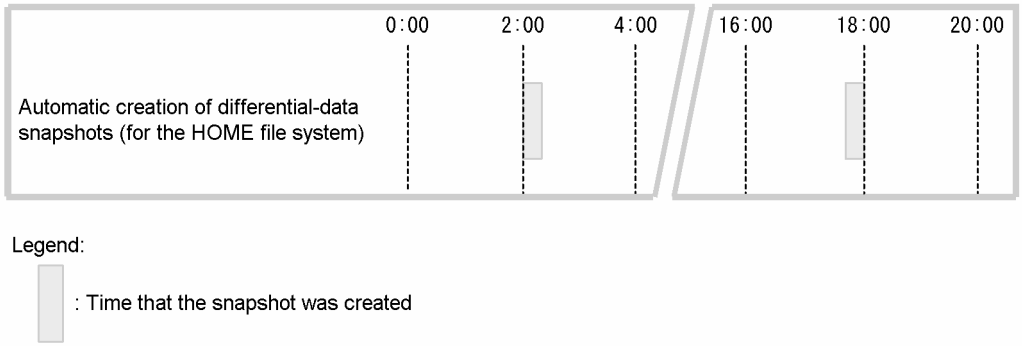


Figure 4.6 Sample Schedule Settings

If the test has proved that there is a difference in the amount of data updated between the estimate and the actual value, re-estimate the disk space requirements and re-specify the settings or expand the storage device.

Continue testing until the settings have no problems and start snapshot operation.

4.4 Starting a Snapshot Operation

To start snapshot operations, you can manually take differential-data snapshots as clients request them, shown in Figure 4.7.

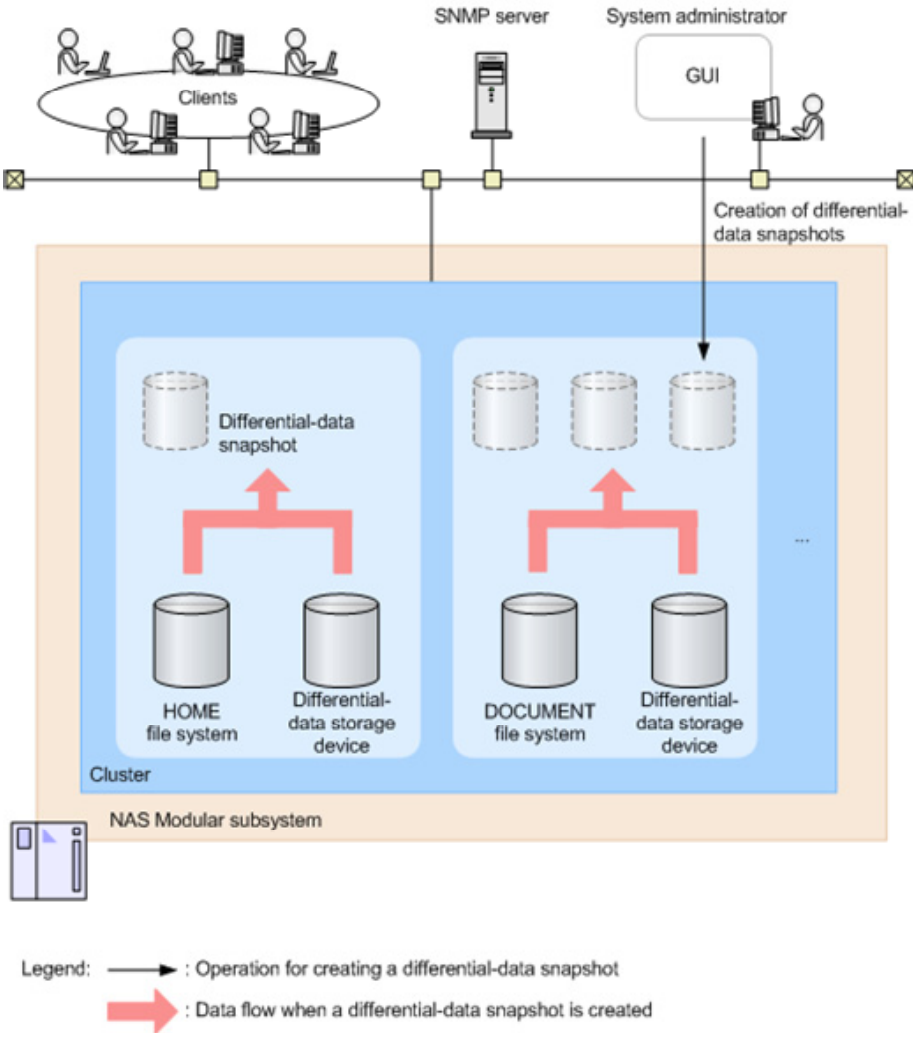


Figure 4.7 Starting Snapshot Operations

To create a differential-data snapshot, use the Create a Differential-Data Snapshot window or the Delete and Create a Differential-Data Snapshot window, shown in Figure 4.8.

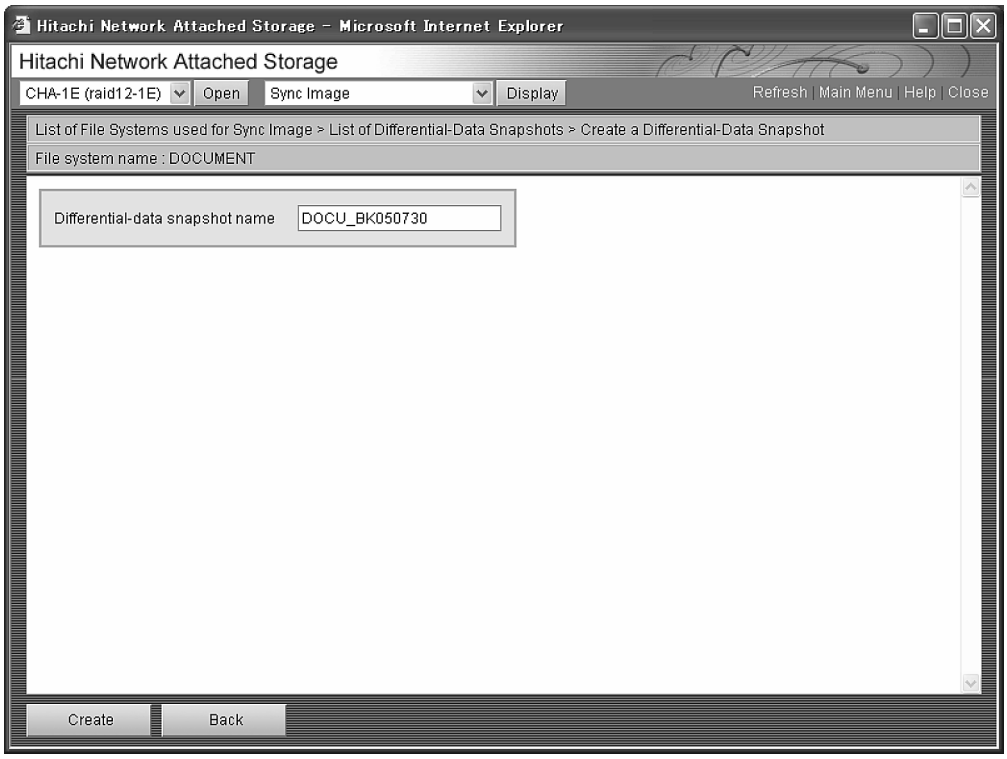


Figure 4.8 Creating a Snapshot for DOCUMENT File System

After the operation is started, the operation policy for the file system might be changed or the amount of data to be updated might become larger than the initial estimate. If that happens, you can perform the following operations, depending on the situation:

- Expand the differential-data storage device
- Change the warning threshold for usage of the differential-data storage device
- Change the number of reserved generations for differential-data snapshots
- Change the maximum number of differential-data snapshot generations that can be created automatically
- Change the interval for creating differential-data snapshots

If there are unnecessary snapshots, or if either the maximum number of reserved generations for snapshots or the maximum number of automatically created snapshots is reached, you can do the following:

- Delete unnecessary differential-data snapshots
- Change the number of reserved generations for differential-data snapshots
- Change the maximum number of differential-data snapshot generations that can be created automatically

4.5 Client Operations

Differential-data snapshots are mounted in the read-only mode. Clients can access file shares for a snapshot to view files and to copy directories and files to client machines or to the file system for which the snapshot was created. These client operations are shown in Figure 4.9.

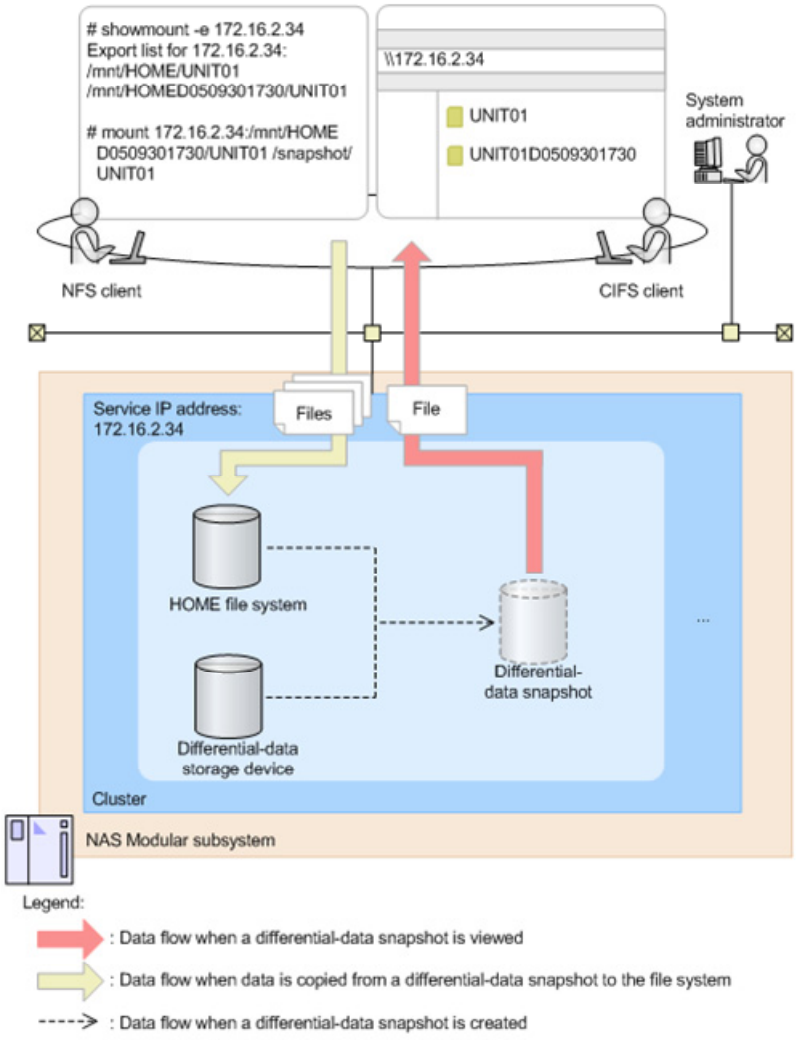


Figure 4.9 Client Access to a Differential-Data Snapshot

NFS clients can access a differential-data snapshot by NFS-mounting the shared directory onto an existing directory on the client machine. For NFS clients, path information for a snapshot displays in the following format:

```
/mnt/mount-point-name-of-a-differential-data-snapshot/subdirectory-name-of-file-share
```

The following shows an example of path information displayed for a snapshot created for the HOME file system at 02:00 on July 30, 2005:

```
/mnt/HOMED0507300200/UNIT01
```

After completing the work, NFS-unmount the snapshot from the client machine.

CIFS clients can access a snapshot by specifying the service IP address for the resource group to which the snapshot belongs, and the CIFS share name. Specify either of the following path formats to access a snapshot:

```
\\service-IP-address\CIFS-share-name
\\channel-adapter-name\CIFS-share-name
```

For example, to access a snapshot created for the HOME file system at 02:00 on July 30, 2005, specify the following path:

```
\\172.16.2.34\UNIT01D0507300200
```

For notes on NFS and CIFS clients using data in the NAS system, see the *NAS Manager User's Guide*.

4.6 Monitoring the Operating Status

Once a differential-data snapshot operation has started, you should check the status of the storage devices and snapshots. You should also monitor system messages (`em_alertfile`) and SNMP notification periodically to check the free space of the storage devices and the results of automatic creation, as shown in Figure 4.10.

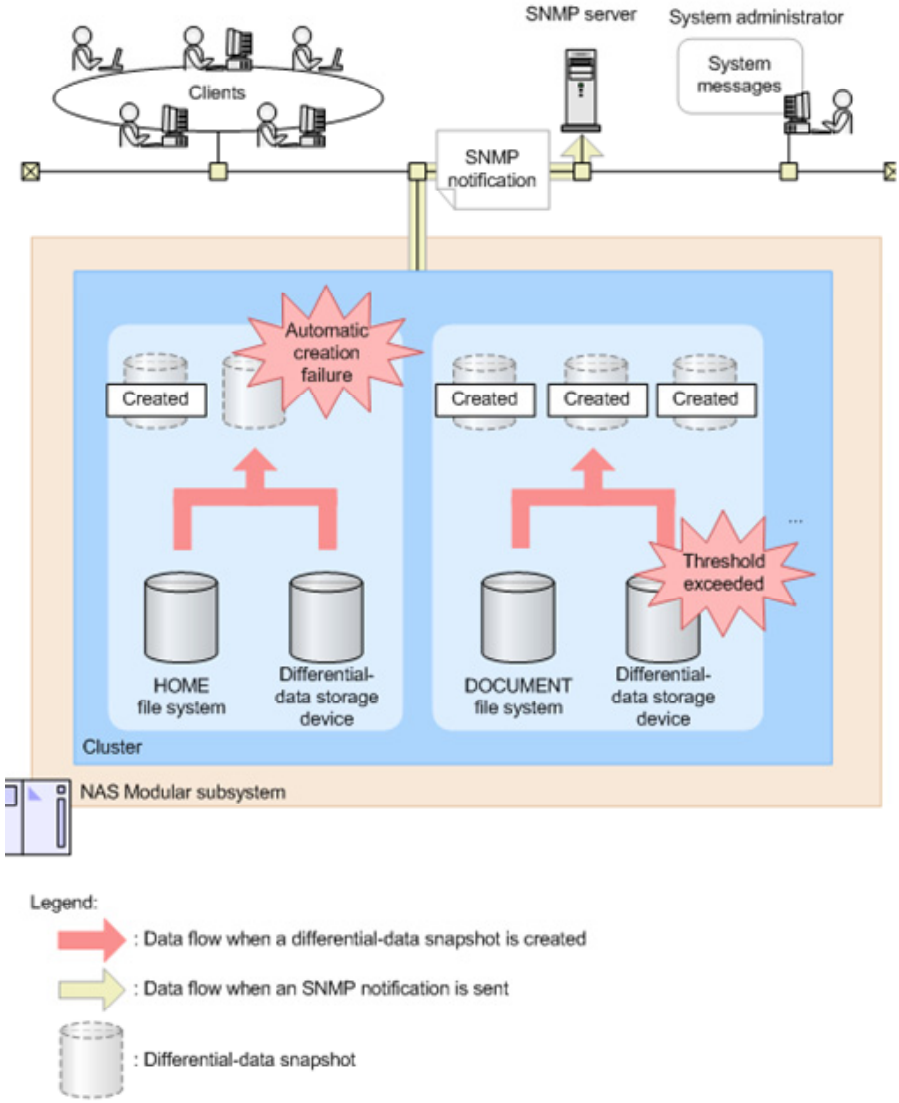


Figure 4.10 Monitoring for Errors

If an error has occurred, promptly take corrective action according to the system messages and messages output to SNMP notification. Ask your HDS representative for assistance if necessary.

4.7 After Performing Snapshot Operations

After a project has finished, differential-data snapshots for the file systems used for the project may no longer need to be created or stored. In such a case, release the differential-data storage devices.

If a storage device is released, all the snapshots stored for the associated file system are deleted. In addition, the automatic snapshot creation schedule set for the file system is canceled.

Chapter 5 Commands

This chapter describes the NAS Sync Image commands to perform snapshot operations. It includes the following sections:

- List of commands (section 5.1)
- Using commands (section 5.2)
- Specifying command arguments and options (section 5.3)
- Commands in alphabetical order (section 5.4)

5.1 List of Commands

Table 5.1 lists the NAS Sync Image commands by operation. To perform an operation using a command, see the corresponding Command section. To perform an operation from the NAS Sync Image GUI windows, see the corresponding GUI section.

Table 5.1 List of Commands

Operation	Command	See Command Section	See GUI Section
Set up a differential-data storage device	syncstart	5.4.7	3.5
Create a differential-data snapshot	syncadd	5.4.1	3.7.2
Delete a differential-data snapshot	syncdel	5.4.3	3.11
Mount a differential-data snapshot	syncmount	5.4.6	3.9
Unmount a differential-data snapshot	syncumount	5.4.9	3.10
Display the status of a differential-data snapshot	synclist	5.4.5	3.6
Modify the configuration of a differential-data snapshot	syncconfig	5.4.2	3.5.2
Expand a differential-data storage device	syncexpand	5.4.4	3.5.3
Release a differential-data storage device	syncstop	5.4.8	3.12

5.2 Using Commands

This section describes two methods of using commands with NAS Sync Image and items to consider before using them.

To use commands to manipulate NAS Sync Image, a public key for use of SSH must have been registered. For more information on registering a public key, see the *NAS Manager User's Guide*.

There are two methods of using commands:

- Logging in to the NAS unit and executing commands
- Executing commands from a remote host.

5.2.1 Logging In and Using Commands

To log in (as a system administrator) to the NAS unit and use the NAS Sync Image commands:

1. Using SSH, log in to the desired NAS unit. During login, specify the fixed IP address of the NAS unit.
   - In UNIX, use the `ssh` command from the control terminal:

```
ssh {-1|-2} user-name-of-the-ssh-account@fixed-IP-address-of-the-NAS-unit
```

   - In Windows, use communications software that supports SSH:
2. Use the `sudo` command to use the NAS Sync Image command. The following example is for executing the `synclist` command:

```
$ sudo synclist -a
```

5.2.2 Executing Commands from a Remote Host

To execute a command from a remote host:

1. Enter the command with the following syntax:

```
ssh {-1|-2} user-name-of-the-ssh-account@IP-address-of-the-NAS-Unit sudo
command-to-be-executed
```

2. Specify an IP address for the command you are using, as listed in the following table.

Table 5.2 Specifying IP Addresses

Command	IP Address
`syncadd`	service IP address
`syncconfig`	service IP address
`syncdel`	service IP address
`syncexpand`	fixed IP address

synclist	service IP address
syncmount	fixed IP address
syncstart	fixed IP address
syncstop	fixed IP address
syncumount	fixed IP address

You can automate the execution of multiple commands by creating a shell script on the remote host. For more information, see the operating system documentation.

5.2.3 Guidelines for Using Commands

Follow these guidelines when using commands:

- Do not use any commands that are not described in this manual.
- Do not perform any operations using commands while using the NAS Manager GUI windows.
- If you use a command when the cluster, node, or resource group is not running correctly, an error might occur. We recommend that you first check if the cluster, node, or resource group is running correctly before executing a command. For more information on checking the status of the cluster, node and resource group, see the *NAS Manager User's Guide*.
- Before you use a command, make sure that the time is correct between networks. If the times differ between networks, the creation date and time of a differential-data snapshot may not match the actual date and time. For more information on how to set the time between networks, see the *NAS Manager User's Guide*.
- After using a command, make sure that you check the result. If you cancel a command, use one of the following commands depending on the situation:
  - When the `syncstart` or `syncstop` command is canceled, use the `syncstop` command.
  - When the `syncadd` or `syncdel` command is canceled, use the `syncdel` command.
  - When the `syncmount` or `syncumount` command is canceled, use the `syncumount` command.
  - When the `syncconfig` command is canceled:

    Use the `syncconfig` command.
  - When the `syncexpand` command is canceled:

    Use the `syncexpand` command with the `-R` option specified.
- Until the operation required for cancellation ends, do not use the device files that in the storage device for other operations.
- If you cancel a command, it might take a few minutes for the processing to terminate.

5.3 Specifying Command Options and Arguments

This section explains how to specify options and arguments.

- To specify a character string that contains a space in an argument, you must enclose the entire argument in double quotation marks (").

  For example, to specify `1 2` as an argument of the `-a` option, enter the following:

```
command-name -a "1 2"
```

- To specify, in an argument, a character string that contains a double quotation mark ("), you must specify a backslash (\) immediately before the double quotation mark.

  For example, to specify `1"2` as an argument of the `-a` option, enter the following:

```
command-name -a 1\"2
```

- To specify multiple options, separate them with a space.

  For example, to specify option `-a` and option `–b`, enter the following:

```
command-name -a -b
```

  For example, you cannot specify two options at once as shown below:

```
command-name -ab
```

- You cannot specify the same option more than once in a command.

  For example, specifying the following, in which the same option is specified more than once, results in an error:

```
command-name -a 1 -a 2
```

- When you want the command to suppress the messages in standard output and standard error output, specify the `–nomsg` option at the end of the format. This option is especially useful when the command is automatically executed.

  For example, to use the *command-name* command without displaying a message, enter the following:

```
command-name -a 1 -b 2 -nomsg
```

- You can view the syntax format of a command by executing the command with the `-h` option specified directly after the command name.

  For example, to view the syntax format of the *command-name* command, enter the following:

```
command-name -h
```

5.4 Commands

This section describes each command you can use to perform snapshot operations:

- syncadd — Creates a snapshot (section 5.4.1)
- syncconfig — Configures a snapshot (section 5.4.2)
- syncdel — Deletes a snapshot (section 5.4.3)
- syncexpand — Expands a storage device (section 5.4.4)
- synclist — Displays the status of a storage device (section 5.4.5)
- syncmount — Mounts a snapshot (section 5.4.6)
- syncstart — Sets up a storage device (section 5.4.7)
- syncstop — Releases a storage device (section 5.4.8)
- syncumount — Unmounts a snapshot (section 5.4.9)

5.4.1 syncadd (creates a snapshot)

Synopsis

```
syncadd [-r differential-data-snapshot-name-to-be-deleted] file-system-name
differential-data-snapshot-name-to-be-created [-nomsg]
syncadd -h
```

Description

The `syncadd` command creates a differential-data snapshot of a file system.

To create a snapshot, you must have set up in advance a storage device for the file system. For more information on setting up a storage device, see section 5.4.7.

The maximum number of snapshots that can be created is equal to the number of reserved generations set for the storage device. This count includes the number of snapshots that were automatically created as well as those that were created through online backup.

When you create or delete a snapshot, background processing is used. If the `syncadd` command is used on the file system while background processing for either creating or deleting another snapshot is running, an error occurs (return value 75). The background processing time required for snapshot creation or deletion increases in proportion to the file system size. Under a low system load, it takes about 15 seconds when the file system space is 50 GB, and about 5 minutes when the file system space is 1 TB. Under a high system load, the background processing time might increase to a maximum of about 30 times the time required when under a low system load.

When multiple snapshots are created in succession from one file system, use the command at appropriate intervals, after taking into consideration the file system space and system load.

You can check whether background processing for creating or deleting a snapshot is being performed, by using the `synclist` command. For more information on the `synclist` command, see section 5.4.5.

To avoid excessive I/O processing loads, do not use the `syncadd` commands for multiple file systems concurrently. Executing such commands concurrently might take a long time.

Do not restart the CIFS service while creating a snapshot. If you restart the CIFS service while creating a snapshot, the CIFS clients might not be able to access or write data to the file system.

When the storage device capacity is insufficient and the number of snapshots has reached the number of reserved generations, snapshot creation will fail. Once the first snapshot is created, check the status of the storage device regularly, and perform the following as necessary:

- Delete unnecessary differential-data snapshots:

  Use the `syncdel` command to delete any unnecessary snapshots. For more information on the `syncdel` command, see section 5.4.3 .

  You can also perform snapshot deletion and creation simultaneously. In this case, a snapshot is created when command execution is completed. When using commands, use the `syncadd` command with the `-r` option specified. If the snapshot specified for the `-r` option does not exist, only creation processing is performed, followed by normal termination.

- Change the number of reserved generations for snapshots:

  Use the `syncconfig` command to change the number of reserved generations for snapshots. For more information on the `syncconfig` command, see section 5.4.2. For more information about how to use the GUI to change the number of reserved generations, see section 3.6.2.

- Expand the differential-data storage device:

  Use the `syncexpand` command or to expand the storage device. For more information about the `syncexpand` command, see section 5.4.4.

You can mount a created snapshot and create NFS and CIFS shares as needed. For more information on mounting a snapshot, see section 5.4.6. For more information on creating NFS and CIFS shares, see the *NAS Manager User's Guide*.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

-r *differential-data-snapshot-name-to-be-deleted*

Specifies the name of the snapshot being deleted when you want to delete a differential-data snapshot and create a new one.

file-system-name

Specifies the name of the source file system.

differential-data-snapshot-name-to-be-created

Specifies the name of the new snapshot being created. A snapshot name must consist of 1-16 alphanumeric characters and underscores (_).

You cannot use the following names:

- Names already used by other snapshots in the file system (not including those being deleted in this operation)
- Names starting with `auto-`
- Names starting with SyncBackup

Return Values

`0`	The command terminated normally.
`1`	A specified option is invalid. Specify the correct option and use the command again.
`2`	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
`10`	The specified file system name is invalid. Specify the correct file system name and use the command again.
`11`	The specified file system does not exist. Check the specified file system name and use the command again.
`14`	The specified file system is not active on NAS Sync Image. Check the specified file system name and use the command again.
`16`	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
`18`	The specified differential-data snapshot is not unmounted. Unmount the specified snapshot and use the command again.

30	The name specified for the differential-data snapshot is invalid. Specify a valid name for the snapshot and use the command again.
32	The name specified for the differential-data snapshot is already in use. Specify another name for the snapshot and use the command again.
50	The number of differential-data snapshots has reached the maximum. Delete any unneeded snapshots and use the command again.
51	The specified file system does not exist. Check the specified file system name and retry.
52	No differential-data storage device has been set up for the specified file system. Check whether the storage device is inactive. If this return value returns although the storage device is active, acquire the Sync Image log files and contact your HDS representative.
53	The command was unable to acquire information about the snapshot due to an error on the logical volume. Acquire the Sync Image log files, and contact your HDS representative.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error, and release the storage device for the same target file system as when the error occurred.
55	An error occurred during mount or unmount processing previously performed for a snapshot. Eliminate the cause of the error, and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
58	Setup or release of a storage device, or mounting or unmounting of a snapshot that began on the failover source has not finished. The command cannot create a snapshot during failback operation. Perform failback and retry.
62	An error occurred during expansion processing previously performed for a storage device. Perform recovery processing for expansion of the storage device.
63	Data on the storage device became invalid due to a space shortage. Take either of the following actions: ▪ Unmount all snapshots for the specified file system and delete them simultaneously. ▪ Unmount all snapshots for the specified file system, release the storage device and set up the storage device again.
65	The current directory is invalid. Possible causes are: ▪ The current directory is located under /mnt. ▪ The current directory is set in a directory that does not exist. Change the current directory and re-use.
66	An error occurred in the processing that was previously used to delete all snapshots simultaneously. Re-use the operation for deleting all differential-data snapshots simultaneously.

72	The maximum number of logical volumes that can be created on the node may have been reached. Delete any unneeded file systems or snapshots and use the command again.
74	The command cannot create a snapshot because an error occurred in a device file contained in the file system or storage device. Unmount the snapshots from the specified file system and release the storage device. After the release has finished, acquire the Sync Image log files and contact your HDS representative.
75	Background processing is running for creating or deleting a snapshot for the specified file system. Wait a few minutes and use the command again.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
86	An error occurred due to one of the following reasons: ▪ An error occurred in the file system or in the device files in the storage device. Unmount the snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and perform the task again. ▪ The resource group became Offline during processing. Put the resource group Online and perform the task again.
87	The snapshot function is unavailable because a resource group is `Offline`. Put the resource group `Online` and retry.
89	The specified file system could not be operated. Most likely, one of the following occurred: ▪ A failover occurred. Perform a failback and retry. ▪ The resource group became `Offline`. Put the resource group `Online` and retry. If neither of these has occurred, collect all the log data and contact your HDS representative.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example:

In the following example, the command creates a differential-data snapshot:

```
$ sudo syncadd fs01 ss01
Sep 30 19:24:17 KAQS11000-I The syncadd command execution has started.
Sep 30 19:24:19 KAQS11001-I The syncadd command has finished.
```

In the following example, the command deletes and creates a snapshot at the same time:

```
$ sudo syncadd -r ss01 fs01 ss02
Sep 30 19:24:17 KAQS11000-I The syncadd command execution has started.
Sep 30 19:24:19 KAQS11001-I The syncadd command has finished.
```

Note: If many I/O requests are issued to the source file system after a snapshot has been created, the I/O performance of the NAS system may deteriorate.

5.4.2 syncconfig (modifies the configuration of a storage device)

Synopsis

Format 1

```
syncconfig {-g reserved-generations|-w warning-threshold} file-system-name [-nomsg]
```

Format 2

```
syncconfig -g reserved-generations -w warning-threshold file-system-name [-nomsg]
syncconfig -h
```

Description

The `syncconfig` command changes the number of reserved generations for a differential-data snapshot, as well as the warning threshold of a differential-data storage device.

When changing either the number of reserved generations or the warning threshold, perform specifications as shown in *Format 1*.

When changing both the number of reserved generations and the warning threshold, perform specifications as shown in *Format 2*.

If you are using an automatic creation schedule for snapshots, adjust the maximum number and the creation date from the GUI when you change the number of reserved generations. Even if you set a value that is less than the maximum number for automatic creation for the number of reserved generations, the schedule settings are not changed automatically. Differential-data snapshots are automatically created on the assumption that the number of newly set reserved generations is the maximum number for automatic creation. For more information, see section 3.6.4.

Options and Arguments

-g *reserved-generations*

Specifies the number of generations for differential-data snapshots (reserved generations), as an integer from 3 to 124. You must specify a value larger than the number of snapshots already created and stored.

Use the `synclist` command to check the number of snapshots already stored before specifying the new number of reserved generations. If you subtract the number of current reserved generations from the number of logical volumes on the node on which the source file system for the storage device has been created, and the resulting value is 3,973 or greater, the specifiable value is less than 124.

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

-w *warning-threshold*

Specifies the storage device usage rate at which a warning message is output (warning threshold), as an integer from 0 to 99. When `0` is specified, no message is displayed until the amount of space of the storage device becomes insufficient. If the specified value is less than the current usage rate of the storage device, a message is displayed as soon as the setting is changed. Use the `synclist` command to check the current usage rate and specify the new warning threshold.

file-system-name

Specifies the name of the file system for which the storage device is set up.

Return Values

`0`	The command terminated normally.
`1`	A specified option is invalid. Specify the correct option and use the command again.
`2`	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
`3`	The specified number of reserved differential-data snapshot generations is invalid. Specify the correct number and use the command again.
`6`	The specified warning threshold is invalid. Specify the valid warning threshold and use the command again.
`7`	A value smaller than the number of currently created differential-data snapshots is specified for the number of reserved generations. Specify a number of reserved generations that is greater than or equal to the number of currently created snapshots and use the command again.

10	The specified file system name is invalid. Specify the correct file system name and use the command again.
11	The specified file system does not exist. Check the specified file system name and use the command again.
14	The specified file system is not operating on NAS Sync Image. Check the specified file system name and use the command again.
16	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error and release the storage device for the same target file system as when the error occurred.
55	An error occurred during mount or unmount processing previously performed for a differential-data snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	The portion of the resource required for data processing is being used by another user. Wait a few minutes and use the command again.
62	An error occurred during expansion processing previously performed for a differential-data storage device. Perform recovery processing for expansion of the storage device.
63	Data on the differential-data storage device became invalid due to a space shortage. Take either of the following actions: ▪ Unmount all snapshots for the specified file system and delete them simultaneously. ▪ Unmount all snapshots for the specified file system, release the storage device, and set up the storage device again.
65	The current directory is invalid. Possible causes are as follows: ▪ The current directory is located under `/mnt`. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
66	An error occurred in the processing that was previously used to delete all snapshots simultaneously. Re-run the operation for deleting all differential-data snapshots simultaneously.
74	The settings for a snapshot cannot be changed because an error occurred in a device file contained in the file system or storage device. Unmount the snapshots for the specified file system and release the storage device. After the release has finished, acquire the Sync Image log files, and contact your HDS representative.
77	The settings for the storage device cannot be changed because the specified number of reserved snapshot generations may exceed the maximum number of logical volumes. If this is the case, delete any unneeded file systems or storage devices, or otherwise reduce the number of reserved snapshots and use the command again.
79	Data processing failed due to an error that occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files, and contact your HDS representative.

83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
86	An error occurred for one of the following reasons: ▪ An error occurred in the file system or in the device files that comprise the file system or the storage device. Unmount the snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and perform the task again. ▪ The resource group became `Offline` during processing. Put the resource group Online and perform the task again.
87	The differential-data snapshot function is unavailable because a resource group is `Offline`. Put the resource group `Online` and perform the task again.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example:

In the following example, the command changes the number of reserved generations to 10, and the warning threshold to 90%.

```
$ sudo syncconfig -g 10 -w 90 fs01
Sep 30 19:24:17 KAQS11000-I The syncconfig command execution has started.
Sep 30 19:24:19 KAQS11001-I The syncconfig command has finished.
```

5.4.3 syncdel (deletes a differential-data snapshot)

Synopsis

Format 1 (deletes all snapshots for file system simultaneously)

```
syncdel -a file-system-name [-nomsg]
```

Format 2 (deletes a specific snapshot for a file system)

```
syncdel file-system-name differential-data-snapshot-name [-nomsg]
syncdel -h
```

Description

The `syncdel` command deletes one or more differential-data snapshots. With this command, you can also delete snapshots that were created automatically.

You must unmount a snapshot before you delete it. For more information on unmounting a snapshot, see section 5.4.9.

To delete all differential-data snapshots for a file system simultaneously, enter the command using Format 1.

To delete a specific differential-data snapshot for a file system, enter the command using Format 2.

When you create or delete a snapshot, background processing is used. If the `syncdel` command is used on file systems while the background processing for creating or deleting another snapshot is running, the command causes an error (return value 75).

The background processing time required for snapshot creation or deletion increases in proportion to the file system size. Under a low system load, it takes about 15 seconds when the file system space is 50 GB, and about 5 minutes when the file system space is 1 TB. Under a high system load, the background processing time might increase to a maximum of about 30 times the time required when under a low system load.

When you delete multiple snapshots in succession from one file system, use the command at appropriate intervals after taking into consideration the file system space and system load.

You can check whether background processing for creating or deleting a snapshot for the file system is running, by using the `synclist` command. For more information on the `synclist` command, see section 5.4.5.

To avoid excessive I/O processing loads, do not use the `syncdel` commands for multiple file systems concurrently.

Options and Arguments

-a *file-system-name*

Specifies that all differential-data snapshots for the specified file system are to be deleted simultaneously.

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

file-system-name

Specifies the name of the file system for which differential-data snapshot deletion processing is to be performed.

differential-data-snapshot-name

Specifies the name of a differential-data snapshot that is being deleted.

Use this argument to delete a specific snapshot for the specified file system. To delete multiple snapshots, you must use this command for each snapshot you are deleting.

Return Values

0	The command terminated normally.
1	A specified option was invalid. Specify the correct option and use the command again.
2	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
10	The specified file system name is invalid. Specify the correct file system name and use the command again.
11	The specified file system does not exist. Check the specified file system name and use the command again.
14	The specified file system is not active on NAS Sync Image. Check the specified file system name and use the command again.
16	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
18	The specified differential-data snapshot has not been unmounted. Unmount the snapshot and use the command again.
30	The specified differential-data snapshot name is invalid. Specify the correct snapshot name and use the command again.
31	The specified differential-data snapshot was not found. Check the specified file system name or snapshot name and use the command again.
51	The specified file system does not exist. Check the specified file system name and perform the task again.
52	No differential-data storage device has been set up for the specified file system. Check whether the storage device is inactive. If this return value returns although the storage device is active, acquire the Sync Image log files and contact your HDS representative.
53	The command was unable to acquire information about the differential-data snapshot due to an error on the logical volume. Acquire the Sync Image log files and contact your HDS representative.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error, and release the storage device for the same target file system as when the error occurred.
55	An error occurred during mounting or unmounting previously performed for a snapshot. Eliminate the cause of the error, and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	The portion of the resource required for data-processing is being used by someone else. Wait a few minutes and use the command again.

58	Setup or release of a storage device, or mounting or unmounting of a snapshot that began on the failover source node, has not finished. The command cannot delete a snapshot during such an operation. Perform failback and retry.
62	An error occurred during expansion processing previously performed for a storage device. Perform recovery processing for expansion of the storage device.
63	Data on the differential-data storage device is invalid due to a space shortage. Take either of the following actions: ▪ Unmount all differential-data snapshots for the specified file system and delete them simultaneously. ▪ Unmount all differential-data snapshots for the specified file system, release the storage device and set up the storage device again.
65	The current directory is invalid. Possible causes are as follows: ▪ The current directory is located under `/mnt`. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
66	An error occurred in the operation to delete all differential-data snapshots simultaneously. Re-use the operation for deleting all snapshots simultaneously.
74	The command cannot create a snapshot because an error occurred in a device file contained in the file system or storage device. Unmount the snapshots from the specified file system and release the storage device. After the release has finished, acquire the Sync Image log files and contact your HDS representative.
75	Background processing for creating or deleting a snapshot for the specified file system is running. Wait for a few minutes and use the command again.
79	Data processing failed due to an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
86	An error occurred for one of the following reasons: ▪ An error occurred in the device files in the file system or storage device. Unmount the snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact you HDS representative. ▪ A failover occurred during processing. Perform a failback and retry. ▪ The resource group became `Offline` during processing. Put the resource group Online and retry.
87	The differential-data snapshot function is unavailable because a resource group is `Offline`. Put the resource group `Online` and retry.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Examples:

In the following example, the command deletes all differential-data snapshots for the specified file system simultaneously:

```
$ sudo syncdel -a fs01
Sep 30 19:24:17 KAQS11000-I The syncdel command execution has started.
Sep 30 19:24:20 KAQS11001-I The syncdel command has finished.
```

In the following example, the command deletes a specific differential-data snapshot for a specified file system:

```
$ sudo syncdel fs01 ss01
Sep 30 19:24:17 KAQS11000-I The syncdel command execution has started.
Sep 30 19:24:19 KAQS11001-I The syncdel command has finished.
```

5.4.4 syncexpand (expands a storage device)

Synopsis

```
syncexpand file-system-name device-file-name[,device-file-name...] [-nomsg]
syncexpand –R file-system-name [-nomsg]
syncexpand -h
```

Description

The `syncexpand` command expands a differential-data storage device, up to the maximum size of 2,047.937 GB.

Once you have expanded the storage device, you cannot decrease its size, unless you release the storage device and perform the settings again. Keeping in mind how operation is performed for snapshots, specify the device file to be added to the storage device. You can use the NAS Manager `nas_devfreelist` command to check unused device files.

After using the `syncexpand` command, use the `synclist` command to view the status of the storage device, and check that processing has terminated normally. If a failure occurs during processing and the processing is suspended, correct the failure and use the `syncexpand` command with the `-R` option specified to perform recovery for expansion processing.

Suspended processing can be completed by performing recovery processing, and then the differential-data storage device can be expanded normally.

If the NAS Backup Restore remote copy function is used for the file system, reconfigure the remote copy pair after expanding the storage device. For more information on remote copy, see the *ShadowImage User's Guide*.

Do not restart the CIFS service during expansion for a differential-data storage device, or the CIFS clients might not be able to access or write data to the file system.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

-R *file-system-name*

Specifies this option when expansion processing is canceled due to a failure.

file-system-name

Specifies the name of the file system for which the differential-data storage device is set up.

device-file-name [,device-file-name...]

Specifies the name of an unused device file that is added to the differential-data storage device. If the path to this device file is `/dev/enas/lu0F`, you would specify `lu0F`. You can specify multiple device files by delimiting the device file names with commas (`,`).

When adding device files, make sure that:

- The size of each device file being added is 160 MB or greater.
- The total number of device files in the storage device, including those being added, is 128 or less.
- The total amount of space of the differential-data storage device, including the size of the device files being added, is 2,047.937 GB or less.

`-R`

Specify this option when expansion processing is canceled due to a failure.

Return Values

`0`	The command terminated normally.
`1`	A specified option is invalid. Specify the correct option and use the command again.
`2`	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
`10`	The specified file system name is invalid. Specify the correct file system name and use the command again.
`11`	The specified file system does not exist. Check the specified file system name and use the command again.
`14`	The specified file system is not operating on NAS Sync Image. Check the specified file system name and use the command again.

16	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
20	The specified device file name is invalid. Specify the correct device file name and use the command again.
21	The specified device file was not found. Check the specified device file name and use the command again.
22	The specified device file is already in use. Specify a device file that is not in use and use the command again.
23	The size of each specified device file does not satisfy the conditions for setting up the storage device. Specify device files that satisfy the conditions for setting up a storage device and use the command again.
24	An attempt to connect to a device file has failed. Wait a few minutes and use the command again. If this error occurs repeatedly, ask your HDS representative to check if the path of the device file is defined for both of the nodes in the cluster. If no problems are found, acquire the Sync Image log files and contact your HDS representative.
27	129 or more device files are specified. Check the number of specified device files and use the command again.
28	If the specified device file is added, the amount of space for the storage device exceed the maximum. Specify device files with the appropriate size and use the command again.
29	If the specified device files are added, the number of device files in the storage device will exceed the maximum. Check the number of device files specified and use the command again.
36	Although the expansion processing ended normally for the differential-data storage device that you have logged in to, the connection to the device file failed on the other node in the cluster. Make sure that the LAN cable is connected, that the load on the nodes in the cluster has returned to a normal state, and that the NAS OS on the other node in the cluster is running.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error and release the storage device for the same target file system as when the error occurred.
55	An error occurred during mount or unmount processing previously performed for a snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
61	An attempt to expand the differential-data storage device has failed. Specify the `-R` option and use the command again. If this error occurs again, acquire the Sync Image log files and contact your HDS representative.
62	An error occurred during expansion processing previously performed for a differential data storage device. Perform recovery processing for expansion of the storage device.
63	Data on the differential-data storage device became invalid due to a space shortage. Take either of the following actions: ▪ Unmount all differential-data snapshots for the specified file system and delete them simultaneously. ▪ Unmount all differential-data snapshots for the specified file system, release the storage device and set up

	the storage device again.
65	The current directory is invalid. Possible causes are: ▪ The current directory is located under /mnt. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
66	An error occurred in the processing that was previously used to delete all differential-data snapshots simultaneously. Re-use the operation for deleting all snapshots simultaneously.
74	The command cannot set up a differential-data storage device because an error occurred in a device file contained in the file system. Acquire the Sync Image log files and contact your HDS representative.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files, and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to a failover. Use the command again after applying failback to restore normal status.
86	An error occurred due to one of the following reasons: ▪ An error occurred in the device files in the differential-data storage device. Unmount the differential-data snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and perform the task again. ▪ The resource group became Offline during processing. Put the resource group Online and perform the task again.
87	The differential-data snapshot function is unavailable because a resource group is Offline. Put the resource group Online and retry.
89	The specified file system could not be operated. Either of the following may have occurred during processing: ▪ A failover occurred. Perform a failback and retry. ▪ The resource group is Offline. Put the resource group Online and retry. If neither of these has occurred, collect all the log data and contact your HDS representative.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Examples

In the following example, the command expands a differential-data storage device:

```
$ sudo syncexpand fs01 lu01,lu02
```

```
Sep 30 19:24:17 KAQS11000-I The syncexpand command execution has started.
Sep 30 19:24:27 KAQS11001-I The syncexpand command has finished.
```

In the following example, the command performs recovery for expansion of a storage device that was canceled.

```
$ sudo syncexpand -R fs01
Sep 30 19:24:17 KAQS11000-I The syncexpand command execution has started.
Sep 30 19:24:27 KAQS11001-I The syncexpand command has finished.
```

5.4.5 synclist (displays the status of a storage device)

Synopsis

Format 1 (view status of all snapshots)

```
synclist [-w] –a [-nomsg]
```

Format 2 (view status of snapshots for a specific file system)

```
synclist [-w] [-t|-T] -l file-system-name [-nomsg]
```

Format 3 (view status of specific snapshot)

```
synclist [-w] file-system-name differential-data-snapshot-name [-nomsg]
synclist -h
```

Description

The `synclist` command lists information about differential-data snapshots.

Use Format 1 if you want to view the status of all differential-data snapshots.

Use Format 2 if you want to view the status of differential-data snapshots for a specific file system.

Use Format 3 if you want to view status of a specific differential-data snapshot.

The following table lists the information that displays when the `synclist` command is used in each format.

Table 5.3 synclist Command Displayed Information

Item	Description
FORMAT 1 (***Note 1***)	
`file system`	Displays the name of a file system that is active on NAS Sync Image.
`snaps`	Displays the number of differential-data snapshots created for the file system.
`rsrvd`	Displays the number of reserved differential-data snapshot generations.

`status`	Displays the status of the differential-data storage device.
	`avail`
	The differential-data storage device is normal.
	`busy`
	Background processing for creating or deleting a differential-data snapshot is running.
	`deleting`
	Displayed when processing is being used to simultaneously delete all the differential-data snapshots created for a file system, or when an error occurred during the processing.
	Wait a few minutes and re-use the `synclist` command. If the status does not change after re-executing, an error might have occurred during the processing. Re-use the operation for deleting all the snapshots simultaneously.
	`expanding`
	Displayed when processing is being used to expand the differential-data storage device, or when an error occurred during the processing.
	Wait a few minutes and use the `synclist` command again. If the status does not change after re-executing, an error might have occurred during the processing. Take corrective action as described in Chapter 6.
	`overflow`
	Free space on the differential-data storage device is insufficient.
	Take corrective action as described in Chapter 6.

`size`	Displays the total space of the file system.
`diff-dev`	Displays the total space of the differential-data storage device.
`used`	Displays the size of the used part in the entire differential-data storage device space. If `status` is `overflow` or `deleting`, `--` displays.
`capacity`	Displays the used space as a percentage of the total space of the differential-data storage device. If `status` is `overflow` or `deleting`, `--` displays.
`warn`	Displays the warning threshold set for the differential-data storage device. This is only displayed when the `-w` option is specified. If `--` displays, the warning threshold has not been set.
`Total LV`	Displays the number of logical volumes created on the node, and the maximum number of logical volumes that can be created, in the following format: *number-of-logical-volumes-created-on-the-node / maximum-number-of-logical-volumes-that-can-be-created*
`--Other node -- Total LV`	Displays the number of logical volumes that are being used on other nodes within the cluster, and the maximum number of logical volumes that can be created. The information displays in the following format: *number-of-created-logical-volumes/maximum-number-of-logical-volumes-that-can-be-created* This information displays when a resource group on another node within the cluster has been failed over from the node.

Item	Description
FORMAT 2	
`Original file system name`	Displays the name of a file system that is active on NAS Sync Image.

`Status`	Displays the status of the differential-data storage device.
	`available`
	The differential-data storage device is normal.
	`busy(`*progress*`% processed)`
	Background processing for creating or deleting a differential-data snapshot is running. The value in parentheses indicates the progress of processing in percent.
	`deleting`
	Displayed when processing is being used to simultaneously delete all the differential-data snapshots created for the file system, or when an error occurred during the processing.
	Wait for a few minutes and re-use the `synclist` command. If the status does not change after re-executing, an error might have occurred during the processing. Re-use the operation for deleting all the differential-data snapshots simultaneously.
	`expanding`
	Displayed when processing is being used to expand the differential-data storage device, or when an error occurred during the processing.
	Wait a few minutes and use the `synclist` command again. If the status does not change after re-executing, an error might have occurred during the processing. Take corrective action as described in Chapter 6.
	`overflow`
	Free space on the differential-data storage device is insufficient.
	Take corrective action as described in Chapter 6.

`Total size`	Displays the total space of the differential-data storage device.
`Reserved snapshots`	Displays the number of reserved differential-data snapshot generations.
`Used size` (***Note 2***)	Displays the capacity being used of the entire differential-data storage device capacity. The value in parentheses shows the used space as a percentage of the total space. If `Status` is `overflow` or `deleting`, `*** ERROR ***` displays.
`Warning threshold`	Displays the warning threshold, as the size of the used space, set for the differential-data storage device. This is only displayed when the `-w` option is specified. The used space displays in parentheses as a percentage of the total space. If `none` displays, the warning threshold has not been set.
`Differential-data snapshot(s)` (***Note 2***)	Displays information about each differential-data snapshot that has been created. The following information displays from left to right: ▪ Name of the differential-data snapshot ▪ Size and percentage of the space occupied by each differential-data snapshot within the total differential-data storage device space ▪ Creation date and time If the snapshot has been failed over even though a space shortage problem is left unsolved or if the NAS OS or resource group has restarted, `INVALID` may be displayed. If `INVALID` displays, refer to Chapter 7 and take the necessary action.

Item	Description

`Device file(s)`	Displays the paths to the device files that make up the differential-data storage device.
	If the -d option is specified, the drive type is displayed to the right of the device file name as follows:
	path-of-the-device-file (*drive-type*)
	For *drive-type*, either of the following character strings is displayed:
	`FC`
	An FC drive.
	`SATA`
	A SATA drive.
	If processing is being used to expand the differential-data storage device, or an error occurred during the processing, the information about the device file being added to the differential-data storage device is displayed in the following format.
	path-of-the-device-file (*drive-type*) `-- expanding --`

`Mount point information`	Displays information about the differential-data snapshot mount point, including the differential-data snapshot name and the path to the mount point. The information displays in the order written above.
FORMAT 3	
`Original file system name`	Displays the name of a file system that is active on NAS Sync Image.

`Status`	Displays the status of the differential-data storage device:
	`available`
	The differential-data storage device is normal.
	`busy(`*progress*`% processed)`
	Background processing for creating or deleting a differential-data snapshot is running. The value in parentheses indicates the progress of processing in percent.
	`deleting`
	Displayed when processing is being used to simultaneously delete all the differential-data snapshots created for the file system, or when an error occurred during the processing.
	Wait for a few minutes and use the `synclist` command again. If the status does not change after re-executing, an error might have occurred during the processing. Perform the operation for deleting all the snapshots simultaneously again.
	`expanding`
	Displayed when processing is being used to expand the differential-data storage device, or when an error occurred during the processing.
	Wait a few minutes and use the `synclist` command again. If the status does not change after re-executing, an error might have occurred during the processing. Take corrective action as described in Chapter 7
	`overflow`
	Free space on the differential-data storage device is insufficient.
	Take corrective action as described in Chapter 7

`Total size`	Displays the total space of the differential-data storage device.
`Reserved snapshots`	Displays the number of reserved differential-data snapshot generations.
`Used size` (***Note 2***)	Displays the capacity being used of the entire differential-data storage device capacity. The value in parentheses shows the used space as a percentage of the total space If `Status` is `overflow` or `deleting`, `*** ERROR ***` displays.

Item	Description
`Warning threshold`	Displays the warning threshold, as the size of the used space, set for the differential-data storage device. This is only displayed when the `-w` option is specified. The value in parentheses shows the used space as a percentage of the total space. If `none` displays, the warning threshold has not been set.
`Differential-data snapshot` (***Note 2***)	Displays information about each differential-data snapshot that has been created. The following information displays from left to right: ▪ Name of the differential-data snapshot ▪ Size and percentage of the space occupied by each differential-data snapshot within the total differential-data storage device space ▪ Creation date and time

`Device file(s)`	Displays the paths to the device files that make up the differential-data storage device.
	If the -d option is specified, the drive type is displayed to the right of the device file name as follows:
	path-of-the-device-file (*drive-type*)
	For *drive-type*, either of the following character strings is displayed:
	`FC`
	An FC drive.
	`SATA`
	A SATA drive.
	If processing is being used to expand the differential-data storage device, or an error occurred during the processing, the information about the device file being added to the storage device is displayed in the following format.
	path-of-the-device-file (*drive-type*) `-- expanding --`

`Mount point information`	Displays information about the differential-data snapshot mount point, including the snapshot name and the path to the mount point. The information displays from left to right, as shown above.

Important Note: If you cannot obtain differential-data storage device information, only information about mounted snapshots is displayed.

If a snapshot name begins with auto-, the snapshots were created automatically. The creation date and time displays the date and time when creation of the snapshot started. For this reason, the creation date and time displayed by the synclist command may differ from the creation date and time set in the automatic creation schedule.

If a snapshot name begins with `SyncBackup`, the snapshots were created automatically when online backup was used. They are automatically deleted after normal online backup terminates normally.

Note 1: If the resource groups on the other node is failed over to the node that you have logged into, information about the differential-data storage devices on the other node displays below `-- Other node --`.

Note 2: A differential-data storage device is divided into an area that stores the differential data shared by multiple differential-data snapshots and an area that stores the differential data for each differential-data snapshot. Therefore, the sum of used size values of all differential-data snapshots will not equal the total amount of space used by the differential-data storage device.

If the `synclist` command is used when the storage device has insufficient space, the command displays the information that was valid before the device ran short of space. Therefore, the sum of the displayed usage rates may not add up to 100%, even when the capacity of the differential data shared by multiple snapshots is small.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

-a

Specify this option to view information for all differential-data snapshots.

-d

Specify this option to reference the drive type of a device file that makes up the file system or the storage device.

-l file-system-name

Specify this option to view information about the differential-data snapshots for a specific file system handled by NAS Sync Image.

-t, -T

Specify these options to display snapshots in the chronological order in which they were created. Specify the `-t` option to display differential-data snapshots from oldest to newest and the `-T` option to display differential-data snapshots from newest to oldest. You cannot use these options at the same time. If you do not specify these options, snapshots are displayed in the ascending order of their ASCII codes. Both `-t` and `-T` are ignored if you do not specify `-l`.

-w

Specify this option to view the warning threshold set for the storage device.

file-system-name

Specify to view status of snapshot in file system with this name.

differential-data-snapshot-name

Specify to view status of specific snapshot with this name.

Return Values

0	The command terminated normally.
1	A specified option is invalid. Specify the correct option and use the command again.
2	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
4	An operation is being performed on the file system, or an error might have occurred. If the differential-data storage device is not being set or released, release the storage device. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
5	An operation is being performed on the differential-data snapshot, or an error might have occurred. If the snapshot is not being mounted or unmounted, unmount the snapshot. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
10	The specified file system name is invalid. Specify the correct file system name and use the command again.
11	The specified file system does not exist. Check the specified file system name and use the command again.
14	NAS Sync Image does not support the specified file system. Check the specified file system name and use the command again.
30	The specified differential-data snapshot name is invalid. Specify the correct snapshot name and use the command again.
31	The specified differential-data snapshot was not found. Check the specified file system name or snapshot name and use the command again.
51	The file system is not available due to an error. Acquire the Sync Image log files and contact your HDS representative.
52	No differential-data storage device has been set up for the specified file system. Check whether the storage device is inactive. If this return value returns although the differential-data storage device is active, acquire the Sync Image log files and contact your HDS representative.
53	The command was unable to acquire information about the snapshot due to an error on the logical volume. Acquire the Sync Image log files and contact your HDS representative.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error and release the storage device for the same target file system as when the error occurred.
55	An error occurred during mount or unmount processing previously performed for a differential-data snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
65	The current directory is invalid. Possible causes are as follows: ▪ The current directory is located under /mnt. ▪ The current directory is set in a directory that does not exist. Change the current directory and perform the task again.

70	There is no file system that is handled by NAS Sync Image.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example

In the following example, the command displays information about all differential-data snapshots:

```
$ sudo synclist -w -a
Sep 30 20:44:15 KAQS11000-I The synclist command execution has started.
file system      snaps/rsrvd    status      size  diff-dev      used capacity warn
fs01                3/  124     avail   99.94GB   59.81GB  800.06MB    1.31%  75%
fs02                2/   62     avail   99.94GB   59.81GB  810.19MB    1.32%  85%
Total LV  192/4096

Sep 30 20:44:17 KAQS11001-I The synclist command has finished.
```

In the following example, the command displays information about a specific differential-data snapshot:

```
$ sudo synclist -w -d fs01 ss01
Sep 30 20:44:15 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 59.81GB
Reserved snapshots: 124
Used size: 800.06MB (1.31%)
Warning threshold: 44.86GB (75%)
Differential-data snapshot:
  ss01 5.12MB(0.13%) Wed Sep 1 08:45:13 2005
Device file(s):
  /dev/enas/lu18 (FC)
  /dev/enas/lu19 (FC)
Mount point information:
  ss01  /mnt/snapshot1

Sep 30 20:44:16 KAQS11001-I The synclist command has finished.
```

Note: If the following result displays when this command is used, see the corresponding message and take action. For more information on each message, see the *NAS Error Codes* manual.

Displayed Result	Corresponding Message
file-system-name `-- File system is being failed-over --`	KAQS11020-E
`-- system error --`	KAQS11024-E
`-- failed to get the VG information --`	KAQS11065-E
`-- I/O error --`	KAQS11070-E
path-of-each-device-file `-- error --`	KAQS11070-E
file-system-name `-- In processing or error --`	KAQS11077-I
differential-data-snapshot-name mount-point-name `-- In processing or error --`	KAQS11078-I
`-- Not Available --`	KAQS11083-E
`-- Offline --`	KAQS11086-E
path--of-each-device-file `-- expanding --`	KAQS11266-I

5.4.6 syncmount (mounts a snapshot)

Synopsis

```
syncmount file-system-name differential-data-snapshot-name mount-point-directory-name
[-nomsg]
syncmount -h
```

Description

The `syncmount` command mounts a differential-data snapshot in the read-only mode. With this command, you can also mount differential-data snapshots that were created automatically.

A differential-data snapshot is always mounted at the following location:

```
/mnt/mount-point-directory-name
```

The maximum number of created file systems and mounted differential-data snapshots that can be registered in a cluster is 256 in total.

NAS Manager registers and manages mounted snapshots as file systems. Once a snapshot has been mounted, you can view information about it with its mount point name in NAS Manager.

You cannot perform any of the following operations on a mounted snapshot from NAS Manager:

- Deletion: You must perform this operation from NAS Sync Image.
- Expansion
- Quota settings and changes: The quota value set for the file system at the time of differential-data snapshot creation is applied to the differential-data snapshot. This setting cannot be changed.
- Mounting : You must perform this operation from NAS Sync Image.
- Unmounting: You must perform this operation from NAS Sync Image.

The settings for the file system when the differential-data snapshot is created are copied to the differential-data snapshot. You can check the copied settings by using the `enas_fsctl` command in NAS Manager. Copied settings cannot be changed. For more information about this command, see the *NAS Manager User's Guide*.

Once a snapshot has been mounted, you can use the NAS Manager to create NFS and CIFS shares, in the same way as with ordinary file systems. For more information on creating NFS and CIFS shares, see the *NAS Manager User's Guide*.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

file-system-name

Specify the name of the file system containing the snapshot you are mounting.

differential-data-snapshot-name

Specify the name of the differential-data snapshot you are mounting.

mount-point-directory-name

Specify the name of the mount point for the snapshot you are mounting. To mount the snapshot on the `/mnt/snapshot1` directory, you would specify `snapshot1`.

You can use from 1-16 alphanumeric characters and underscores. The name must be unique in the cluster.

If some snapshots are being mounted automatically in a cluster, specify a mount point directory name in a format other than the one used for automatic mounting. If you mount a snapshot in the format used for automatic mounting, the snapshot is treated as one that was created automatically. If a duplicate mount point directory name is found when a snapshot is being mounted, automatic mounting terminates with an error.

Return Values

0	The command terminated normally.
1	A specified option is invalid. Specify the correct option and use the command again.
2	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
10	The specified file system name is invalid. Specify the correct file system name and use the command again.
11	The specified file system does not exist. Check the specified file system name and use the command again.
14	The specified file system is not active on NAS Sync Image. Check the specified file system name and use the command again.
30	The specified differential-data snapshot name is invalid. Specify the correct snapshot name and use the command again.
31	The specified differential-data snapshot was not found. Check the specified snapshot and use the command again.
33	The specified differential-data snapshot has already been mounted. Check the specified snapshot and use the command again.
35	Mounting of the differential-data snapshot failed. Use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative. This error may occur if the size of the storage device is insufficient. Check the size of the storage device.
40	The specified mount point name is invalid. Specify the correct mount point name and use the command again.
42	Another differential-data snapshot has already been mounted in the specified mount point. Specify another mount point name and use the command again.
43	The specified mount point is in use by another program. Specify another mount point name and use the command again.
51	The file system is not available due to an error. Acquire the Sync Image log files and contact your HDS representative.
52	No differential-data storage device has been set up for the specified file system. Check whether the storage device is inactive. If this return value returns although the storage device is active, acquire the Sync Image log files and contact your HDS representative.
53	The command was unable to acquire information about the differential-data snapshot due to an error on the logical volume. Acquire the Sync Image log files and contact your HDS representative.
54	An error occurred during setup or release processing previously performed for a differential-data storage device. Eliminate the cause of the error and release the storage device for the same target file system as when the error occurred.

55	An error occurred during mount or unmount processing previously performed for a differential-data snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being performed in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
62	An error occurred during expansion processing previously performed for a differential-data storage device. Perform recovery processing for expansion of the storage device.
63	Take either of the following actions: ▪ Unmount all differential-data snapshots for the specified file system and delete them simultaneously. ▪ Unmount all differential-data snapshots for the specified file system, release the differential-data storage device, and set up the differential-data storage device again.
65	The current directory is invalid. Possible causes are as follows: ▪ The current directory is located under `/mnt`. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
66	An error occurred in the processing that was previously used to delete all differential-data snapshots simultaneously. Re-run the operation for deleting all snapshots simultaneously.
71	The total number of created file systems and mounted differential-data snapshots that are registered in a cluster has reached the maximum. Unmount some of the mounted snapshots or delete an unnecessary file system and use the command again.
74	The command cannot perform mounting because an error occurred in a device file contained in the file system or differential-data storage device. Unmount the snapshots from the specified file system and release the storage device. After the release has finished, acquire the Sync Image log files and contact your HDS representative.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes, and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.

86	An error occurred due to one of the following reasons: ▪ An error occurred in the device files that comprise the file system or differential-data storage device. Unmount the differential-data snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and perform the task again. ▪ The resource group became Offline during processing. Put the resource group Online and perform the task again.
87	The differential-data snapshot function is unavailable because a resource group is Offline. Put the resource group Online and perform the task again.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example

In the following example, the command mounts a differential-data snapshot:

```
$ sudo syncmount fs01 ss01 snapshot1
Sep 30 19:24:17 KAQS11000-I The syncmount command execution has started.
Sep 30 19:24:25 KAQS11001-I The syncmount command has finished.
```

Note: If you use more than one `syncmount` command simultaneously, the system may output the return value `57` and the KAQS11071-E message, and the commands may terminate with an error, due to a lock timeout. If you use this command immediately after starting the cluster, the system may output the return value `35` and the KAQS11028-E message and the command may terminate with an error. In such cases, use the `syncmount` command again.

5.4.7 syncstart (sets up a storage device)

Synopsis

```
syncstart [-g number-of-reserved-generations] [-w warning-threshold] file-system-name
device-file-name[,device-file-name...] [-nomsg]
syncstart -h
```

Description

The `syncstart` command sets up a differential-data storage device for storing the differential data of a file system.

You can set up only one differential-data storage device for each file system. In a node, you can create a maximum of 64 differential-data storage devices.

Requirements

Before you can set up a storage device, at least four logical volumes must exist on the node. In addition, you must make sure that:

- The file system has been created using the volume manager (LVM).
- No differential-data storage device has been set up for the file system.
- The file system is not a differential-data snapshot.

Specify the device files to be used as a differential-data storage device keeping in mind how operation is performed for differential-data snapshots. For more information on how to determine the size of a differential-data storage device, see section 3.3.1. You can use the NAS Manager `enas_devfreelist` command to check for unused device files.

When you set up a storage device, you must also set up the number of reserved generations for snapshots and set the warning threshold for the storage device. You can create a maximum of 124 differential-data snapshots for each file system. If there are 3,972 or more logical volumes on the node on which the source file system for the differential-data storage device has been created, you must specify less than 124 snapshot generations. Before setting up a differential-data storage device, keep in mind how operation is performed for differential-data snapshots, and specify the number of reserved generations and warning threshold appropriately.

Once you have set up a storage device and have created in it the first snapshot, data as it exists before the update operation is saved in the storage device each time you request an update.

If the NAS Backup Restore remote copy function is used for the file system, reconfigure the remote copy pair after setting up the storage device. For more information on using remote copy, see the *ShadowImage User's Guide*.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

–g number-of-reserved-generations

Specifies the number of reserved generations for differential-data snapshots, as an integer from 3 to 124. If this is omitted, the number of differential-data snapshot generations that can be stored is 3.

-w warning-threshold

Specifies the threshold level (%) of differential-data storage device usage at which a warning message is output. Use an integer from 0 to 99. When 0 is specified, no message will be output until the amount of space on the differential-data storage device becomes insufficient. If this is omitted, the warning threshold is set to 80% of the space.

file-system-name

Specify the name of the file system for which you are setting up a differential-data storage device.

device-file-name[,device-file-name...]

Specify a name for the storage device. The name should be a new one, not one already being used. If the path to this device file is `/dev/enas/lu0F`, you would specify `lu0F`.

You can specify multiple device files by delimiting the device file names with the comma (`,`). You can specify a maximum of 128 device files. The total size of the device files must be no more than 2,047.937 GB. The size of each device file must be 160 MB or greater.

Return Values

`0`	The command terminated normally.
`1`	A specified option is invalid. Specify the correct option and use the command again.
`2`	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
`3`	The specified number of reserved differential-data snapshot generations is invalid. Specify a correct number and use the command again.
`6`	The specified warning threshold is invalid. Specify a valid warning threshold and use the command again.
`10`	The specified file system name is invalid. Specify the correct file system name and use the command again.
`11`	The specified file system does not exist. Check the specified file system name and use the command again.
`12`	A differential-data storage device has already been set for the specified file system.
`15`	The specified file system was not created using a volume manager (LVM).
`16`	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
`19`	The command cannot set up a differential-data storage device because the specified file system is a snapshot mount point. Specify the correct file system name and use the command again.
`20`	The specified device file name is invalid. Specify the correct device file name and use the command again.
`21`	The specified device file was not found. Check the specified device file name and use the command again.
`22`	The specified device file is already in use. Specify a device file that is not in use and use the command again.
`23`	The size of each device file specified, or the total size of the device files specified, does not satisfy the conditions for setting up the differential-data storage device. Specify device files that meet the requirements for a storage device and use the command again.

24	Connection to a specified device file failed. Wait a few minutes and use the command again. If this error occurs repeatedly, ask your HDS representative to check if the path of the device file is defined for both of the nodes in the cluster. If no problems are found, acquire the Sync Image log files and contact your HDS representative.
26	The sum total size of the specified device file is too large for a differential-data storage device. Specify device files that meet the requirements for a storage device and use the command again.
27	129 or more device files are specified. Check the number of device files and retry.
36	Although the setup processing ended normally for the storage device, the connection to the device file failed on the other node in the cluster. Make sure that the LAN cable is connected, that the load on the nodes in the cluster has returned to a normal state, and that the NAS OS on the other node in the cluster is running.
51	The specified file system does not exist. Check the specified file system name and retry.
54	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error and release the storage device for the same target file system where the error occurred.
55	An attempt to mount or unmount the differential-data snapshot has resulted in an error. Eliminate the cause of the error and unmount the same target mount point where the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
60	Creation of the differential-data storage device failed. Use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
62	An error occurred during expansion processing previously performed for a differential-data storage device. Perform recovery processing for expansion of the storage device.
64	The storage device cannot be set up because the number of storage devices that can be created within a single node has reached the limit. Delete any unneeded storage devices and use the command again.
65	The current directory is invalid. Possible causes are: ▪ The current directory is located under `/mnt`. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
72	The maximum number of logical volumes that can be created on the node may have been reached. If this is the case, delete any unnecessary file systems or snapshots and use the command again.
74	The command cannot set up a storage device because an error occurred in a device file contained in the file system. Acquire the Sync Image log files and contact your HDS representative.
77	The differential-data storage device cannot be set up because the specified number of reserved differential-data snapshots exceeds the maximum number of logical volumes. Delete any unnecessary file systems or storage devices, or otherwise reduce the number of reserved snapshots and use the command again.

79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
86	An error occurred for one of the following reasons: ▪ An error occurred in the device files that comprise the file system or storage device. Unmount the snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and retry. ▪ The resource group became `Offline` during processing. Put the resource group Online and retry.
87	The differential-data snapshot function is unavailable because a resource group is `Offline`. Put the resource group `Online` and retry.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example

In the following example, the command sets up a differential-data storage device with 124 differential-data snapshot reserved generations and a 75% warning threshold:

```
$ sudo syncstart -g 124 -w 75 fs01 lu01,lu02
Sep 30 19:24:17 KAQS11000-I The syncstart command execution has started.
Sep 30 19:24:29 KAQS11001-I The syncstart command has finished.
```

5.4.8 syncstop (releases a storage device)

Synopsis

```
syncstop file-system-name [-nomsg]
syncstop -h
```

Description

The `syncstop` command releases the differential-data storage device that has been set up for a file system.

Before you release a differential-data storage device, you must unmount all differential-data snapshots for the file system. See section 5.4.9.

When the setup settings have been released, the differential-data storage device is deleted and the data in all the differential-data snapshots for the file system is no longer available.

If you release a storage device when automatic scheduling is in use, the schedule information set for the file system is deleted.

If the NAS Backup Restore remote copy function is used for the file system, reconfigure the remote copy pair after releasing the storage device. For more information on using remote copy, see the *ShadowImage User's Guide*.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

file-system-name

Specify the name of the file system from which you are releasing differential-data storage device setup settings.

Return Values

0	The command terminated normally.
1	A specified option is invalid. Specify the correct option and use the command again.
2	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
10	The specified file system name is invalid. Specify the correct file system name and use the command again.
11	The specified file system does not exist. Check the specified file system name and use the command again.
14	The specified file system is not active on NAS Sync Image. Check the specified file system name and use the command again.
16	Processing that is part of the remote copy function of NAS Backup Restore is being used for the specified file system. Use the command again after the processing has finished.
18	A differential-data snapshot has been mounted for the specified file system. Unmount all differential-data snapshots for the file system and use the command again.
25	The disconnection from a specified device file failed. Wait a few minutes and use the command again. If this error occurs repeatedly, ask your HDS representative to check if the path of the device file is defined for both of the nodes in the cluster. If no problems are found, acquire the Sync Image log files and contact your HDS representative.

37	Although the release processing ended normally for the differential-data storage device that you have logged in to, the attempt to disconnect from the device file failed on the other node in the cluster. Make sure that the LAN cable is connected, that the load on the nodes in the cluster has returned to a normal state, and that the NAS OS on the other node in the cluster is running. If the NAS OS on the other node is running, ask your HDS representative to restart the NAS OS. Do not use the device file that was used for the storage device until the NAS OS restart processing is complete.
51	The specified file system does not exist. Check the specified file system name and retry.
53	The command was unable to acquire information about a snapshot due to an error on the logical volume. Acquire the Sync Image log files and contact your HDS representative.
55	An error occurred during mount or unmount processing previously performed for a differential-data snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
65	The current directory is invalid. Possible causes are as follows: ▪ The current directory is located under `/mnt`. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
74	Although the storage device has been released, an error occurred in a device file contained in the storage device. Acquire the Sync Image log files and contact your HDS representative.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
84	The command cannot release the storage device because an error occurred in a device file contained in the file system or storage device and the file system is mounted. Unmount the specified file system and use the command again. If an error occurs, acquire the Sync Image log files and contact your HDS representative.
86	An error occurred due to one of the following reasons: ▪ An error occurred in the device files that comprise the file system or storage device. Unmount the snapshots for the specified file system and release the storage device. When the release is completed, acquire the Sync Image log files and contact your HDS representative. ▪ A failover occurred during processing. Perform a failback and use the command again. ▪ The resource group became `Offline` during processing. Put the resource group Online and use the command again.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.

99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and contact your HDS representative.

Example

In the following example, the command releases a differential-data storage device:

```
$ sudo syncstop fs01
Sep 30 19:24:17 KAQS11000-I The syncstop command execution has started.
Sep 30 19:24:25 KAQS11001-I The syncstop command has finished.
```

Note: If this command terminates in an error, make sure when you use command again that you specify the same file system name as when the error occurred.

5.4.9 syncumount (unmounts a snapshot)

Synopsis

```
syncumount mount-point-directory-name  [-nomsg]
syncumount -h
```

Description

The `syncumount` command unmounts the differential-data snapshot that has been mounted in a specified mount point. With this command, you can also unmount differential-data snapshots that were mounted automatically. If you unmount a differential-data snapshot while a client is accessing it, the client is disconnected.

If any NFS or CIFS shares have been created for the differential-data snapshot, make sure that the differential-data snapshot has been unmounted by the clients before deleting the NFS or CIFS shares. For more information, see the *NAS Manager User's Guide*.

Options and Arguments

-h

Specifies this option to view the command syntax.

-nomsg

Specifies this option to suppress the messages in standard output and standard error output.

mount-point-directory-name

Specify the name of the mount point where the applicable snapshot is mounted.

To unmount a snapshot from the `/mnt/snapshot1` directory, specify `snapshot1`.

Return Values

`0`	The command terminated normally.
`1`	A specified option is invalid. Specify the correct option and use the command again.
`2`	The number of specified arguments is invalid. Specify the correct arguments and use the command again.
`40`	The specified mount point name is invalid. Specify the correct mount point name and use the command again.
`41`	The specified mount point does not exist. Check the specified mount point and use the command again.
`43`	Another program is using the specified mount point. Check the name of the specified mount point and use the command again.
`44`	An NFS or CIFS share has been created on the snapshot that is mounted on the specified mount point. Delete all NFS and CIFS shares and use the command again.
`45`	NAS Sync Image cannot manipulate the file system mounted on the specified mount point. Check the name of the specified mount point and use the command again.
`46`	The command failed to unmount the differential-data snapshot. Use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
`48`	No differential-data snapshot is mounted on the specified mount point. Check the name of the specified mount point and use the command again.
`49`	Unmounting the differential-data snapshot failed. Either a cluster, node, or resource group stopped, or an error occurred. Put the cluster, node, or resource group back to the normal status, and then use the command again. If an error occurs again, collect all the log data and contact your HDS representative.
`54`	An error occurred during setup or release processing previously performed for a storage device. Eliminate the cause of the error and release the storage device for the same target file system as when the error occurred.

55	An error occurred during mount or unmount processing previously performed for a differential-data snapshot. Eliminate the cause of the error and unmount the same target mount point as when the error occurred.
56	Other NAS Sync Image processing is being used in the specified file system. Wait a few minutes and use the command again.
57	Another user is using some of the resources required for data processing. Wait a few minutes and use the command again.
65	The current directory is invalid. Possible causes are: ▪ The current directory is located under /mnt. ▪ The current directory is set in a directory that does not exist. Change the current directory and use the command again.
79	Data processing failed because an error occurred in a NAS Cluster Management LU. Contact your HDS representative.
80	Memory allocation failed. Wait a few minutes and use the command again. If the error occurs again, acquire the Sync Image log files and contact your HDS representative.
83	The command was unable to manipulate the specified file system due to failover. Use the command again after applying failback to restore the normal status.
98	The NAS Sync Image license has not been set. Set the NAS Sync Image license and use the command again.
99	An error that was not one of the above errors occurred. Acquire the Sync Image log files and use the command again.

Example

In the following example, the command unmounts a differential-data snapshot:

```
$ sudo syncumount snapshot1
Sep 30 19:24:17 KAQS11000-I The syncumount command execution has started.
Sep 30 19:24:25 KAQS11001-I The syncumount command has finished.
```

Note: If you use the `syncumount` command immediately after the cluster starts, the system may output the return value `45` and the KAQS11035-E message, and the command may terminate with an error. If a failover occurs while the `syncumount` command is being used, unmounting of the snapshot might fail.

If this command terminates with an error, make sure that you use the command again, specifying the same file system name as when the error occurred.

Chapter 6 Sample Snapshot Operations Using Commands

This chapter describes several sample differential-data snapshot operations using commands. Use these examples to help you perform snapshot operations effectively.

In these examples, differential-data snapshots are created twice a day and are stored for a month (up to 62 generations).

This chapter includes the following sections:

- Sample Operations Configuration and Guidelines (section 6.1)
- Setting Up a Storage Device (section 6.2)
- Creating a Snapshot (section 6.3)
- Deleting a Snapshot and Creating a New One (section 6.4)
- Publishing a Snapshot for a Client (section 6.5)
- Viewing Status Information (section 6.6)
- Changing the Reserved Generations (section 6.7)
- Changing the Warning Threshold for Storage Devices (section 6.8)
- Expanding a Storage Device (section 6.9)
- Releasing a Storage Device (section 6.10)

The system configuration for these sample operations is illustrated in Figure 6.1.

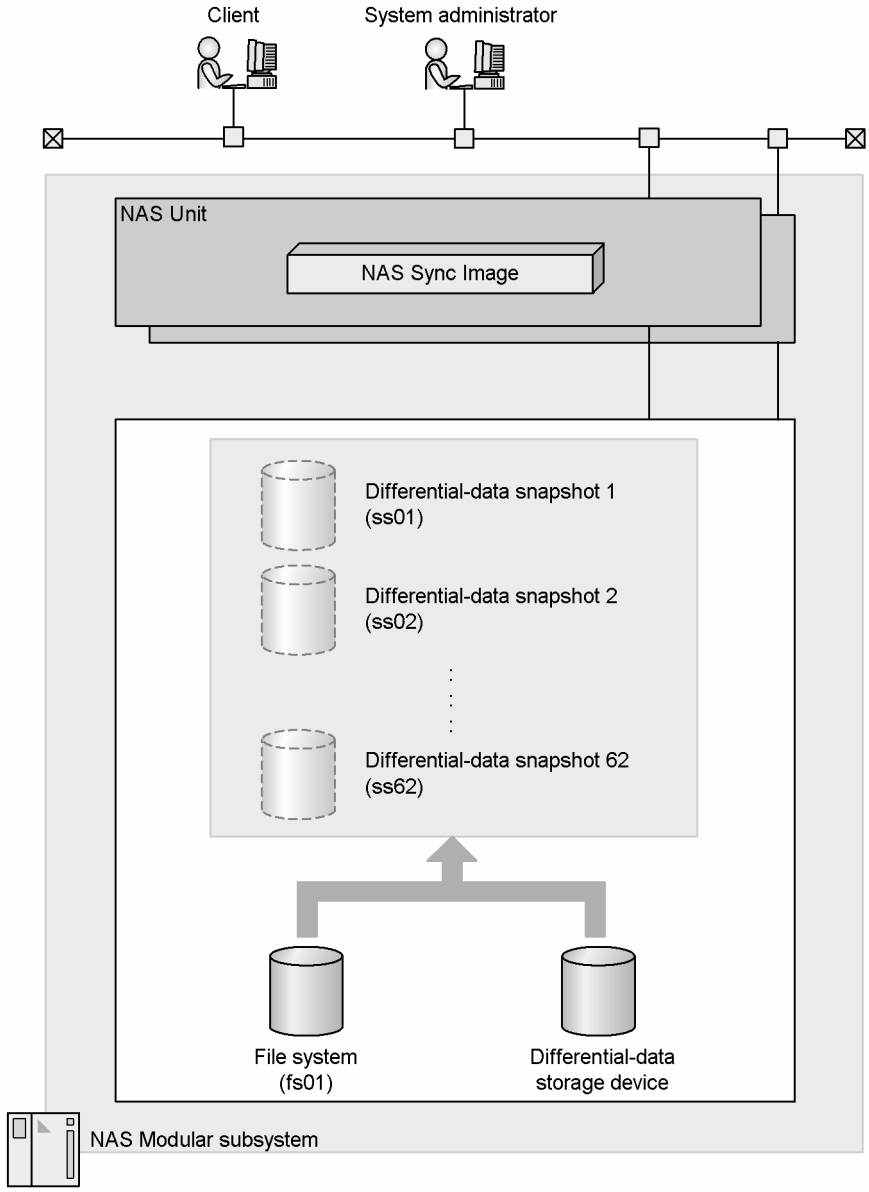


Figure 6.1 System Configuration for Sample Snapshot Operations

6.1 Sample Operations Configuration and Guidelines

These sample operations are configured so that:

- Your machine is connected to a NAS Unit in the NAS Modular system through a LAN.
- The public key being used in Secure Shell (SSH) has been registered.

These sample operations follow these guidelines:

- The file system from which differential-data snapshots are created is `fs01`.
- A notification message is output when the usage rate of the differential-data storage device reaches 90% or more.
- The device files used when a new differential-data storage device is set up are `lu01` and `lu02`.
- The names of the differential-data snapshots are `ss01`, `ss02`, through to `ss62`, in sequential order.
- The mount point for differential-data snapshot 1 (ss01) is /mnt/snapshot1.
- An NFS share and a CIFS share are created for differential-data snapshot 1 (`ss01`).
  - An NFS share and a CIFS share are created in the `/mnt/snapshot1` directory.
  - The NFS share is issued to `host01`.
  - The name of the CIFS share is `CIFS_SNAP`.
- After operation starts, the following settings are changed according to the usage status of the file system (`fs01`):
  - The number of reserved generations for differential-data snapshots is changed (to 124 generations).
  - The warning threshold is changed (to 85%).
  - The differential-data storage device is expanded (`lu03` is used as the device file).
- In these examples, you log on to the NAS unit and use commands manually.

6.2 Setting Up a Storage Device

Before beginning differential-data snapshot operations, you must set up the storage device, taking into account how the device will be used. This section describes the procedure to setup a differential-data storage device using commands. The examples used in the setup procedure are based on the following assumptions:

- The source file system of the differential-data storage device is fs01.
- The device files used for the differential storage device are lu01 and lu02.
- The number of reserved generations differential-data snapshots is set to 62.
- The warning threshold is set to 75%

To set up a differential-data storage device using commands:

1. Determine the size of the differential-data storage device and the number of snapshot generations that the storage device will store.

   For more information about calculating the space requirements for a storage device, see section 3.3.11.

2. Execute the `enas_fslist` command to check the status of the source file system of the differential-data storage device. The output should display `normal` for Device status and `use` for Volume manager. Nothing other than the file system name should be displayed for `File system (used by)`. For details on the syntax of the `enas_fslist` command, see the *NAS Manager User's Guide*.

```
$ sudo enas_fslist fs01
List of File Systems:
The number of file systems(1)
 File system(used by)    : fs01
 Total disk capacity(GB) : 13.567
 Device status           : normal
 Device files            : lu10
 Block used(GB)          : 0.047
 Block free(GB)          : 2.245
 I-node used             : 11
 I-node free             : 2359285
 Volume manager          : use
 Mount status            : rw
 Quota                   : on
```

3. Confirm that the device files you are using for the storage device have not been used.

   To check whether device files have been used, use the `enas_devfreelist` command. For details on the syntax of the `enas_devfreelist` command, see the *NAS Manager User's Guide*.

```
$ sudo enas_devfreelist
Device files for use:
 /dev/enas/lu01 FC 13.567GB
 /dev/enas/lu02 FC 13.567GB
 /dev/enas/lu03 FC 13.567GB
 /dev/enas/lu04 FC 13.567GB
 /dev/enas/lu05 FC 13.567GB
...
```

4. Set up the differential-data storage device.

   Use the `syncstart` command, specifying such parameters as the number of reserved generations and the warning threshold. For more information on the syntax of the `syncstart` command, see 5.4.7.

   Example: Specify `62` for the number of snapshot generations that are reserved for the storage device.

```
$ sudo syncstart -g 62 -w 75 fs01 lu01,lu02
```

5. Confirm that the differential-data storage device has been set up.

   Use the `synclist` command with the `-l` option and the file system name specified. If setup of a storage device has terminated normally, `available` is displayed for Status. For more information on the syntax of the `synclist` command, see section 5.4.5.

```
$ sudo synclist -w -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 224.06MB (0.81%)
Warning threshold: 20.30GB (75%)
Differential-data snapshot(s):
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

6.3 Creating a Snapshot

To be prepared for clients who mistakenly edit or delete data in the file system, you must periodically create differential-data snapshots of their file systems. This section describes the procedure to setup a differential-data storage device using commands. The example used in the setup procedure is based on the following assumptions:

- The source file system of the differential-data storage device is fs01.
- The name of the differential-data snapshot to be created is ss01.

When the first differential-data snapshot is created, the data before the update is backed up in the differential-data storage device every time the update request is issued to the file system. Use the `synclist` command regularly to make sure that the amount of space of the storage device does not become insufficient.

To create a differential-data snapshot using commands:

1. Execute the synclist command to check the status of the differential-data storage device. You should check the output for the following information:

- Status must be available
- The number of differential-data snapshots displayed for `Differential-data snapshot(s)` is less than `Reserved snapshots`.
- Used size should show sufficient free space

```
$ sudo synclist -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 224.06MB (0.81%)
Differential-data snapshot(s):
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

2. Create the first differential-data snapshot.

   Use the `syncadd` command, specifying the snapshot name and the file system name. For more information on the syntax of the `syncadd` command, see section 5.4.1.

```
$ sudo syncadd fs01 ss01
```

3. Confirm that the differential-data snapshot has been created.

   Use the `synclist` command with the file system name and the snapshot name specified. If the background processing to create a snapshot has terminated normally, `available` is displayed under `Status`. For more information on the synclist command, see section 5.4.5.

```
$ sudo synclist fs01 ss01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 229.12MB (0.83%)
Differential-data snapshot:
  ss01 5.06MB(0.02%) Wed Mar 29 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

4. After the first differential-data snapshot is created, continue creating new generations in order twice a day.

   Use the `syncadd` command, specifying the snapshot name and the file system name in the same way as above.

```
$ sudo syncadd fs01 ss02
```

5. Periodically check how many generations of differential-data snapshots have been created and how much space has been used in the differential-data storage device.

   Use the `synclist` command with the `-a` option specified, and check the number of snapshot generations displayed under `snaps/rsrvd` and the amount of used space displayed under `used`.

```
$ sudo synclist –a
```

6.4 Deleting a Snapshot and Creating a New One

If the number of stored differential-data snapshot generations has exceeded the number of reserved generations, you can create new differential-data snapshots after deleting unnecessary snapshots or changing the number of reserved generations.

In the following example, the oldest differential-data snapshot (`ss01`) is deleted and a new one is created. The example is based on the following assumptions:

- The source file system of the differential-data snapshot to be deleted is `fs01`.
- The name of the differential-data snapshot to be deleted is `ss01`.
- `ss01` is mounted in the `/mnt/snapshot1` directory.
- One NFS share and one CIFS share are created in the `/mnt/snapshot1` directory.
- The host to which the NFS share is issued is `host01`.
- The name of the CIFS share is `CIFS_SNAP`.

To delete existing snapshots and create new ones using commands:

1. Execute the `enas_nfslist` and `enas_cifslist` commands to check whether the NFS share and the CIFS share have been created for the differential-data snapshot to be deleted. For details on the syntax of the `enas_nfslist` and `enas_cifslist` command, see the *NAS Manager User's Guide*.

```
$ sudo enas_nfslist -d /mnt/snapshot1
List of File Shares:
The number of NFS share(1)
    Shared directory                          : /mnt/snapshot1
        Public destination host/network       : host01
        Permission mode / Synchronous writing : ro
        Anonymous mapping                     : root_only
        Anonymous UID                         : --
        Anonymous GID                         : --
        Transmission port restriction         : do_not_perform
        Subtree check                         : perform
        Access check with lock request        : do_not_perform
```

```
$ sudo enas_cifslist -x CIFS_SNAP
List of File Shares:
The number of CIFS share(1)
  Name of file share            : CIFS_SNAP
  Shared directory              : /mnt/snapshot1
  Use ACL                       : not_use
  Server specification          : --
  Comment for file share        :
  Permission mode               : ro
  Browse permission             : permit
  File access permissions       : rw,ro,ro
  Directory access permissions  : rw,ro,ro
```

2. Execute the `enas_nfsdelete` and `enas_cifsdelete` commands to delete the NFS shares and CIFS shares for the differential-data snapshot. Before deleting the NFS share or CIFS share, the differential-data snapshot must be unmounted from the client machines. For details on the syntax of the `enas_nfsdelete` and `enas_cifsdelete` commands, see the manual *NAS Manager Modular User's Guide*.

```
$ sudo enas_nfsdelete -d /mnt/snapshot1 -a
```

```
$ sudo enas_cifsdelete -x CIFS_SNAP
```

3. Execute the `enas_nfslist` and `enas_cifslist` commands to confirm that all the NFS shares and CIFS shares for the differential-data snapshot have been deleted. For details on the syntax of the `enas_nfslist` and `enas_cifslist` commands, see the manual NAS Manager Modular User's Guide.

4. Execute the `syncumount` command to unmount the differential-data snapshot.

```
$ sudo syncumount snapshot1
```

5. Execute the `synclist` command to check the status of the differential-data storage device. You should check the following items:

- `available` is displayed for Status
- No information is displayed for `Mount point information`.

```
$ sudo synclist fs01 ss01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 234.56MB (0.85%)
Differential-data snapshot:
    ss01 5.44MB(0.02%) Wed Mar 29 02:00:00 2006
Device file(s):
    /dev/enas/lu01
    /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

6. Execute the `syncdel` command to delete the differential-data snapshot. When executing the `syncdel` command specify the file system name, and the name of target differential-data snapshot to be deleted. For more information on the syntax of the `syncdel` command, see 5.4.3. In this example, the oldest differential-data snapshot (`ss01`) is deleted.

```
$ sudo syncdel fs01 ss01
```

7. Execute the `synclist` command to confirm that the differential-data snapshot has been deleted. If the background processing to delete a differential-data snapshot has terminated normally, create a new differential-data snapshot. Use the `syncadd` command, specifying the differential-data snapshot name and the file system name. For details using the `syncadd` command, see section 5.4.1.

8. You can use the `syncadd` command to perform steps 6 and step 7 in a batch operation as shown in the following example. Use the `syncadd` command, specifying the -r option, the name of the differential-data snapshot to be deleted, a file system name and the name of the differential-data snapshot you are creating.

```
$ sudo syncadd -r ss01 fs01 ss01
```

6.5 Publishing a Snapshot for a Client

When a request is received from a client, you can mount a differential-data snapshot and create an NFS share or CIFS share. Creating an NFS share or CIFS share enables a client to access a snapshot on a read-only basis. Once a client completes a task such as data recovery, delete the NFS share or CIFS share of a snapshot and unmount a snapshot.

This section describes the procedure to publish a differential-data snapshot for a client using commands. The example used in this section is based on the following assumptions:

- You will mount the differential-data snapshot ss01 of the file system fs01 in the /mnt/snapshot1 directory and create the NFS share and CIFS share.
- The host to which the NFS share is to be issued is host01.
- The name of the CIFS share is CIFS_SNAP

To publish a differential-data snapshot for a client using commands:

1. Mount the differential-data snapshot containing the data that the client needs.

   Use the `syncmount` command, specifying the file system name, the differential-data snapshot name and a mount point for the differential-data snapshot. For more information on the syntax of the `syncmount` command, see section 5.4.6.

```
$ sudo syncmount fs01 ss01 snapshot1
```

2. Confirm that the snapshot has been mounted.

   Use the `synclist` command with the file system name and snapshot name specified. If mounting of the snapshot has terminated normally, the mount point name is displayed for `Mount point information`.

```
$ sudo synclist fs01 ss01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 234.56MB (0.85%)
Differential-data snapshot:
  ss01 5.44MB(0.02%) Wed Mar 29 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
  ss01  /mnt/snapshot1
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

3. Create an NFS share or CIFS share for the snapshot.

   To create an NFS share, use the `enas_nfscreate` command, specifying the shared directory and the host to which the NFS share is to be issued. To create a CIFS share, use the `enas_cifscreate` command, specifying the CIFS share name and shared directory. For more information, see the *NAS Manager User's Guide*.

```
$ sudo enas_nfscreate -d /mnt/snapshot1 -H host01

$ sudo enas_cifscreate -x CIFS_SNAP -d /mnt/snapshot1
```

4. Confirm that the NFS share or the CIFS share has been created for the snapshot.

   To confirm that the NFS share has been created, use the `enas_nfslist` command with the `-d` option and the shared directory specified. To confirm that the CIFS share has been created, use the `enas_cifslist` command with the `-x` option and the CIFS share name specified. For more information about deleting an NFS or CIFS share, see the *NAS Manager User's Guide*.

```
$ sudo enas_nfslist -d /mnt/snapshot1
List of File Shares:
The number of NFS share(1)
    Shared directory                          : /mnt/snapshot1
        Public destination host/network       : host01
        Permission mode / Synchronous writing : ro
        Anonymous mapping                     : root_only
        Anonymous UID                         : --
        Anonymous GID                         : --
        Transmission port restriction         : do_not_perform
        Subtree check                         : perform
        Access check with lock request        : do_not_perform
```

```
$ sudo enas_cifslist -x CIFS_SNAP
List of File Shares:
The number of CIFS share(1)
  Name of file share            : CIFS_SNAP
  Shared directory              : /mnt/snapshot1
  Use ACL                       : not_use
  Server specification          : --
  Comment for file share        :
  Permission mode               : ro
  Browse permission             : permit
  File access permissions       : rw,ro,ro
  Directory access permissions  : rw,ro,ro
```

5. Unmount a public differential-data snapshot.

   Use the `syncumount` command, specifying the name of the mount point at which the public differential-data snapshot is located. For more information on the syntax of the `syncumount` command, see section 5.4.6.

```
$ sudo syncumount snapshot1
```

6. Confirm that the differential-data snapshot has been unmounted.

   Use the `synclist` command with the file system name and snapshot name specified. If unmounting of the snapshot has terminated normally, nothing is displayed under `Mount point information`.

```
$ sudo synclist fs01 ss01
```

7. After being notified by the client that the task has finished, execute the `enas_nfsdelete` or `enas_cifsdelete` command to delete the NFS share or CIFS share for the issued differential-data snapshot. Before deleting the NFS share or CIFS share, the differential-data snapshot must be unmounted from the client machines.For details on the syntax of these commands, see the manual *NAS Manager Modular User's Guide*.

```
$ sudo enas_nfsdelete -d /mnt/snapshot1 -H host01
```

```
$ sudo enas_cifsdelete -x CIFS_SNAP
```

8. Execute the `enas_nfslist` or `enas_cifslist` command to confirm that the NFS share or CIFS share created for the differential-data snapshot has been deleted. For details on the syntax of these commands, see the manual *NAS Manager Modular User's Guide*.

6.6 Viewing Status Information

While using differential-data snapshots, you should check status information about the snapshots and storage devices to make sure that the storage device does not run out of space.

This section describes an example of executing the synclist command. The example assumes that information for the differential-data snapshots and differential-data storage device of the file system fs01 is displayed.

To view status the information of snapshots and storage devices, use the `synclist` command as shown in the following example:

```
$ sudo synclist -w -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 234.56MB (0.85%)
Warning threshold: 20.30GB (75%)
Differential-data snapshot(s):
  ss01 5.44MB(0.02%) Wed Mar 29 02:00:00 2006
  ss02 5.06MB(0.02%) Thu Mar 30 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

To view information for all the differential-data snapshots, execute the synclist command with the -a option as follows.

```
$ sudo synclist -w -a
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
file system      snaps/rsrvd    status      size  diff-dev      used capacity warn
fs01                 2/   62     avail   99.94GB   59.81GB  800.06MB    1.31%  75%
fs02                 3/  124     avail   99.94GB   59.81GB  810.19MB    1.32%  85%
Total LV  192/4096
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

Note: If the differential-data snapshot is mounted, use the `enas_fslist` command to view information about the snapshots that NAS Manager manages as a file system.

6.7 Changing the Reserved Generations

When the number of differential-data snapshots reaches the number of reserved generations, you can change the number of reserved generations for differential-data snapshots, for each file system. You can also change this number if there is a change made to the operation policy of the file system operating in NAS Sync Image.

This section describes how to change the number of reserved generations for differential-data snapshots. The example in each step assumes that the number of differential-data snapshot reserved generations for the file system `fs01` is changed to 124.

To change the number of reserved generations for snapshots using commands:

1. Check the current number of reserved generations.

   Use the `synclist` command with the `-l` option and the file system name specified, and check the current number of reserved generations displayed under `Reserved snapshots`.

```
$ sudo synclist -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 234.56MB (0.85%)
Differential-data snapshot(s):
  ss01 5.44MB(0.02%) Wed Mar 29 02:00:00 2006
  ss02 5.06MB(0.02%) Thu Mar 30 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

2. Change the number of reserved generations.

   Use the `syncconfig` command, specifying the new number of reserved generations and the name of the file system.

```
$ sudo syncconfig -g 124 fs01
```

3. Confirm that the number of reserved generations has been changed.

   Use the `synclist` command with the `-l` option and the file system name specified, and confirm that the new number of reserved generations is displayed under `Reserved snapshots`.

```
$ sudo synclist -l fs01
...
** Original file system name : fs01 **
...
Reserved snapshots: 124
...
```

6.8 Changing the Warning Threshold for Storage Devices

You can change the warning threshold for a differential-data storage device, to suit the amount of updated data for the file system and operation conditions.

This section describes how to change the warning threshold for a differential-data storage device. The example in each step assumes that the warning threshold for the differential-data storage device for the file system fs01 is changed to 85%.

To change the warning threshold for a differential-data storage device:

1. Check the current warning threshold.

   Use the `synclist` command with the `-w` option, the `-l` option and the file system name specified, and check the current warning threshold displayed under `Warning threshold`.

```
$ sudo synclist -w -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 27.06GB
Reserved snapshots: 62
Used size: 234.56MB (0.85%)
Warning threshold: 20.30GB (75%)
Differential-data snapshot(s):
  ss01 5.44MB(0.02%) Wed Mar 29 02:00:00 2006
  ss02 5.06MB(0.02%) Thu Mar 30 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

2. Change the warning threshold.

   Use the `syncconfig` command, specifying the new warning threshold and the name of the file system.

```
$ sudo syncconfig -w 85 fs01
```

3. Confirm that the warning threshold is changed.

   Use the `synclist` command with the `-w` option, the `-l` option, and the file system name specified, and confirm that the new warning threshold is displayed under `Warning threshold`.

```
$ sudo synclist -w -l fs01
...
** Original file system name : fs01 **
...
Warning threshold: 23.00GB (85%)
...
```

6.9 Expanding a Storage Device

If the amount of space on a storage device runs low, you can increase space by deleting unnecessary snapshots or expanding the storage device.

This section describes how to expand a differential-data storage device. The example in each step assumes that the device file lu03 is added to the differential storage device for the file system fs01.

To expand a differential-data storage device using commands:

1. Confirm that the device file you are adding to the storage device has not been used.

   Use the `enas_devfreelist` command to make sure the storage device has not been used. For more information about the `enas_devfreelist` command, see the manual *NAS Manager User's Guide*.

```
$ sudo enas_devfreelist
Device files for use:
 /dev/enas/lu03 FC 13.567GB
 /dev/enas/lu04 FC 13.567GB
 /dev/enas/lu05 FC 13.567GB
 /dev/enas/lu06 FC 13.567GB
 /dev/enas/lu07 FC 13.567GB
...
```

2. Expand the differential-data storage device.

   Use the `syncexpand` command, specifying the name of the file system for which the storage device has been set up, and the name of the device file you are adding.

```
$ sudo syncexpand fs01 lu03
```

3. Confirm that the differential-data storage device has been expanded.

   Use the `synclist` command with the `-l` option and the file system name specified, and check the new size displayed under `Total size`.

```
$ sudo synclist -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 40.59GB
Reserved snapshots: 62
Used size: 234.56MB (0.56%)
Differential-data snapshot(s):
  ss01 5.44MB(0.01%) Wed Mar 29 02:00:00 2006
  ss02 5.06MB(0.01%) Thu Mar 30 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
  /dev/enas/lu03
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

6.10 Releasing a Storage Device

Once differential-data snapshots are no longer needed to back up the data on the file system, you can release unnecessary storage devices.

This section describes how to release a differential-data storage device. The example in each step assumes the following conditions:

- One differential-data snapshot (ss01) has been created for the source file system fs01 of the differential-data storage device that is to be released
- ss01 is mounted in the /mnt/snapshot1 directory
- One NFS share and one CIFS share have been created in the /mnt/snapshot1 directory
- The host to which the NFS share is issued is host01
- The name of the CIFS share is CIFS_SNAP

To release a differential-data storage device using commands:

1. Execute the `enas_nfslist` and `enas_cifslist` commands to check whether the NFS share or CFS share has been created for the differential-data snapshots. For details on the syntax of the `enas_nfslist` and `enas_cifslist` commands, see the manual *NAS Manager Modular User's Guide*.

```
$ sudo enas_nfslist -d /mnt/snapshot1
List of File Shares:
The number of NFS share(1)
    Shared directory                          : /mnt/snapshot1
        Public destination host/network       : host01
        Permission mode / Synchronous writing : ro
        Anonymous mapping                     : root_only
        Anonymous UID                         : --
        Anonymous GID                         : --
        Transmission port restriction         : do_not_perform
        Subtree check                         : perform
        Access check with lock request        : do_not_perform
```

```
$ sudo enas_cifslist -x CIFS_SNAP
List of File Shares:
The number of CIFS share(1)
  Name of file share            : CIFS_SNAP
  Shared directory              : /mnt/snapshot1
  Use ACL                       : not_use
  Server specification          : --
  Comment for file share        :
  Permission mode               : ro
  Browse permission             : permit
  File access permissions       : rw,ro,ro
  Directory access permissions  : rw,ro,ro
```

2. Make sure the snapshots are unmounted from the client machine.
3. Delete the NFS or CIFS shares created for all the snapshots on the storage device you are releasing. To delete an NFS share, use the `enas_nfsdelete` command, specifying the `-d` option, the shared directory, and `-a` option. To delete a CIFS share, use the `enas_cifsdelete` command, specifying the `-x` option and the CIFS share name.

```
$ sudo enas_nfsdelete -d /mnt/snapshot1 -a
```

```
$ sudo enas_cifsdelete -x CIFS_SNAP
```

4. Confirm that the NFS and CIFS shares created for all the snapshots have been deleted.

   Use the `enas_nfslist` command without specifying any options and arguments, and confirm that the NFS shares have been deleted from all the snapshots for the file system. Use the `enas_cifslist` command without specifying any options or arguments, and confirm that the CIFS shares have been deleted from all the snapshots for the file system.

```
$ sudo enas_nfslist
```

```
$ sudo enas_cifslist
```

5. Unmount all differential-data snapshots for the source file systems of the storage device that is to be released.

   Use the `syncumount` command, specifying the name of the mount point at which differential-data snapshots are mounted.

```
$ sudo syncumount snapshot1
```

6. Confirm that all the differential-data snapshots of the file system for which the storage device is set have been unmounted.

   Use the `synclist` command with the `-l` option and the file system name specified. If unmounting of the snapshots has terminated normally, nothing is displayed for `Mount point information`.

```
$ sudo synclist -l fs01
Mar 30 11:35:12 KAQS11000-I The synclist command execution has started.
***  Differential-data storage device information  ***
** Original file system name : fs01 **
Status: available
Total size: 40.59GB
Reserved snapshots: 62
Used size: 234.56MB (0.56%)
Differential-data snapshot(s):
  ss01 5.44MB(0.01%) Wed Mar 29 02:00:00 2006
Device file(s):
  /dev/enas/lu01
  /dev/enas/lu02
Mount point information:
Mar 30 11:35:13 KAQS11001-I The synclist command has finished.
```

7. Release the differential-data storage device.

   Use the `syncstop` command, specifying the name of the file system.

```
$ sudo syncstop fs01
```

8. Confirm that the differential-data storage device has been released.

   Use the `synclist` command with the `-l` option and file system name.

```
$ sudo synclist -l fs01
```

Chapter 7 Troubleshooting

This chapter explains what actions you should take if an error occurs during while you are performing snapshot operations with NAS Sync Image. Contact your HDS representative if you cannot identify the cause of an error or solve the problem.

For information on responding to errors that affect the NAS system as a whole, see the *NAS Manager User's Guide*.

For information on error messages displayed by NAS Sync Image, see the *NAS Error Codes* manual.

This chapter includes the following sections:

- General Procedure for Troubleshooting (section 7.1)
- Checking Error Messages (section 7.2
- Taking Action to Remedy the Error (section 7.3)
- Collecting Data and Contacting Your HDS Representative (section 7.4)
- Calling the Hitachi Data Systems Support Center (section 7.5)

7.1 General Procedure for Troubleshooting

If an error occurs when you are performing an operation related to NAS Sync Image, follow these steps:

1. Check the error message to identify what caused the error (see section 7.2.
2. Check the error recovery procedure and take appropriate action (see section 7.3).
3. If no error message was output, or if you are unsure as to what caused the error or what you should do, or if the problem persists after you take action, collect the required information and contact your HDS representative (section 7.4) or call the HDS Support Center (see section 7.5).

7.2 Checking Error Messages

This section explains how to identify the cause of any errors that may occur while you are performing snapshot operations using NAS Sync Image. You can do this by checking several types of error messages.

7.2.1 Processing Results Window

If an error results from an erroneous GUI operation, such as a wrong setting or action, an error message displays in the processing results window. Check the displayed error message to identify what caused the error.

7.2.2 Standard Output

If an error occurs when a NAS Sync Image command is used, an error message is output to the standard output. Check the displayed error message to identify what caused the error.

7.2.3 GUI Windows

If you cannot identify the cause of an error from the messages output to the standard output, use the NAS Manager GUI to check the error information.

7.2.4 System Messages

Important messages that affect the NAS system as a whole are output to the system messages log. Such messages may be about hardware or software errors, or incorrect GUI operations. Check the system messages using the NAS Manager GUI to identify what caused the error. The message IDs of system messages related to NAS Sync Image begin with `KAQS`.

For more information on how to check system messages in the NAS Manager GUI, see the *NAS Manager User's Guide*.

7.2.5 Cluster, Node or Resource Group

If a failover has occurred due to an error of a cluster, node or resource group, check the error status in the Browse Cluster Status window of NAS Manager and identify the cause of the error.

When a hardware error such as insufficient memory, or an NIC error occurs in the NAS Unit, the error status of the resource group is displayed as `srmd executable error` in the Browse Cluster Status window.

For more information on how to view the Browse Cluster Status window, see the *NAS Manager User's Guide*.

7.2.6 File Systems and Storage Devices

You can check the error status of the file system, storage device and snapshot to identify the cause of an error.

To check the error status and identify what caused the error:

1. Check the status of setup processing for the differential-data storage device.

   Check the information displayed in **Operating status** in the List of File Systems used for Sync Image window.

   - If no information displays, go to the next step.
   - If Error displays, setup processing for the differential-data storage device and automatic creation schedule has terminated abnormally. Take corrective action as described in section 3.4.1.1.
   - If Setting displays, setup for the storage device and automatic creation schedule is waiting to be run or is being run. Wait until the setup finishes, and then perform your next task. If the status does not change after an hour, contact your HDS representative.

2. Check the error status of the device files that make up the file system or storage device.

   Check the information displayed in **Status** of **Device files** in the List of File Systems used for Sync Image window.

   - If **Status** displays as Normal, go to the next step.
   - If **Status** displays as Error among the devices files that make up the file system or storage device, identify the device file where the error occurred and take the following action:
     - If an error occurs in device files that make up the file system on the local disk system, take corrective action as described in section 7.3.5.
     - If an error occurs in device files that make up the storage device, take corrective action as described in section 7.3.5.
     - If the error is caused by something other than multiple drive failures, follow the instructions given by your HDS representative.
     - If no error was found in both the device files that make up the file system, as well as the device files that make up the storage device, take appropriate action, following the instructions given by your HDS representative.
   - If **Status** displays as `Expanding`, processing to expand a storage device is being performed or has been cancelled. Wait a few minutes, and then refresh the display. If the status remains unchanged, perform a recovery according to the procedure in section 3.4.2.1

3. Check the status of the differential-data storage device.

   Check the information displayed in **Diff-device status** in the List of File Systems used for Sync Image window.

   - If `Available` is displayed, go to the next step.
   - If `Not available` is displayed, check the status of the resource group by using the Browse Cluster Status window of NAS Manager. If a failover has occurred, perform a failback. If the resource group has stopped, restart it. If the resource group is running normally, contact your HDS representative to determine whether the error occurred in one of the device files that make up the file system and storage device.
   - If the displayed text is neither Available nor Not available, see section 7.3.6, and take appropriate action.

4. Check the status of mount processing for the differential-data snapshot.

   Check the information displayed in **Operating status** in the List of Differential-Data Snapshots window.

   - If no information displays, go to the next step.
   - If Error displays, mount processing has terminated abnormally. Take corrective action as described in section 3.8.1
   - If Mounting displays, mounting is waiting for execution or is being used. Wait until the mounting finishes and perform your next task. If the status does not change after waiting for about an hour, contact your HDS representative.

5. If the error source cannot be identified, acquire all the Sync Image log files and contact your HDS representative.

7.2.7 SNMP Notification

If you set SNMP in NAS Manager, the SNMP manager is notified of error information when a hardware or software error occurs, when automatic creation, mounting, or file sharing for a snapshot terminates with an error, or when available space is insufficient in the storage device. You can identify the cause of the error from the ID of the received message. A message ID related to NAS Sync Image begins with `KAQS`.

For more information on error messages, see the *NAS Error Codes* manual.

7.3 Solving Problems

This section describes the actions you should take to solve problems, once you have identified the cause of error conditions.

For more information on specific error messages, see the *NAS Error Codes* manual.

7.3.1 Erroneous GUI Operation

If the error was due to an erroneous GUI operation, such as a wrong setting or action, perform the operation again, as indicated by the error message displayed in the processing results window.

7.3.2 Incorrectly Entered Command

If the error was due to incorrectly entering a NAS Sync Image command, use the command again, referring to the error message displayed in the standard output.

7.3.3 Insufficient Free Space on the Storage Device

If the amount of free space on the storage device has become insufficient, all the snapshots created for the file system for which the storage device has been set up become invalid, and the NAS Sync Image function becomes unavailable. However, the file system can still be used as is.

To remedy an error in which the amount of free space on the storage device is insufficient:

1. Notify the users using the snapshot that the snapshot data was lost.
2. Delete the NFS and CIFS shares for all the snapshots stored in the storage device where capacity is insufficient. For more information on how to delete the NFS and CIFS shares, see the *NAS Manager User's Guide*.
3. Unmount all the snapshots stored in the storage device where capacity is insufficient.
4. Do one of the following, depending on the status of the storage device:
   - Continue using the current storage device. Simultaneously delete all the snapshots created for the file system for which the storage device has been set up. If necessary, re-estimate the capacity of the storage device and expand the capacity.
   - Resize the capacity of the storage device. Release the storage device, estimate the necessary capacity and set it up again.

7.3.4 Problem at the Cluster, Node or Resource Group

When an error is due to a problem at the cluster, node or resource group, contact your HDS representative to remove the error.

For more information on troubleshooting corresponding to the error status of the cluster, node, or resource group that you checked in the Browse Cluster Status window, see the *NAS Manager User's Guide*.

7.3.5 Multiple-Drive Failure Caused by Device File Errors for a File System

After releasing the storage device set for the failed file system, ask your HDS representative to remove the error in the device files.

To solve this problem:

1. Notify the users that all the snapshots created for the failed file system are invalid.
2. Check the status of each resource group.

   In the Browse Cluster Status (Resource group status) window, check the status of each resource group.

   - If the status of the resource groups on both nodes is `Online` / `No error`

     Go to step 3.
   - If the status of the resource groups on both nodes is `Offline` / `No error`:

     Go to step 4.
   - If the status of the resource groups on both nodes is neither `Online` / `No error` nor `Offline` / `No error`:

     Perform a forced stop of the resource groups on both nodes, and go to step 4. For more information on performing a forced stop of a resource group, see the *NAS Manager User's Guide*.
3. Delete the NFS and CIFS shares for all the snapshots created for the failed file system.

   For more information on how to delete the NFS and CIFS shares, see the *NAS Manager User's Guide*.
4. Unmount all the snapshots created for the failed file system, as described in section 3.9.
5. Release the differential-data storage device set for the failed file system.

   Even if the KAQS11239-E message is displayed, the differential-data storage device is released normally.
6. Delete the failed file system.

   For more information on pre-requisites and how to delete a file system, see the *NAS Manager User's Guide*.
7. Recover the device files that make up the file system from the error.

   For more information on the actions to be taken for an error on one of the device files that make up the file system, see the *NAS Manager User's Guide*.

If you release the storage device while the resource group is offline, the CIFS share for the snapshot might not be deleted normally. After the error is removed, manually delete the CIFS share for the snapshot. If necessary, re-create a file system that has the same configuration as the one before the error occurred, reset the storage device, and resume operations for the snapshot function.

For more information on how to delete the CIFS share and how to create a file system, see the *NAS Manager User's Guide*.

7.3.6 Multiple-Drive Failure Caused by Device File Errors for a Storage Device

If a differential-data storage device that is made up of device files in the local disk system causes an error, the storage device must be released.

To remedy this type of error, perform the following procedure. For more information, refer to the *NAS Manager User's Guide*.

1. Notify the users that all the snapshots stored in the failed storage device are invalid.
2. Check the status of each resource group in the Browse Cluster Status window.
   - If the status of the resource groups on both nodes is `Online / No error`:

     Follow the procedure in section 7.3.7.
   - If the status of the resource groups on both nodes is `Offline / No error`:

     Follow the procedure in section 7.3.8.
   - If the status of the resource groups on both nodes is neither `Online / No error` nor `Offline / No error`:
3. Delete the NFS and CIFS shares for all the snapshots created for the failed file system.
4. Unmount all the snapshots created for the failed file system.
5. Perform a forced stop of the resource groups on both nodes, and follow the procedure in section 7.3.8.

7.3.7 Status of Resource Groups on Both Nodes Is Online / No Error

To remedy this type of error, perform the following procedure with your HDS representative. For more information, see the *NAS Manager User's Guide*.

1. Delete the NFS and CIFS shares for all the snapshots stored in the failed storage device.
2. Unmount all the snapshots stored in the failed storage device.

   For more information on how to unmount snapshots, see section 3.9.
3. Release the failed storage device.

   Even if the KAQS11239-E message displays, the storage device is released normally.

   For more information on how to release a storage device, see section 3.11. After releasing the storage device, perform the following operations on the node where the storage device was set.
4. Manually perform a failover of the resource group.
5. Stop the node.
6. Ask your HDS representative to restart the NAS OS.
7. Start the stopped node.

8. Perform a failback of the resource group to return to the original node.
9. For the other node in the cluster, perform steps 4 to 8.
10. Ask your HDS representative to remove the error in the device file.

To resume NAS Sync Image operations, reset the storage device. For more information, see section 3.4.

7.3.8 Status of Resource Groups on Both Nodes Is Offline / No Error

To remedy this type of error, perform the following procedure with your HDS representative. For more information, see the *NAS Manager User's Guide*.

1. Unmount all the snapshots stored in the failed storage device. For more information, see section 3.9.
2. Release the failed storage device.

   Even if the KAQS11239-E message displays, the storage device is released normally.

   For more information on how to release a storage device, see section 3.11. After releasing the storage device, perform the following steps on the node where the failed storage device was set.
3. Stop the node.
4. Ask your HDS representative to restart the NAS OS.
5. Start the stopped node.
6. Start the resource group on the activated node.
7. For the other node in the cluster, perform steps 3 to 6.
8. Ask your HDS representative to remove the error in the device file.

If the CIFS share has been set for the snapshot, the CIFS share for the snapshot might not be deleted after the error is removed.

To resume NAS Sync Image operations, reset the storage device. For more information, see section 3.4.

7.3.9 Maximum Number of Tasks or Error Details Reached

If an error occurs because the number of tasks queued in the node has reached the maximum, wait about an hour and perform the task again. If the status does not change after an hour, contact your HDS representative.

If an error occurs because the number of error details stored in the node has reached the maximum, use the following windows to check whether previously used tasks have terminated abnormally:

- The List of File Systems window of NAS Manager
- The List of File Shares (List of NFS file shares) window of NAS Manager

- The List of File Shares (List of CIFS file shares) window of NAS Manager
- The List of File Systems used for Sync Image window
- The List of Differential-Data Snapshots window

If there are tasks that have terminated abnormally, check the error details and take appropriate action.

If file system creation, file system mounting, or file share creation has terminated abnormally, take action as described in the *NAS Manager User's Guide*.

If setup of the storage device and automatic creation schedule has terminated abnormally, take action as described in section 3.4.1.1.

If the mounting of a snapshot has terminated abnormally, take action as described in section 3.8.1.

7.3.10 Hardware Problem in the NAS Unit

After the operation being performed finishes, contact your HDS representative to remove the error. For more information, see the *NAS Manager User's Guide*.

7.3.11 Timeout Occurs during NAS Sync Image Processing

Another NAS Sync Image operation might have been executing at the same time. Make sure that multiple operations or schedules are not used at the same time. If the same error still occurs, collect error information when the timeout occurs and contact your HDS representative.

7.4 Collecting Data and Contacting Your HDS Representative

If you cannot identify the cause or location of an error, or if you cannot fix the problem, collect the required error information and send it to your HDS representative, or ask your HDS representative to obtain the error information.

For more information, see the *NAS Manager User's Guide*.

Table 7.1 lists the NAS Sync Image error information that you can download by using the NAS Manager GUI windows.

Table 7.1 Types of Error Information Using NAS Manager GUI Windows

Type		Description
System messages	/enas/data/em_alertfile	System messages
System logs	/var/log/syslog	System log
Other logs	/var/log/kern.log	Kernel log
	/var/log/messages	OS messages
	/var/log/lvm	LVM log
	/enas/log/management.log	Management log
	/enas/log/management.trace	Management trace log
	/enas/log/ebr_alertfile	Backup Restore log*
	/enas/log/backuprestore.trace	Backup Restore trace log*
	/enas/log/syncimage.log	Sync Image log
	/enas/log/syncimage.trace	Sync Image trace log
core		Core files for all applications running on the NAS OS
*Output only if the NAS Backup Restore license is configured.		

7.5 Calling the Hitachi Data Systems Support Center

If you call the Hitachi Data Systems Support Center, make sure to provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure
- The exact content of any error messages displayed on the host system(s).

The worldwide Hitachi Data Systems Support Centers are:

- Hitachi Data Systems North America/Latin America
  San Diego, California, USA
  1-800-446-0744
- Hitachi Data Systems Europe
  Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific
  North Ryde, Australia
  61-2-9325-33

Acronyms and Abbreviations

ACL	access control list
AMS	Adaptable Modular Storage
CIFS	common internet file system
CCI	command control interface
CPU	central processing unit
FC	fibre channel
GUI	graphical user interface
ID	identifier
I/O	Input/output
IP	internet protocol
LAN	local-area network
LDEV	logical device
LU	logical unit (also called device emulation or device type)
LUN	logical unit number, logical unit
LVM	logical volume manager
NAS	network-attached storage
NFS	network file system
NIC	network interface card
NIS	network information service
OS	operating system
RAID	redundant array of independent / inexpensive disks
SATA	serial advanced technology attachment
SIM	service information message
SNMP	simple network management protocol
SSH	secure shell
URL	uniform resource locator
USP	universal storage platform
WMS	Workgroup Modular Storage
WWW	world wide web

Glossary

A

account administrator	The user who oversees the system administrators in a NAS system. An account administrator is allowed to register and delete system administrators.
ACL	Data set for resources, such as access permissions for Windows users on the network, and accessible servers and files. Used to manage usage permissions for devices and information on the network.

C

CIFS	A protocol that provides file-sharing services to Windows users.
cluster	A redundant configuration that allows a service to continue when an error occurs or maintenance work is performed. In a NAS system, each cluster consists of two NAS Units. When an error occurs in one NAS Unit, the other NAS Unit in the cluster inherits the services (failover function). This allows continuous operation of the NFS and CIFS file-sharing services.
command device	A control device for accepting commands used to control the NAS system.

D

device file	An area created by dividing a RAID group.
differential-data snapshot	A virtual volume that reproduces a previous state of a file system by using the data in the file system and data saved in a differential-data storage device.
differential-data storage device	A disk array volume for saving file system pre-update data that is used by differential-data snapshots of NAS Sync Image.
dump LU	A logical unit that stores information held in memory when a fatal error occurs in a NAS Modular system. One dump LU is assigned to each NAS Unit.

E

end user	A user who accesses file systems in the disk array by using the file-sharing services provided by the NAS system. End users can. use the NAS Manager GUI to view usage, access statuses, and quota information relating to file systems

error information LU	A logical unit that is used when the data in a dump LU is converted to a format that the user can view. This LU is shared by all the NAS Units in a NAS system.

F

failback	The migration of a failed-over resource group back to the original node in the cluster after error recovery or maintenance of a NAS Unit is completed.
failover	The relocation of a resource group to another node in a cluster when an error occurs in a NAS Unit or when maintenance is required. Allows continuous operation of NFS and CIFS services.
fixed IP address	An IP address set for a specific interface in a NAS Unit.

L

logical volume	An area consisting of device files that are logically integrated using a volume manager. On NAS Modular systems, this corresponds to file systems, differential-data storage devices, and differential-data snapshots built using the volume manager. In a NAS Modular system, 4,096 logical volumes can be created for one node.
LUN Expansion	Function for expanding the capacity of an LU by integrating multiple LUs into one.
LVM	A type of volume manager. See *volume manager* for more information.

M

Mozilla	A generic name for Mozilla 1.4 and Mozilla 1.7 software for the Solaris operating system

N

NAS Backup Restore	A program used for backing up data shared by users in a NAS Modular system. NAS Backup Restore is an optional program of NAS Manager.
NAS Cluster Management LU	An LU that stores settings information for NAS systems, such as cluster configuration and file system information.
NAS Data Control	One of the programs incorporated in the NAS OS.
NAS File Sharing	One of the programs incorporated in the NAS OS. The NAS File Sharing program is based on Linux 2.4.17.

NAS Manager	A program that allows efficient setup, operation and management of a NAS system.
NAS system	A NAS system that provides file-sharing services through NAS Units mounted on a Hitachi storage system.
NAS OS	An operating system that provides NAS function in a NAS system. Includes NAS Data Control and NAS File Sharing.
NAS OS LU	A logical unit that contains the NAS OS and the programs that run on the NAS OS.
NAS Sync Image	A program that allows creation of a differential-data snapshot for shared data in a NAS system.
NAS system LU	A logical unit that contains configuration and management information about a NAS system, such as NAS OS LUs and a NAS Cluster Management LU.
NAS Unit	A processor board with a mounted Gigabit Ethernet adapter, built into the TagmaStore AMS/WMS series.
NFS	A protocol that provides file-sharing services to UNIX users.
node	A cluster component. In a NAS system, each cluster consists of two NAS Units. One NAS Unit corresponds to one component of a cluster.

Q

quota	The maximum disk space and maximum number of files and directories available to a user, together with restrictions based on those upper limits.

R

resource group	A unit of services, such as NFS and CIFS services, managed together as a group.

S

service IP address	An IP address used by a client connecting to a service running in a resource group.
ShadowImage	A program for replicating user data within the TagmaStore AMS/WMS series disks, bypassing the host system.
system administrator	A user who manages a NAS system by using NAS Manager. The system administrator sets up a NAS system and monitors the system operation and error information.

U

user LU	A logical unit that contains user data of file systems.

V

volume group	An area that is made up of one or more device files by a volume manager. In a NAS system, 128 volume groups can be created for one node. In NAS Manager, a volume group is made up of a file system. In NAS Sync Image, a volume group is made up of a file system, a differential-data storage device, and a differential-data snapshot.
volume manager	In the NAS Modular system, LVM is used as the volume manager. This functionality enables you to create volume groups by combining device files and create logical volumes using volume groups.

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