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Hitachi Thin Image

User Guide

Hitachi Virtual Storage Platform G1000 and G1500

Hitachi Virtual Storage Platform F1500

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Systems

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Preface

This document describes and provides instructions for using Hitachi Thin Image to plan, configure, and perform pair tasks on your storage system.

Please read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

- ☐ Intended audience
- ☐ Product version
- ☐ Release notes
- ☐ Changes in this revision
- ☐ Related documents
- ☐ Document conventions
- ☐ Conventions for storage capacity values
- ☐ Accessing product documentation
- ☐ Getting help
- ☐ Comments

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who install, configure, and operate the storage system.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The Hitachi Virtual Storage Platform storage system and the *Hardware Guide* for your storage system model.
- The Hitachi Command Suite software and the Hitachi Command Suite User Guide or the Device Manager - Storage Navigator software and the *System Administrator Guide* for your storage system model.
- Hitachi Dynamic Provisioning, Hitachi Dynamic Tiering, Hitachi LUN Manager, Hitachi LUN Expansion, Hitachi Virtual LVI, Hitachi Virtual LUN, and Hitachi Data Retention Utility.

Product version

This document revision applies to the following microcode or firmware:

- VSP G1000, G1500, and VSP F1500 microcode 80-05-0*x* or later
- VSP G200, G400, G600, G800, VSP F400, F600, F800: firmware 83-04-0*x* or later
- SVOS 7.0 or later

Release notes

Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document. Release notes are available on Hitachi Data Systems Support Connect: https://knowledge.hds.com/Documents.

Changes in this revision

- Added the Hitachi Virtual Storage Platform G1500 and Hitachi Virtual Storage Platform F1500 storage systems.
- Reserving free CTG IDs for **`raidcom add snapshot`** commands (not available for **`paircreate`**). CTG IDs are reserved in ascending order from 128 to 2047. If CTG IDs from 128 to 2047 are all reserved, the IDs are reserved in ascending order from 0 to 127.
- (VSP G1000, G1500, and VSP F1500) Thin Image cascaded and cloned pairs are supported.

Related documents

Hitachi Virtual Storage Platform Gx00 and Fx00 documents

- *Product Overview*, MK-94HM8013
- *Hitachi Virtual Storage Platform G200 Hardware Reference Guide*, MK-94HM8020
- *Hitachi Virtual Storage Platform G400, G600 Hardware Reference Guide*, MK-94HM8022
- *Hitachi Virtual Storage Platform G800 Hardware Reference Guide*, MK-94HM8026
- *Hitachi Virtual Storage Platform F400, F600 Hardware Reference Guide*, MK-94HM8045
- *Hitachi Virtual Storage Platform F800 Hardware Reference Guide*, MK-94HM8046
- *Provisioning Guide*, MK-94HM8014
- *Hitachi SNMP Agent User Guide*, MK-94HM8015
- *System Administrator Guide*, MK-94HM8016
- *Hitachi TrueCopy® User Guide*, MK-94HM8019
- *Hitachi ShadowImage® User Guide*, MK-94HM8021
- *Hitachi Universal Replicator User Guide*, MK-94HM8023
- *Hitachi Universal Volume Manager User Guide*, MK-94RD8024

Hitachi Virtual Storage Platform G1000, G1500 and VSP F1500 documents

- *Product Overview*, MK-92RD8051
- *Hardware Guide for Hitachi Virtual Storage Platform G1000, G1500, and F1500*, MK-92RD8007
- *Hitachi Compatible FlashCopy/FlashCopy SE User Guide*, MK-92RD8010
- *Performance Guide*, MK-92RD8012
- *Provisioning Guide for Open Systems*, MK-92RD8014
- *Hitachi SNMP Agent User Guide*, MK-92RD8015
- *System Administrator Guide*, MK-92RD8016
- *Hitachi TrueCopy® for Mainframe User Guide*, MK-92RD8018
- *Hitachi TrueCopy® User Guide*, MK-92RD8019
- *Hitachi ShadowImage® for Mainframe User Guide*, MK-92RD8020
- *Hitachi ShadowImage® User Guide*, MK-92RD8021
- *Hitachi Universal Replicator for Mainframe User Guide*, MK-92RD8022
- *Hitachi Universal Replicator User Guide*, MK-92RD8023
- *Hitachi Universal Volume Manager User Guide*, MK-92RD8024
- *Global-Active Device User Guide*, MK-92RD8072

Hitachi Command Suite documents

- *Hitachi Command Suite User Guide*, MK-90HC172

- *Command Control Interface Installation and Configuration Guide*, MK-90RD7008

Document conventions

This document uses the following terminology conventions:

Convention	Description
VSP family	Refers to all models of the Hitachi Virtual Storage Platform family.
VSP Gx00 models	Refers to all of the following storage systems: • Hitachi Virtual Storage Platform G200 • Hitachi Virtual Storage Platform G400 • Hitachi Virtual Storage Platform G600 • Hitachi Virtual Storage Platform G800
VSP G series	Refers to all of the following storage systems: • VSP Gx00 models
• VSP Fx00 models • VSP F series	Refers to all of the following storage systems: • Hitachi Virtual Storage Platform F400 • Hitachi Virtual Storage Platform F600 • Hitachi Virtual Storage Platform F800

This document uses the following typographic conventions:

Convention	Description
Bold	• Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click **OK**. • Indicates emphasized words in list items.
Italic	• Indicates a document title or emphasized words in text. • Indicates a variable, which is a placeholder for actual text provided by the user or for output by the system. Example: `pairdisplay -g group` (For exceptions to this convention for variables, see the entry for angle brackets.)
`Monospace`	Indicates text that is displayed on screen or entered by the user. Example: `pairdisplay -g oradb`
< > angle brackets	Indicates variables in the following scenarios: • Variables are not clearly separated from the surrounding text or from other variables. Example: `Status-<report-name><file-version>.csv` • Variables in headings.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples:

Convention	Description
	[a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.

This document uses the following icons to draw attention to information:

Icon	Label	Description
	Note	Calls attention to important or additional information.
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Caution	Warns the user of adverse conditions and/or consequences (for example, disruptive operations, data loss, or a system crash).
	WARNING	Warns the user of a hazardous situation which, if not avoided, could result in death or serious injury.

Conventions for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 kilobyte (KB)	1,000 (10^3) bytes
1 megabyte (MB)	1,000 KB or $1,000^2$ bytes
1 gigabyte (GB)	1,000 MB or $1,000^3$ bytes
1 terabyte (TB)	1,000 GB or $1,000^4$ bytes
1 petabyte (PB)	1,000 TB or $1,000^5$ bytes
1 exabyte (EB)	1,000 PB or $1,000^6$ bytes

Logical capacity values (for example, logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems: • OPEN-V: 960 KB • Others: 720 KB

Logical capacity unit	Value
1 KB	1,024 (2^{10}) bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes

Accessing product documentation

Product user documentation is available on Hitachi Data Systems Support Connect: https://knowledge.hds.com/Documents. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

Hitachi Data Systems Support Connect is the destination for technical support of products and solutions sold by Hitachi Data Systems. To contact technical support, log on to Hitachi Data Systems Support Connect for contact information: https://support.hds.com/en_us/contact-us.html.

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Comments

Please send us your comments on this document to doc.comments@hds.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Data Systems Corporation.

Thank you!

1

Overview of Thin Image

With Hitachi Thin Image (HTI), you can perform cost-effective replication by storing the differential data between primary volumes (P-VOLs) and secondary volumes (S-VOLs) of virtual volumes (V-VOLs). You can also copy data of an entire volume, instead of copying just the differential data, to a volume. By copying the entire volume, you can expect a higher performance than by just storing the differential data. For information about Hitachi Virtual Storage Platform F1500 availability, contact your HDS representative.

- ☐ About Thin Image
- ☐ Components of Thin Image
- ☐ How Thin Image works
- ☐ How Thin Image pair status changes
- ☐ Copy threshold option and host server I/O performance for Thin Image
- ☐ Sharing Thin Image volumes with other software applications
- ☐ Acronyms and abbreviations for VSP family storage system software applications used in this guide

About Thin Image

Hitachi Thin Image stores snapshots in a Hitachi Virtual Storage Platform family (VSP family) storage system. If the data of the storage system fails, you can restore it using the stored snapshot of the data. Pairs created by using Thin Image are called Thin Image pairs in this document.

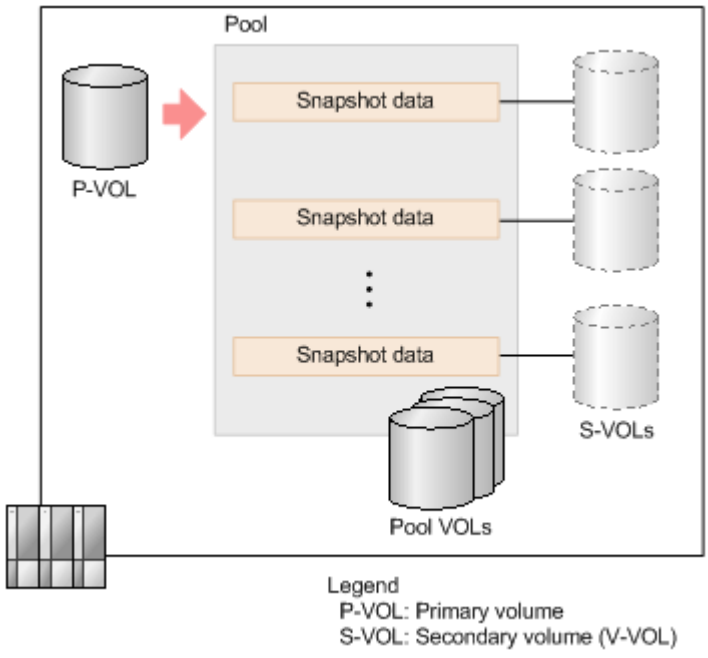
To store snapshot data, you create a pair with a logical volume functioning as the P-VOL, and a virtual volume as the S-VOL. A pair created to store snapshot data is referred to as a snapshot pair. A snapshot pair displays showing the snapshot attribute.

When you create a Thin Image pair, the status changes to "PAIR" and snapshot data is stored. You can use Thin Image to store a maximum of 1,024 snapshots of data (including the number of clones when you clone a volume).

Updating the P-VOL first copies the differential data as snapshot data in pool volumes (pool-VOL), and then updates the data. Snapshot data is a copy of differential data in Thin Image P-VOLs. If your storage system experiences a data storage failure, you can restore the data using the snapshot data in the pool.

Splitting a Thin Image pair saves a snapshot and stops the copying of replaced data in the pool.

The following figure provides a basic illustration of storing snapshot data.



You can use snapshot data in open-system volumes.

Related concepts

- How Thin Image uses V-VOLs on page 28

Related tasks

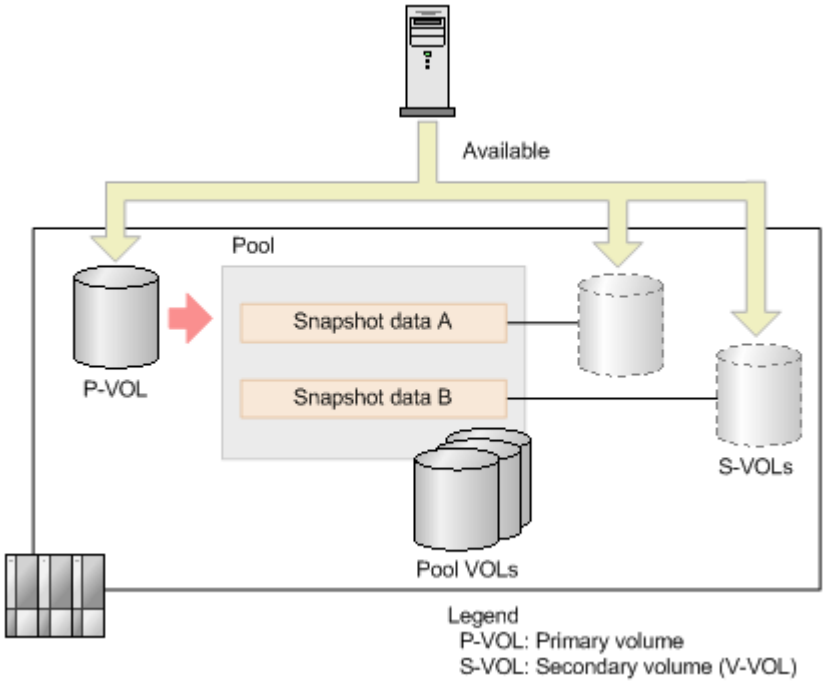
- Splitting Thin Image pairs to store snapshot data on page 135

Workflow for storing Thin Image snapshot data

Snapshot data is data in the pool, which is replaced data. Use this workflow to store snapshot data in the pool.

1. Create a Thin Image pair. You can create a pair with the snapshot attribute. The pair is in "PAIR" status.
2. The host updates the primary volume.
3. Split the Thin Image pair. The snapshot data of the primary volume is stored (Snapshot data A in the figure below).
4. The host updates the primary volume again.
5. Split the Thin Image pair. The updated data in the primary volume is stored as snapshot data (Snapshot data B in the following figure). In the event of data corruption, you can recover using this snapshot data.

The following figure illustrates how data in the pool is replaced.



Note: The host references the P-VOL, which includes Snapshot data A and Snapshot data B. These snapshots are handled as Thin Image S-VOL pairs with the snapshot attribute.

Components of Thin Image

Hitachi Thin Image typically consists of several components, including pairs, groups, and software applications. Thin Image requires Dynamic Provisioning, which is used to access data for open-system servers such as UNIX and PC servers in a pool volume through a virtual volume.

Thin Image components:

- Hitachi Thin Image pairs (clone and snapshot pairs).
- Volume related components (P-VOL, S-VOL, and pools)
- Snapshot tree related components (root volume, node volumes, and leaf volumes)

Groups:

- Consistency groups
- Snapshot groups

Software applications for VSP family storage systems:

- Hitachi Thin Image
- Dynamic Provisioning (HDP)
- Command Control Interface (CCI)
  You can run CCI commands to perform Thin Image tasks (see Pair tasks using CCI or Device Manager - Storage Navigator on page 216).

Thin Image pairs

This table describes Thin Image pairs.

Type	Volume that can be used as P-VOL	Volume that can be used as S-VOL	Cascade capability	Description
Pairs with the snapshot attribute	Logical volume (LDEV)	Thin Image V-VOL (V-VOL of which provisioning type is Snapshot)	No	Pairs used to store snapshot data. The logical volume of the P-VOL contains DP-VOLs (V-VOL of which provisioning type is Dynamic Provisioning).
		DP-VOL	Yes	Pairs used to store snapshot data. To create a cascaded pair with

Type	Volume that can be used as P-VOL	Volume that can be used as S-VOL	Cascade capability	Description
				the snapshot attribute, use a DP-VOL as the S-VOL. The logical volume of the P-VOL contains DP-VOLs (V-VOL of which provisioning type is Dynamic Provisioning).
Pairs with the clone attribute	Logical volume (LDEV)	DP-VOL	Yes	Pairs to be cloned. The logical volume of the P-VOL contains DP-VOLs (V-VOL of which provisioning type is Dynamic Provisioning).

Volume components

To create Thin Image pairs, the following volumes are required.

Volume type	Volumes that can be used	Description
Primary	Logical volume (LDEV)	Logical volume of a P-VOL contains DP-VOLs (V-VOLs of which provisioning type is Dynamic Provisioning).
Secondary	Thin Image V-VOL (V-VOL of which provisioning type is Snapshot)	Use this volume to create snapshot pairs. Cannot be used for cascaded or cloned pairs. This volume is required to create a pair with the S-VOL specified.
	DP-VOL	Use this volume to create cascaded or cloned pairs. This volume is required to create a pair with the S-VOL specified. Cloned pairs must be created with the S-VOL specified.
Pool	Logical volume (LDEV)	Volumes contained in a Thin Image pool. Differential data of a P-VOL is stored in a pool volume as snapshot data.

Snapshot tree components

A snapshot tree contains the following volumes.

Volume type	Volumes that can be used	Description
Root	Logical volume (LDEV)	Volume (L1 pair of the P-VOL) in the top layer of a snapshot tree. The logical volume of the P-VOL contains DP-VOLs (V-VOL of which provisioning type is Dynamic Provisioning).
Node	DP-VOL	Volumes located between the root volume and leaf volumes. S-VOL of the root volume (or another node volume), and the P-VOL of a leaf volume (or another node volume).
Leaf	DP-VOL	Volumes in the bottom layer of a snapshot tree. S-VOL of the root volume or a node volume, which is not a P-VOL of any pair.

Consistency and snapshot groups

Consistency groups and snapshot groups are groups of pairs for which you can simultaneously perform pair tasks on all pairs within the group.

A consistency group can include Thin Image (HTI), ShadowImage (SI), and ShadowImage for Mainframe (SIz) pairs. Use consistency groups to split the Thin Image pairs that are defined in the group. Splitting the pairs using the group assures data consistency at the time the VSP family storage system receives the request.

A snapshot group is a group of only Thin Image pairs. Use consistency or snapshot groups to perform Thin Image tasks on all of the pairs within the group. You define Thin Image pairs to a snapshot group when you create the pairs.

The following table shows the differences between consistency groups and snapshot groups.

Item	Consistency group	Snapshot group
Pair limit per group	8,192	8,192
Limit	2,048	2,048
Data consistency	Guaranteed	Not guaranteed
Software application from which you can define pairs	HTI, SI, and SIz	HTI

For more information about defining TC pairs in consistency groups, see the *Hitachi TrueCopy® User Guide*.

For more information about defining UR pairs in consistency groups, see the *Hitachi Universal Replicator User Guide*.

For more information about defining SI pairs in consistency groups, see the *Hitachi ShadowImage® User Guide*.

Related concepts

- Workflow for creating groups and storing snapshot data using CCI on page 33

Related tasks

- Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI on page 133
- Removing Thin Image snapshot groups on page 148

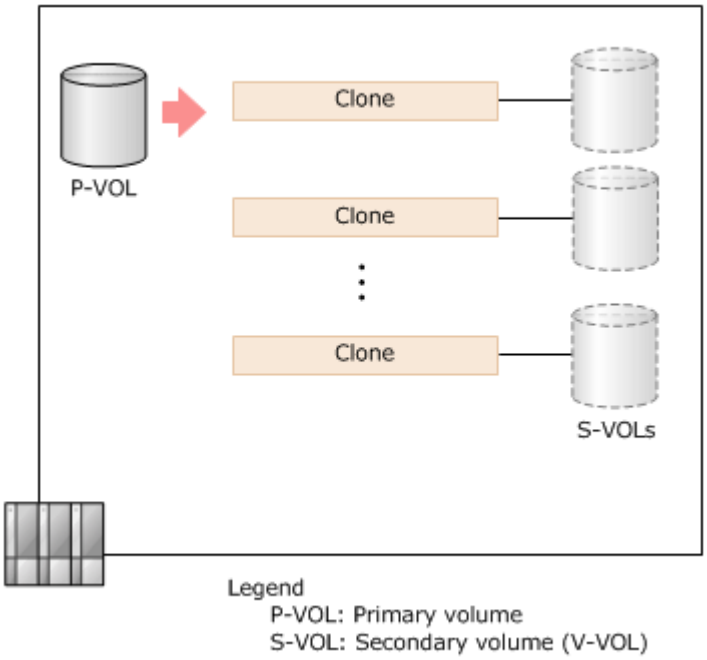
Related references

- Thin Image consistency group requirements on page 73
- Thin Image snapshot group requirements on page 75
- Pair tasks using CCI or Device Manager - Storage Navigator on page 216

Snapshot Clones (VSP G1000, G1500, and VSP F1500)

When distributing data in a storage system, you can use clones to improve efficiency.

The following figure illustrates cloning.



When cloning pairs, use a logical volume as the P-VOL and a DP-VOL as the S-VOL.

If you split pairs that have the clone attribute, the data of the entire P-VOL is copied to the S-VOL asynchronously to create a clone of the primary volume. When the copy completes, pairs are deleted and the S-VOL is unpaired (becomes a DP-VOL). This volume can be used as a volume in the same status as the P-VOL. This operation is referred to as cloning pairs.

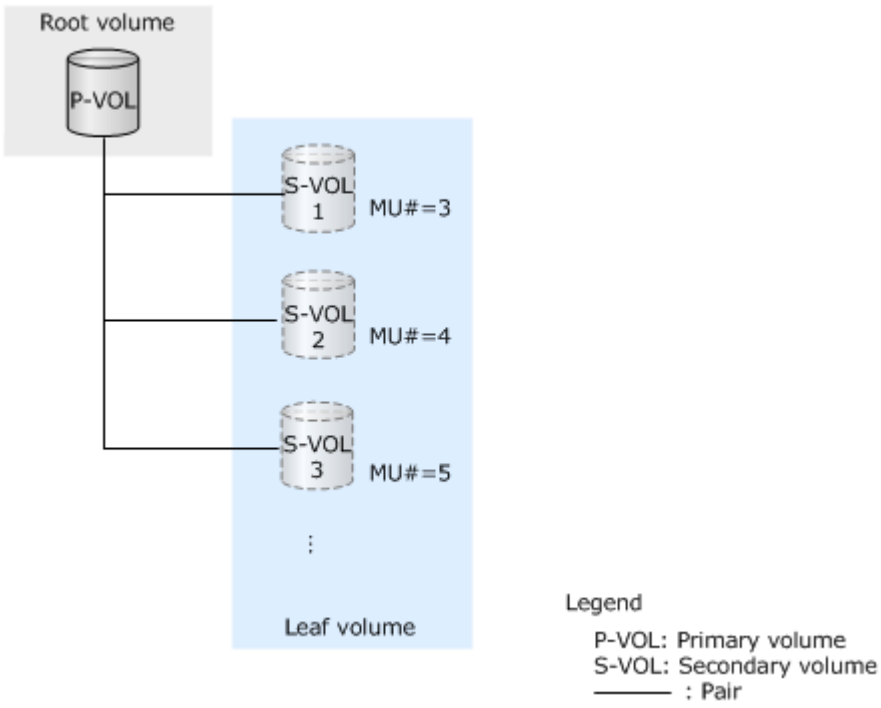
A maximum of 1,024 clones (including the number of snapshots if you store them) can be created by using Thin Image.

Cloning pairs includes operations after the P-VOL is copied to the S-VOL, until volumes are unpaired. Volumes created by cloning are not included.

Snapshot trees and cascaded pairs

Snapshot trees are Thin Image pair configurations where snapshot data is stored.

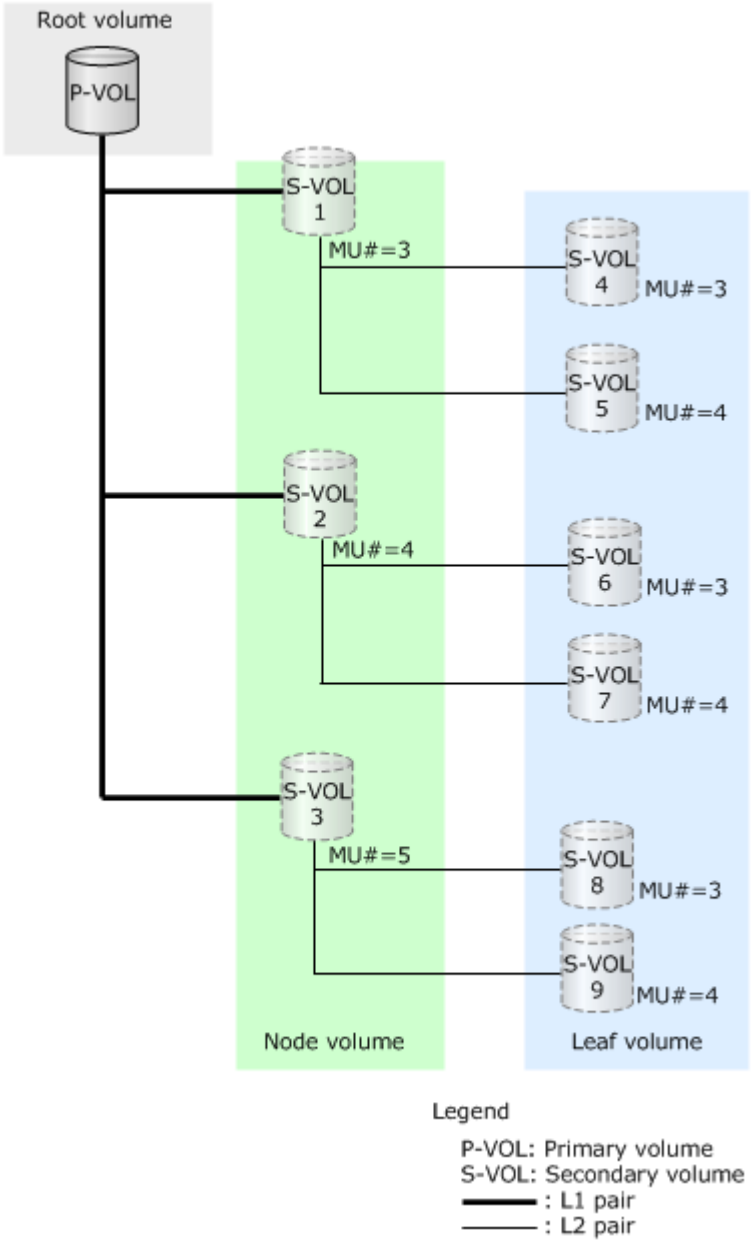
The volume in the top layer of the snapshot tree is the root volume. Volumes in the bottom layer are leaf volumes.



Creating cascaded pairs

Thin Image S-VOLs can be paired with secondary layer S-VOLs. First layer (L1) S-VOLs can also be paired with secondary layer (L2) S-VOLs. A maximum of 64 layers can be created, and a maximum of 1,024 S-VOLs can be used for a P-VOL. In this case, the snapshot tree is cascaded.

L2 to L64 pairs are called cascaded pairs. The following figure illustrates the configuration of cascaded snapshot trees.



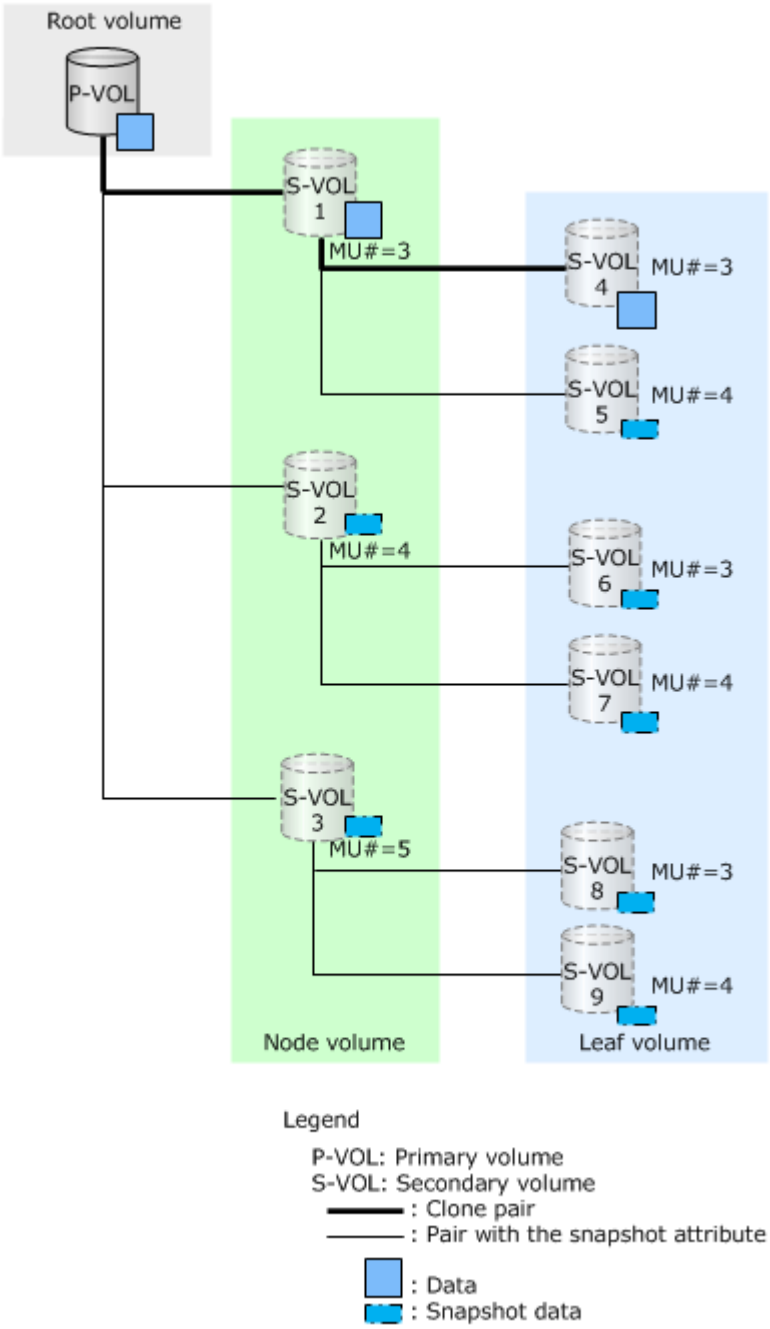
- The volume in the top layer of the snapshot tree (P-VOL of the L1 pair) is the root volume.
- Volumes between the root and leaf volumes are node volumes.
- Volumes in the bottom layer of the snapshot tree are leaf volumes.

To create a Thin Image pair that can be used in a cascaded snapshot tree, open the Create TI Pairs window and select Enable for Cascade. For details, see Creating Thin Image pairs using Device Manager - Storage Navigator on page 128.

When the S-VOL of a Thin Image pair you created for a P-VOL for the first time is a DP-VOL, you can create cascaded pairs. If a Thin Image pair whose

secondary volume is a Thin Image V-VOL (which has the Snapshot provisioning type) is created, remove the pair first, and then create another Thin Image pair whose secondary volume is a DP-VOL.

A snapshot tree can be configured by combining snapshot and cloned pairs. As shown in the following figure, you can also cascade pairs that are being cloned, but you can only clone up to three pairs concurrently. The following figure shows an example of when pairs that are being cloned are also cascaded.



You can use the S-VOL of a cascaded and cloned pair as a new L1 pair of the P-VOL. In this case, the volume is a node or leaf or root volume.

VSP family software applications for Thin Image

A Thin Image installation typically includes the Thin Image software, Dynamic Provisioning software, and CCI.

Thin Image

Use the Thin Image software on the Device Manager - Storage Navigator (HDvM - SN) computer that is connected to the service processor (SVP) by means of the TCP/IP local area network (LAN).

Dynamic Provisioning

Use the HDP software on the HDvM - SN computer. A user license is required to use HDP.

Since Thin Image uses a portion of the HDP licensed capacity for its pool capacity, reserve enough HDP licensed capacity to run both HDP and Thin Image and to accommodate the Thin Image pairs or pools that you will create.

Thin Image and HDP pool-VOLs are also referred to as used volumes. The licensed capacity must exceed the total capacity of used volumes.

CCI

When you use CCI to define multiple Thin Image pairs in a consistency group, you can only specify one consistency group for a group defined by the configuration definition file for CCI.

Note: The configuration definition file for CCI is a group that is not a consistency group.

If you create a new pair and define the pairs in a consistency group for a group you defined using the configuration definition file for CCI, and the pair is already defined in a consistency group, the pair is defined in the same consistency group even if you try to create a new pair and assign it to a different consistency group.

Related tasks

- Installing Thin Image on page 68
- Splitting Thin Image pairs to store snapshot data using CCI on page 136

Related references

- Thin Image licensed capacity requirements on page 68

How Thin Image works

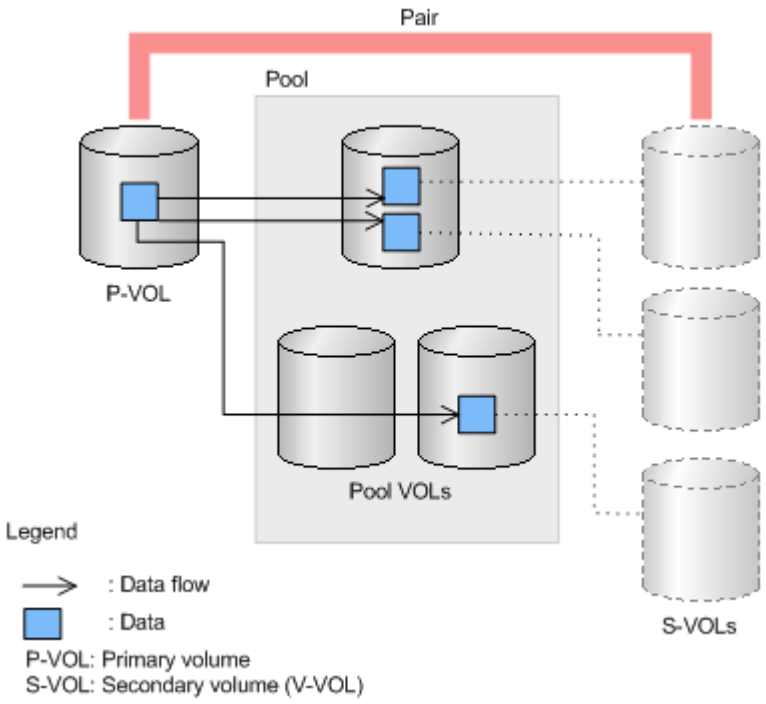
This topic explains how Thin Image works.

How Thin Image uses pools and pool volumes

Thin Image stores snapshot data in pools. A pool consists of multiple pool volumes (pool-VOLs) which are, as a group, the container for the snapshot data.

You must create pools to use Thin Image. You can create pools and add and delete pool-VOLs from them using Thin Image.

The following figure illustrates the relationship between a Thin Image pair and a pool.



Caution: When creating pools, calculate the pool capacity and reserve a sufficient amount of pool capacity. When you write data to Thin Image pair volumes and the amount of pool usage exceeds the pool capacity, the Thin Image pair is suspended ("PSUE" status), snapshot data is not stored, and you cannot create additional Thin Image pairs.

Related tasks

- Thin Image data pool requirements on page 72

- Calculating and assigning pool capacity on page 78
- Creating Thin Image data pools on page 98
- Increasing pool capacity on page 175
- Decreasing pool capacity on page 179
- Deleting pools on page 189
- Restoring suspended Thin Image pairs on page 142

Usage level rebalancing among parity groups

If multiple parity groups that contain LDEVs used as pool-VOLs exist, rebalancing can improve biased usage rates in parity groups.

Rebalancing is performed as if each parity group were a single pool-VOL. After rebalancing, the usage rates of LDEVs in a parity group may not be balanced, but the usage rate in the entire pool is balanced.

The usage level among parity groups is automatically rebalanced when expanding or shrinking pool capacity operations are in progress.

If you expand the pool capacity, Dynamic Provisioning moves data to the added space on a per-page basis. When the data is moved, the usage rate among parity groups of the pool-VOLs is rebalanced.

Host I/O performance may decrease when data is moved. If you do not want to have the usage level of parity groups automatically balanced, call customer support.

You can see the rebalancing progress of the usage level among parity groups in the **View Pool Management Status** window. Dynamic Provisioning automatically stops balancing the usage levels among parity groups if the cache memory is not redundant or the pool usage rate reaches up to the threshold.

Related tasks

- Viewing formatted pool capacity and pool usage rates on page 175

How Thin Image uses V-VOLs

V-VOLs are virtual volumes that do not have any physical storage space.

Thin Image uses V-VOLs (V-VOLs of provisioning type Snapshot) or DP-VOL as V-VOLs. Thin Image V-VOLs and DP-VOLs are referred to as virtual volumes (V-VOLs). Use DP-VOLs to create cascaded or cloned pairs. Use Thin Image V-VOLs to create snapshot pairs. Note that you can use DP-VOLs to cascade snapshot pairs.

Thin Image uses V-VOLs to access snapshot data from hosts or clone pairs, so if you are using a storage system that does this (creates snapshot pairs or clone pairs), V-VOLs are required to assign an S-VOL to snapshot data. If the storage system or snapshot pair (a pair with the snapshot attribute) does not need to access snapshot data from hosts, V-VOLs are not necessary.

You can release the V-VOLs that are being used as Thin Image S-VOLs from assignment of snapshot data. Released V-VOLs can be assigned to other snapshot data. However, you cannot release allocation of V-VOLs used as node volumes to snapshot data or allocate the V-VOL to different snapshot data. Also, you cannot release allocation of V-VOLs which are being used for the S-VOL of a clone pair to snapshot data, or allocate it to different snapshot data.

You cannot release definitions of V-VOLs if the V-VOLs are being used as Thin Image secondary volumes; you must first release the Thin Image pairs that are using the V-VOLs.

How Thin Image pairs are created

When creating a Thin Image pair, you need to specify the pool to be used for the pair. If multiple Thin Image pairs share the same primary volume, the pairs must also share the same pool. For example, if you specify three secondary volumes for one primary volume, you must specify the same pool for the three Thin Image pairs.

If you release a Thin Image pair, the volume status becomes SMPL. Immediately after a volume becomes SMPL, you cannot use the volume to create a Thin Image pair. If you want to create Thin Image pairs using SMPL volumes, you should wait for a while before creating the pairs. The wait time required depends on your system environment.

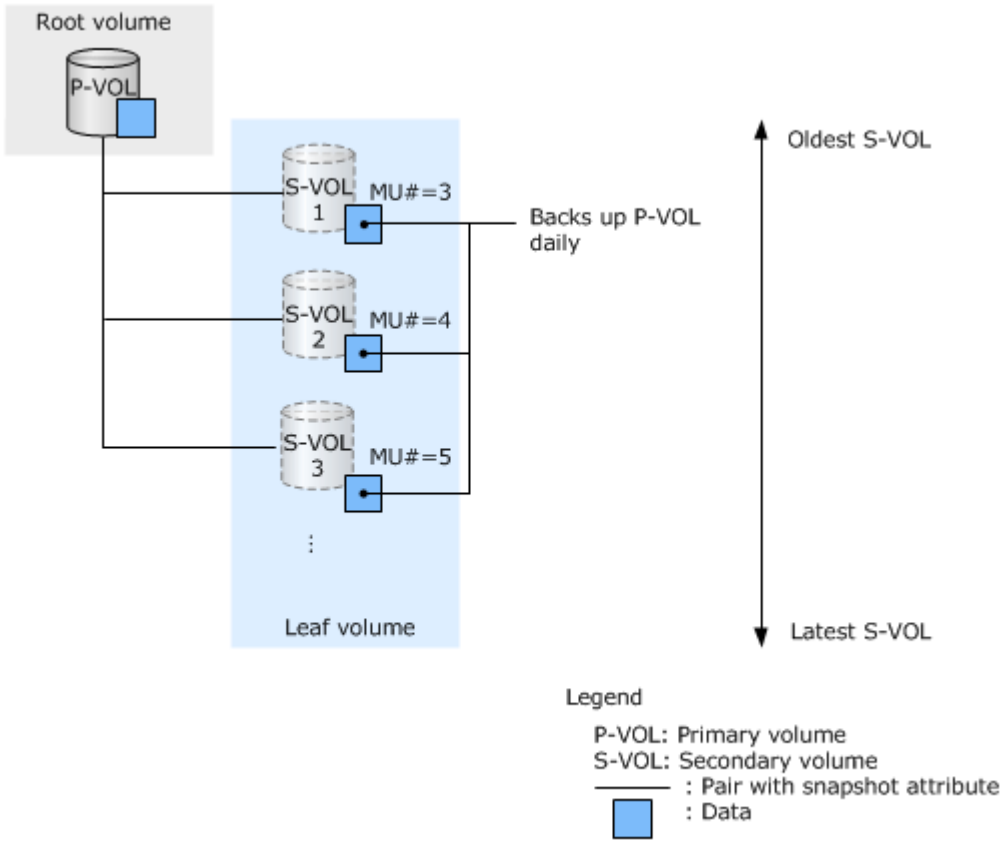
Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128
- Viewing pair properties on page 160

Using snapshot pairs (not cascaded)

The following figure shows how snapshot pairs are used when they are not cascaded.

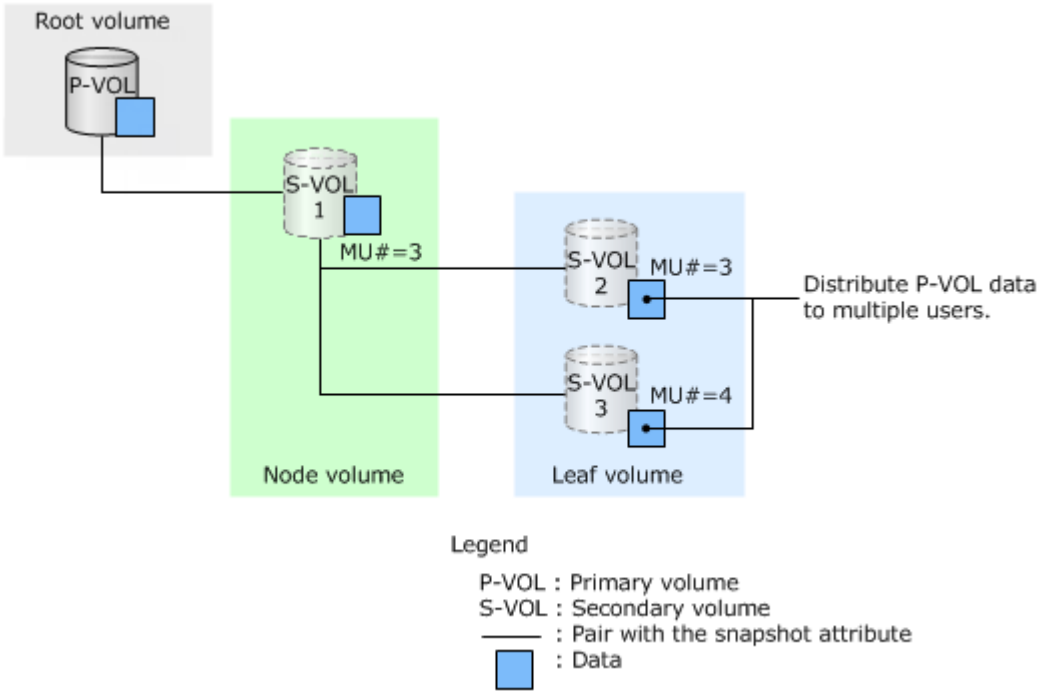
Data in the P-VOL is backed up one time every day. The P-VOL can be restored using the S-VOL if a logical failure occurs during data update or if there is a virus in the P-VOL.



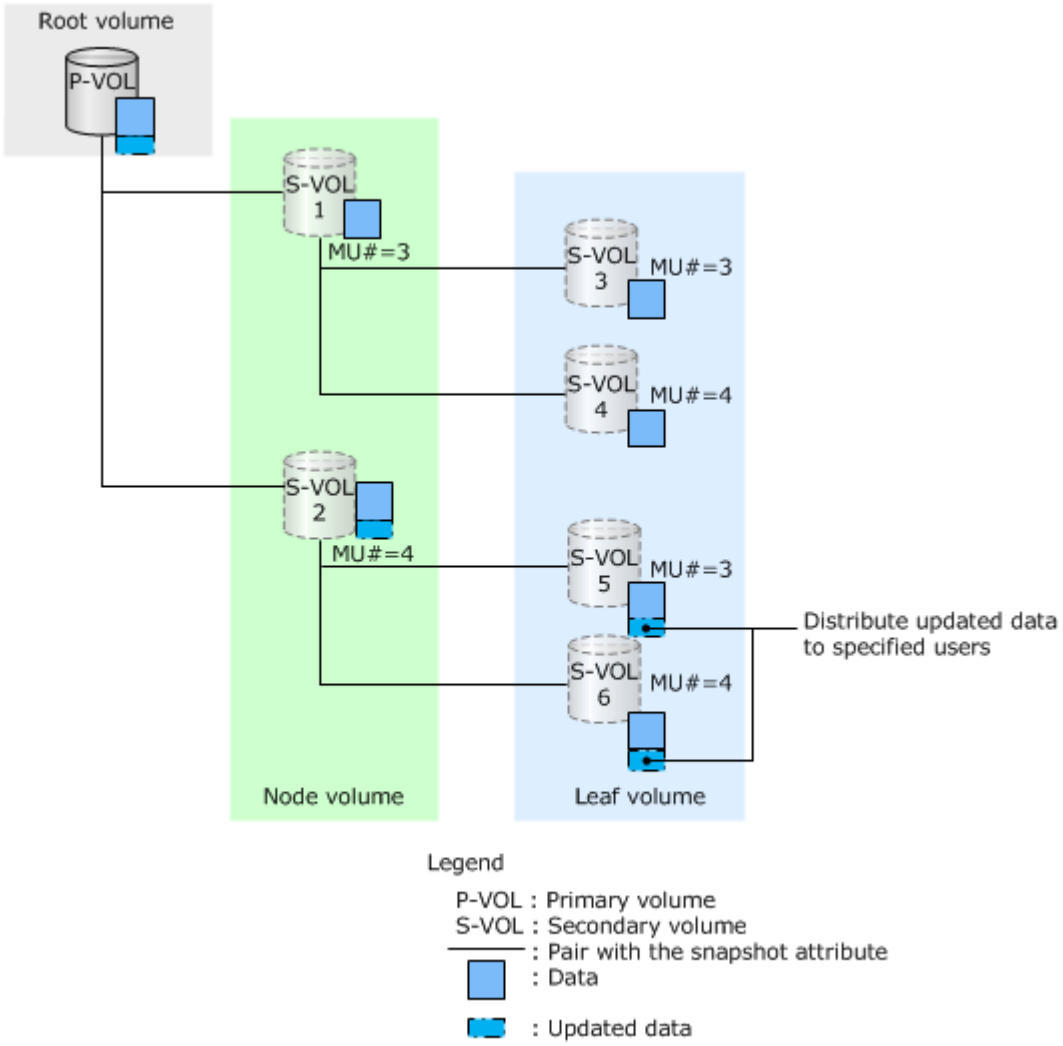
Using cascaded pairs

Distributing data in the P-VOL to multiple users

Create the same number of leaf volumes as the number of users to whom you want to distribute data. This allows you to distribute data in the P-VOL without increasing loads to the P-VOL.



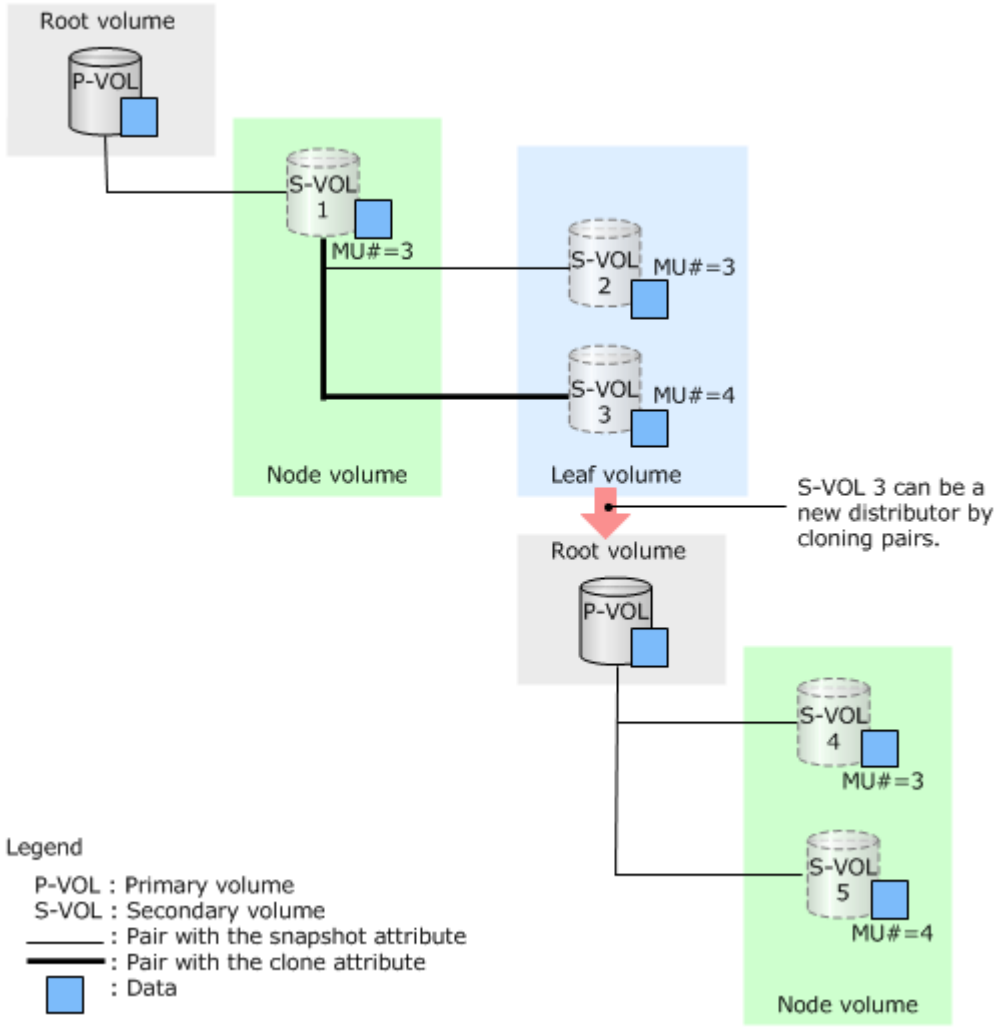
Distributing updated data in the P-VOL to specified users



When you update the P-VOL and want to give it only to the specified users (S-VOLs 5 and 6 in the figure), do the following:

1. Create cascaded pairs, and distribute data in the P-VOL. Assign users to whom you want to distribute the updated data, and users to whom you do not want to distribute the updated data to separate node volumes.
2. Delete the pairs in the node volume where you assigned users you do not want to distribute the updated data to (S-VOL 1 in the figure).
3. Update the P-VOL.

Creating a new distributor with cloned pairs



1. Create cascaded pairs and distribute data in the P-VOL. Assign the clone attribute to the volume to be a new distributor (S-VOL 3 in the figure).
2. Clone pairs.

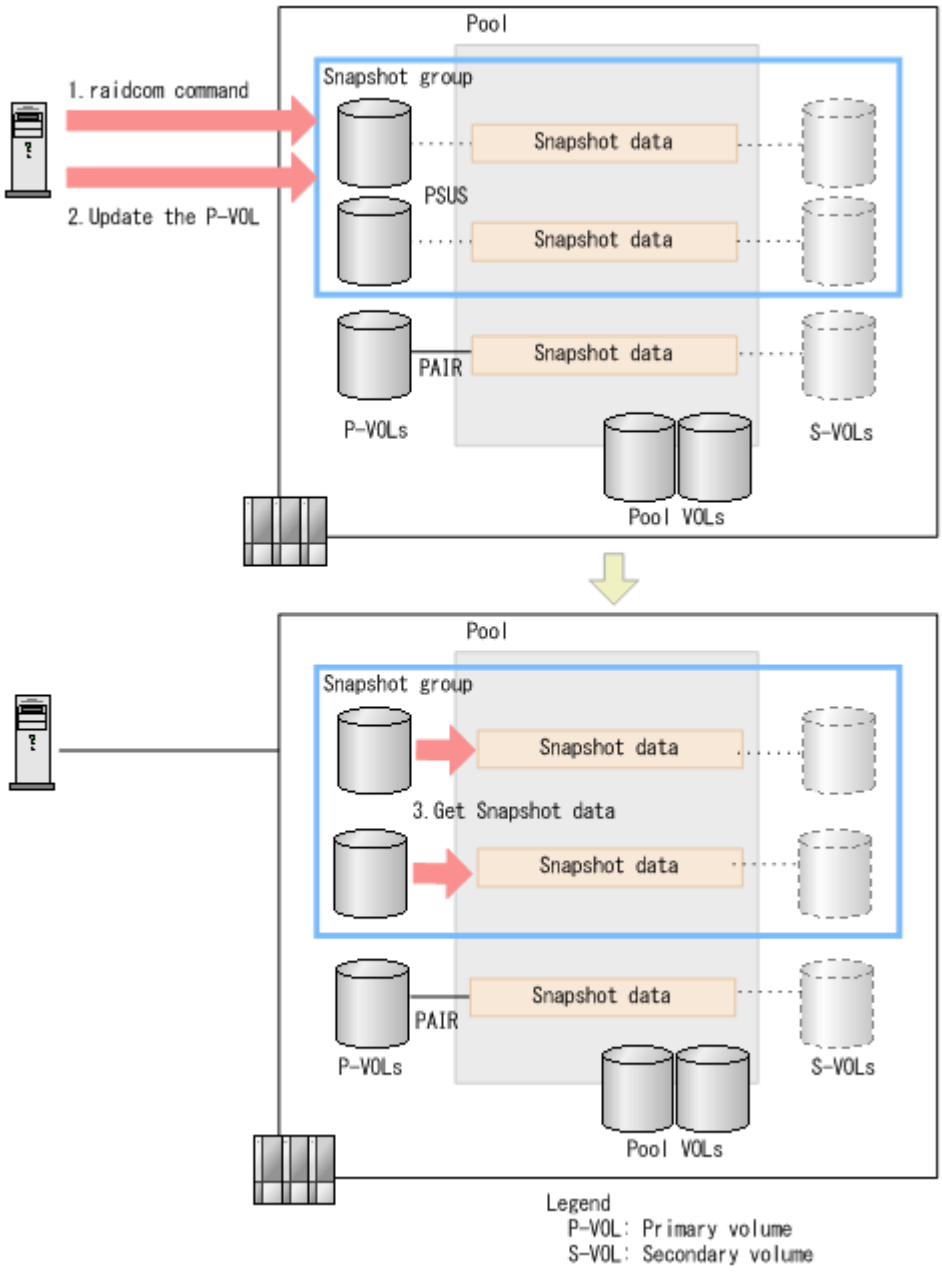
By cloning pairs, S-VOL 3 and S-VOL 1 become unpaired volumes (DP-VOLs) in the same status, and S-VOL 3 can be a new distributor. As a result, the overhead of the Thin Image pairs can be reduced.

Workflow for creating groups and storing snapshot data using CCI

You can use CCI raidcom commands to create a consistency or snapshot group and to split pairs to store the snapshot data for the group.

With Thin Image, ShadowImage, and ShadowImage for Mainframe, you can create up to 2,048 consistency groups in a VSP family storage system.

The following figure illustrates how snapshot data is stored for a consistency or snapshot group using CCI raidcom commands.



Use the following workflow to create a snapshot group and store volume snapshot data in the group:

1. Split the pair and store snapshot data for a group. To do this using CCI, run the following raidcom command:
   `raidcom modify snapshot -snapshot_data create`
2. The host issues a write request to each P-VOL in the group. Snapshot data for the volumes are stored.

A CCI command is used to store snapshot data for a consistency group or a snapshot group. Device Manager - Storage Navigator can only be used to reference consistency groups and snapshot groups.

Related concepts

- Consistency and snapshot groups on page 20

Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128
- Removing Thin Image snapshot groups on page 148

Related references

- Pair tasks using CCI or Device Manager - Storage Navigator on page 216

Methods of storing snapshot data

The Copy-After-Write (CAW) method is the default method of storing snapshot data. However, if the write pending rate (percentage of data waiting to be written in cache memory) is 60% or higher when writing in cascaded pairs random access mode, or 30% or higher when writing in sequential access mode, the Copy-On-Write (COW) method is used.

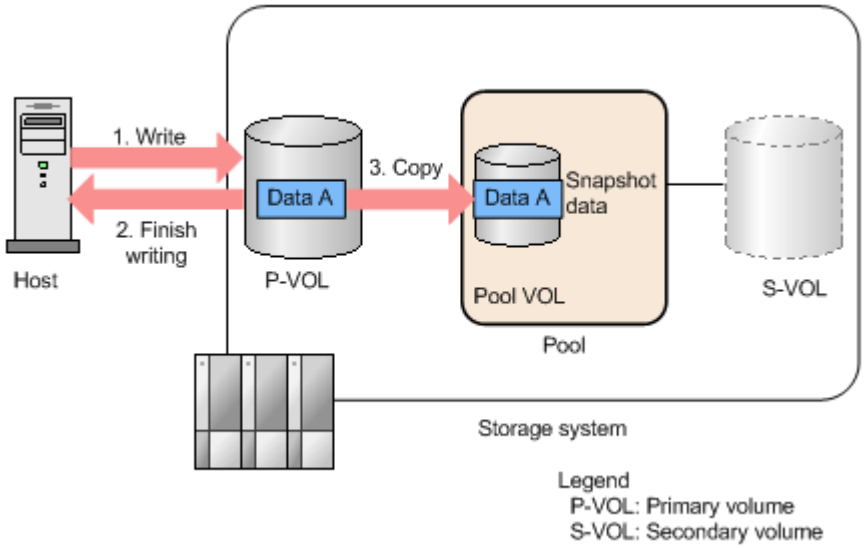
In the CAW method, writing the P-VOL snapshot data changes the status to "write completion". In the COW method, storing the P-VOL snapshot data changes the status to "write completion". The CAW method wait time is shorter than that of the COW method.

Workflow for the CAW method

The following workflow describes the CAW method and how a VSP G series or VSP F series storage system stores snapshot data:

1. The host writes data to a P-VOL.
2. The storage system returns the write completion status to the host.
3. The storage system stores snapshot data for the P-VOL in the background.

The following figure illustrates the CAW method.

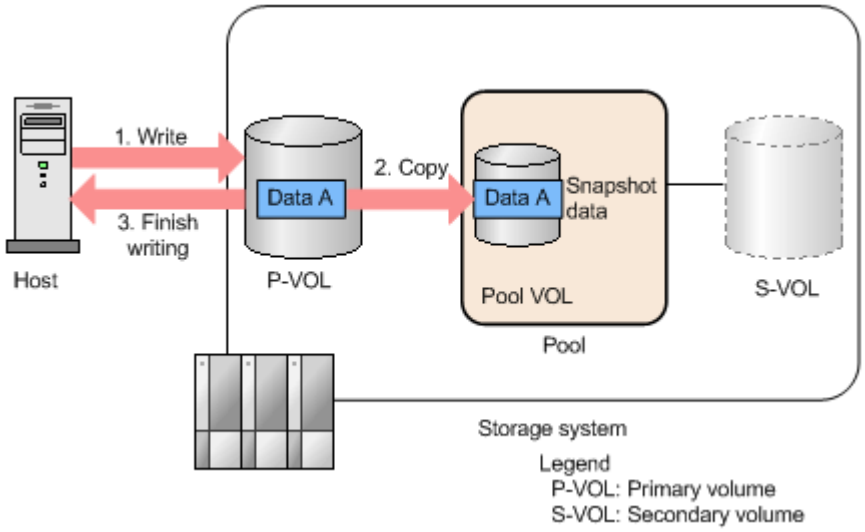


Workflow for the COW method

The following workflow describes the COW method and how a VSP G series or VSP F series storage system stores snapshot data:

1. The host writes data to a P-VOL.
2. The storage system stores snapshot data for the P-VOL.
3. The storage system returns the write completion status to the host.

The following figure illustrates the COW method.



Thin Image pair restoration

You can use Thin Image to overwrite snapshot data in pools to P-VOLs so that the P-VOL content is returned to the condition it was when you stored snapshot data.

Overwriting snapshot data to P-VOLs is also referred to as restoring Thin Image pairs.

If data is written to a secondary volume, this particular data (not snapshot data) is overwritten to the primary volume when the Thin Image pair is restored.

If a problem occurs in P-VOL data due to a failure, restoring the pair restores the P-VOL data saved when the snapshot data was stored.

The time for restoring a Thin Image pair depends on the following, even if the pair synchronization rate is 100%:

- The amount of pool capacity a pair is using.
- The number of pairs being operated concurrently.

The pair synchronization rate shows the rate that S-VOL data matches that of the next generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL with the P-VOL.

For the Thin Image pair where the cascade attribute is enabled, the information displayed in Synchronization Rate (%) of the View Pair Synchronization Rate window varies depending on the pair status.

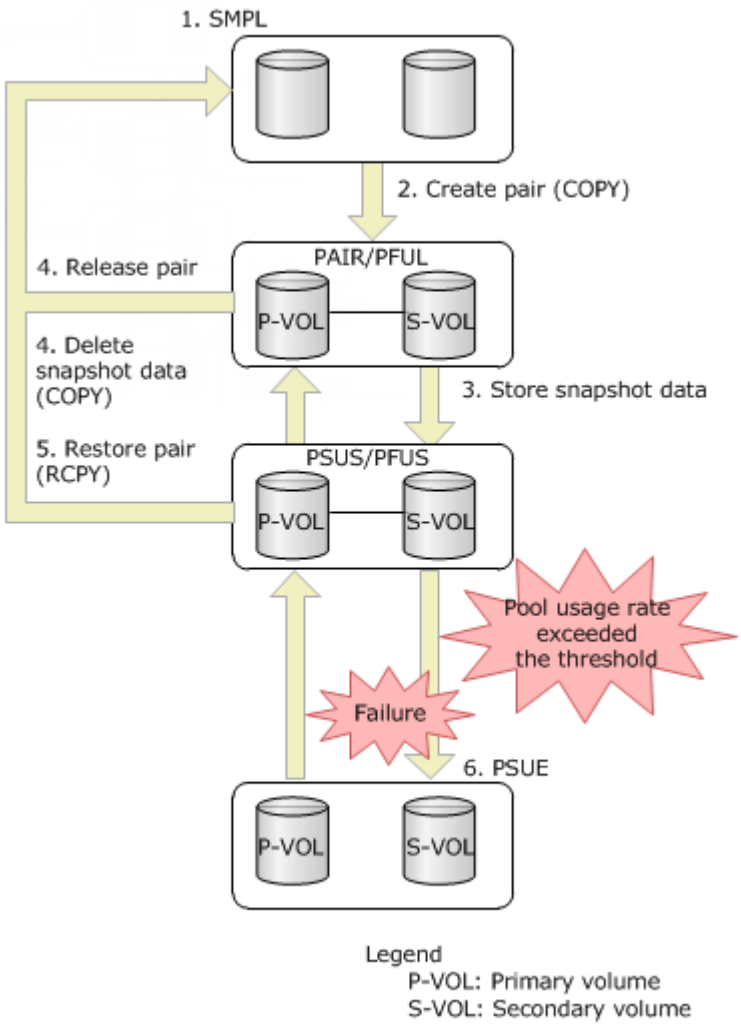
Related tasks

- Restoring Thin Image pairs on page 140

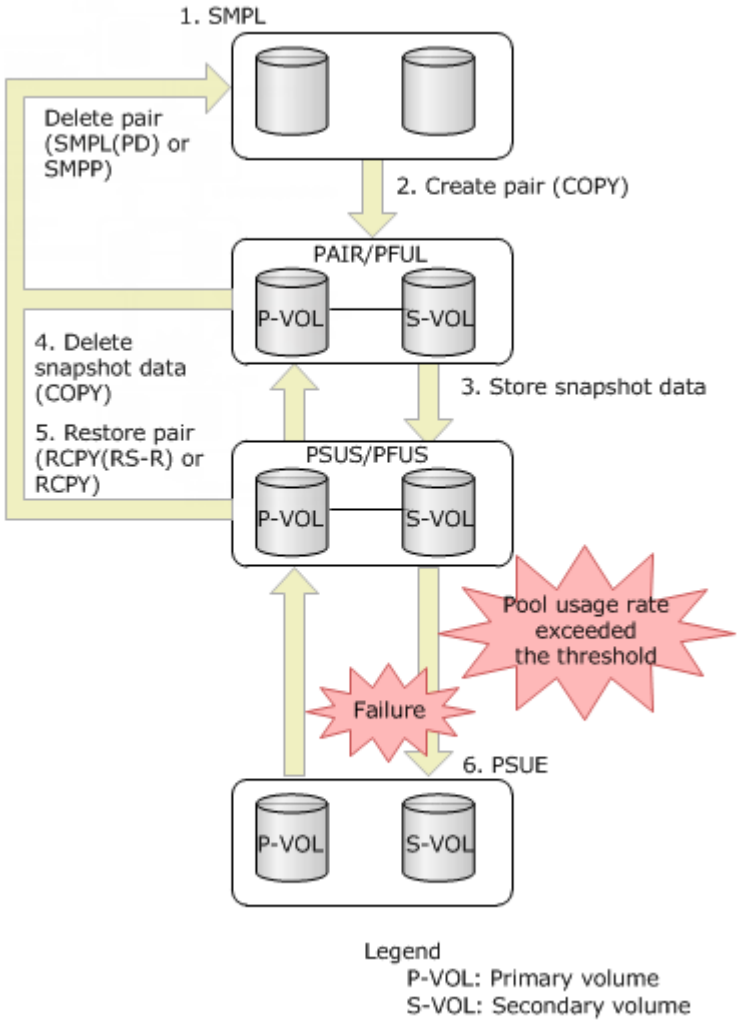
How Thin Image pair status changes

The Thin Image pair status changes as you create, split, or perform other pair tasks.

(VSP Gx00 models and VSP Fx00 models) The following figure illustrates pair status changes.



(VSP G1000, G1500, and VSP F1500) The following figure illustrates status changes to Thin Image and snapshot pairs.



The following workflow describes the Thin Image pair status changes:

1. You choose two volumes that are in SMPL status and are not in use as a Thin Image pair.
2. You create a pair. If the primary volume has not previously been paired with any secondary volume, the pair status changes to "COPY" at first, and then to "PAIR" after the pair creation finishes.
   - Creation of a Thin Image pair may be time consuming if you create a pair immediately after deleting the last snapshot data for the primary volume.
   - If the pool threshold is exceeded when the Thin Image pair is in "PAIR" status, the pair status changes to "PFUL."
   - Thin Image pairs cannot be created when the pool threshold is exceeded.
3. Snapshot data is stored when you split a pair in "PAIR" status. After snapshot data is stored, the pair status is "PSUS." If the pool threshold is

exceeded when the Thin Image pair is in "PSUS" status, the pair status changes to "PFUS."

4. If you only want to delete snapshot data but do not want to release the Thin Image pair, you delete the snapshot data for the pair in "PSUS" or "PFUS" status.
5. If you restore a Thin Image pair in "PSUS" status, snapshot data is overwritten to the primary volume. The pair status is "COPY(RS-R) or RCPY" when the restore process is in progress. The pair status is "PAIR" after the restore process finishes.
6. The pool can only contain data of predetermined capacity. If the total capacity of snapshot data in the pool exceeds the pool capacity, the status of the Thin Image pair becomes "PSUE." In addition, the pair status changes to "PSUE" if a failure occurs during the restore process or if the pool usage rate reaches 100 percent. Even if the restore process is not in progress, the pair status may change to "PSUE" when a failure occurs.

Thin Image host access and pair status

The status of Thin Image (HTI) pairs depends on whether the hosts can read from or write to the Thin Image pair P-VOL or S-VOLs.

The following table explains the host access and pair status for snapshot pairs.

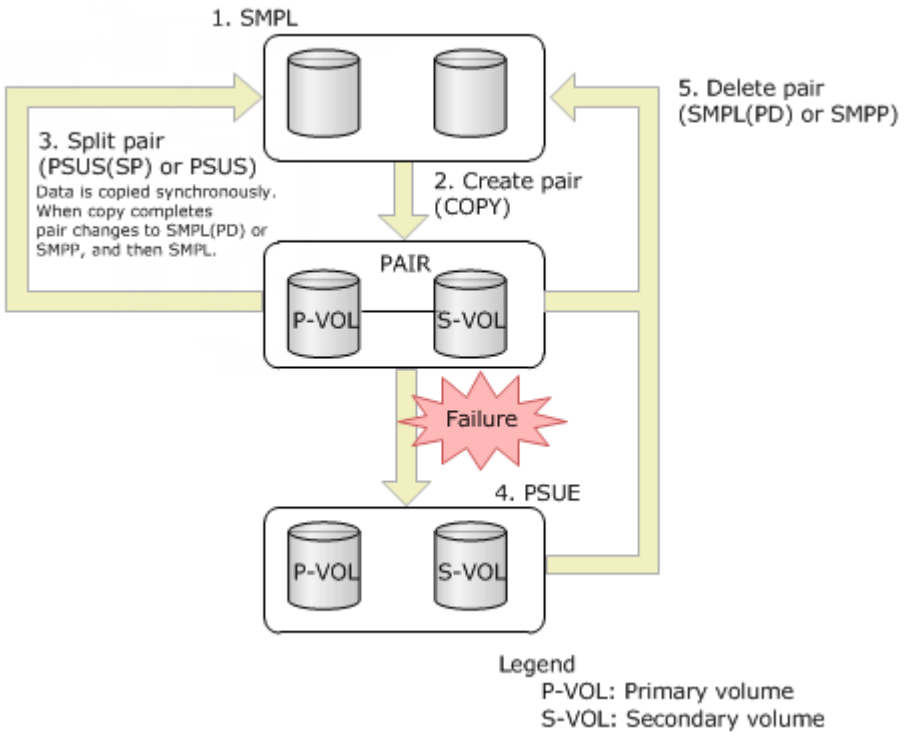
HTI pair status	P-VOL		S-VOL	
	Read	Write	Read	Write
SMPL	Yes	Yes	No	No
SMPL(PD) or SMPP	Yes	Yes	No	No
COPY	Yes	Yes	No	No
PAIR/PFUL	Yes	Yes	No	No
PSUS/PFUS	Yes	Yes	Yes	Yes
COPY(RS-R) or RCPY	Yes	Yes	No	No
PSUE	Yes	Yes	No	No
Legend Yes: Hosts can access the volume No: Hosts cannot access the volume				

Caution: If a host uses a software application to monitor Thin Image pair volumes other than Thin Image, the S-VOL status determines if the software application ends abnormally. For example, if the S-VOLs are in a status other than "PSUS" and "PFUS," the host can reject access.

If a host connects to at least two ports, an abnormality can occur with ports that are not connected to S-VOLs rejecting access from hosts. To resolve these issues, close the software application that monitors volumes.

Workflow for Thin Image pair status changes

(VSP G1000, G1500, and VSP F1500) The following figure illustrates status changes to Thin Image cloned pairs.



The following workflow describes Thin Image pair status changes:

1. You choose two volumes that are in the SMPL status and are not in use as a Thin Image pair.
2. You create a pair. If the P-VOL has not previously been paired with any S-VOL, the pair status changes to COPY at first, and then to PAIR after the pair creation finishes.
3. You split a pair. When you split a pair in the PAIR status, the pair status changes to PSUS(SP) or PSUP, and copying data is started asynchronously. When the copy operation completes, the pair status changes to SMPL(PD) or SMPP. When the pair deletion completes, the pair status changes to SMPL. The S-VOL becomes unpaired (a DP-VOL) and can be used as a volume in the same status as the P-VOL.

Note: If you delete a pair when the pair status is PSUS(SP) or PSUP, copying data stops at the time when the pair deletion is

accepted, and the status changes to SMPL. If this happens, data in the S-VOL is not guaranteed.

4. The DP pool can only contain data of predetermined capacity. If the total capacity of data in the DP pool exceeds the DP pool capacity, the status of the Thin Image pair changes to PSUE. In addition, the pair status also changes to PSUE if a failure occurs during the process or if the DP pool usage rate reaches 100 percent.
5. You delete a pair. When a pair is deleted, the pair status changes to SMPL(PD) or SMPP. After that, it changes to SMPL when pair deletion completes.

Whether the host can read or write data from and to a Thin Image pair P-VOL or S-VOL is determined by the pair status. The following table describes whether the host can access volumes, and their cloned pair status.

Pair status	Primary volume		Secondary volume	
	Read	Write	Read	Write
SMPL	Y	Y	Y	Y
COPY	Y	Y	N	N
PAIR	Y	Y	N	N
PSUS(SP) or PSUP	Y	Y	Y	Y
SMPL(PD) or SMPP	Y	Y	Y	Y
PSUE	Y	Y	N	N

Copy threshold option and host server I/O performance for Thin Image

You can enable the copy threshold option to help minimize the decline of host server I/O performance by lowering the workload on the storage system.

I/O performance of the host server might be lowered as the workload on the storage system increases. If you perform Thin Image restore operations when the workload on the storage system is high, I/O performance of the host server is more likely to be lowered because replication processes for the primary volumes are triggered. The copy threshold option can be used to temporarily stop the replication processes triggered by the restore operations when the workload on the storage system is high. The copy threshold option can contribute to minimizing the decline in I/O performance of the host server.

The copy threshold option is applicable only when the workload on the storage system is excessively heavy. If the copy threshold option is applied, all the replication processes triggered by restore operations are stopped.

Replication processes stopped by the copy threshold option will be restarted as the workload on the storage system is lowered. Enabling the copy threshold option stops replication processes for Thin Image and the following products when the storage system is overloaded.

- ShadowImage
- ShadowImage for Mainframe
- Compatible FlashCopy® V2
- Volume Migration V2

For more information about enabling the copy threshold option, call customer support.

For more information about Compatible FlashCopy® V2, see the *Hitachi Compatible FlashCopy/FlashCopy SE User Guide*.

Related concepts

- Thin Image pair restoration on page 37

Sharing Thin Image volumes with other software applications

You can create Thin Image (HTI) pairs using pair volumes for other replication software applications, such as ShadowImage and TrueCopy. You can also create Thin Image pairs using volumes to which you define attributes using Data Retention Utility or CCI.

You can share Thin Image volumes with the following software application volumes:

- Data Retention Utility
- Volume Migration V2
- ShadowImage (SI)
- TrueCopy (TC)
- Universal Replicator (UR)
- Global-active device (GAD)

The following table shows when you can share Thin Image pair volumes with other software application volumes. If a volume that you share with a Thin Image volume is shown in the table, the pair status determines whether you can perform tasks. If the S-VOL is not assigned to snapshot data, you cannot share Thin Image volumes with other software applications, because the S-VOL does not exist.

Note: For node or leaf volumes, see the Used as an HTI S-VOL column instead of the Used as an HTI P-VOL column.

Software application volume type	Used as an HTI P-VOL	Used as an HTI S-VOL
SI P-VOL	Yes[3]	No
SI S-VOL	Yes	No
TC P-VOL	Yes	No
TC S-VOL	Yes	No
UR P-VOL	Yes	No
UR S-VOL	Yes	No
UR journal volume	No	No
GAD P-VOL	Yes	No
GAD S-VOL	Yes	No
GAD volume with reservation attribute	No	No
GAD volume for quorum disk	No	No
Volume Migration source volume	No	No
Volume Migration target volume	No	No
Read Only volume[1, 4, 6]	Yes	Yes
Protect volume[1, 4, 6]	Yes	Yes
S-VOL Disable volume[4, 6]	Yes	No
Zero Read Capacity volume[2, 5, 6]	Yes	Yes
Invisible volume[2, 5, 6]	Yes	Yes
DP-VOL	Yes	Yes[7]
V-VOL with capacity saving enabled	Yes	(VSP G1000, G1500, and VSP F1500) Yes [8] (VSP Gx00 models and VSP Fx00 models) No
Deduplication system data volume	No	No

1. If you use HDvM - SN to share the volume with other software applications, the pair status determines whether you can share the volume.
2. To share the volume with other software applications, you must use CCI.
3. You cannot Quick Restore.
4. Use the Data Retention Utility to set this attribute.
5. Use CCI to set this attribute.
6. Use the Data Retention Utility to confirm whether this attribute is set to volume.
7. Can be shared if the pair is cascaded or has the clone attribute.
8. Can be set on a S-VOL of a cascade pair or a clone attribute pair. Note that only the clone attribute enables capacity saving.

Legend:

Yes: You can share the volume.
No: You cannot share the volume.

Sharing Thin Image volumes that have Data Retention Utility access attributes

You can create Thin Image (HTI) pairs using volumes on which you set Data Retention Utility access attributes. In addition, you can set any access attribute for virtual volumes of HTI.

Depending on access attributes of the P-VOL, S-VOL, or pool volume, you cannot perform some pair tasks and pool tasks with Thin Image. The Thin Image pair tasks you can perform are different depending on whether you assign Data Retention Utility access attributes using CCI or HDvM - SN. The tables below explain whether you can perform Thin Image pair tasks and pool tasks on volumes that have access attributes assigned by Data Retention Utility. If you release assignment of snapshot data after assigning access attributes to a Thin Image S-VOL, the Thin Image tasks you can perform are the same as those that can be performed when the Read/Write attribute is assigned to the S-VOL.

Also, you can assign access attributes to Thin Image P-VOL and S-VOLs. The tables below also explain Thin Image pair tasks and pool tasks after access attributes are assigned.

Access attributes and supported Thin Image pair tasks

The following table lists the relationship between P-VOL and S-VOL access attributes and Thin Image pair tasks when using HDvM - SN to assign Data Retention Utility access attributes.

Volume access attributes specified for the HTI pair		HTI pair task		
P-VOL	**S-VOL**	**Create, split, suspend, Resync pair (Normal Copy)**	**Resync (Reverse Copy)[1]**	**Delete**
Read/Write	Read/Write	Yes		
	Read Only, Protect, S-VOL Disable	No		
Read Only, Protect, S-VOL Disable	Read/Write	Yes	No	Yes
	Read Only, Protect, S-VOL Disable	No		

1. Reverse Copy does not copy S-VOL access attributes to P-VOLs (see Pair resynchronization methods on page 143).

The following table lists the relationship between P-VOL and S-VOL access attributes and Thin Image pair tasks when using CCI to assign Data Retention Utility access attributes.

Volume access attributes specified for the HTI pair		HTI pair task		
P-VOL	S-VOL	Create, split, suspend, Resync pair (Normal Copy)	Resync (Reverse Copy)[1]	Delete
Read/Write, Read Only, Protect	Read/Write, Read Only, Protect	Yes		
	S-VOL Disable	No		
S-VOL Disable	Read/Write, Read Only, Protect	Yes	No	Yes
	S-VOL Disable	No		

1. Reverse Copy does not copy S-VOL access attributes to P-VOLs (see Pair resynchronization methods on page 143).

Access attributes and supported Thin Image pool tasks

The following table lists the relationship between P-VOL and S-VOL access attributes specified by Thin Image and Thin Image pool tasks when using CCI or HDvM - SN to assign Data Retention Utility access attributes.

Volume access attributes specified by HTI	HTI pool task
	Pool-VOL setting
Read/Write	Yes
Read Only	No
Protect	No
S-VOL Disable	No

Legend:

Yes: You can perform the task.
No: You cannot perform the task.



Note: Performing a Thin Image task does not change the volume access attributes.

Required Thin Image pair status when using Data Retention Utility to assign access attributes to some volumes

The following table shows the Thin Image pair status that is required to use Data Retention Utility to assign access attributes to some Thin Image P-VOLs and S-VOLs when also using HDvM - SN to assign Data Retention Utility access attributes.

HTI volume		Access attribute to be assigned	
Pair status	**Volume**	**Read/Write**	**Read Only Protect S-VOL Disable**
COPY	P-VOL	Yes	Yes
	S-VOL	Yes	No
PAIR, PFUL	P-VOL	Yes	Yes
	S-VOL	Yes	Yes
PSUS, PFUS	P-VOL	Yes	Yes
	S-VOL	Yes	Yes
SMPL(PD)	P-VOL	Yes	Yes
	S-VOL	Yes	No
RCPY	P-VOL	Yes	No
	S-VOL	Yes	No
PSUE	P-VOL	Yes	Yes
	S-VOL	Yes	No
Legend: Yes: You can perform the setting No: You cannot perform the setting.			

The following table shows the Thin Image pair status that is required to use Data Retention Utility to assign access attributes to some Thin Image P-VOLs and S-VOLs when also using CCI to assign Data Retention Utility access attributes.

HTI volume		Access attribute to be assigned	
Pair status	**Volume**	**Read/Write Read Only Protect**	**S-VOL Disable**
COPY	P-VOL	Yes	Yes
	S-VOL	Yes	No
PAIR, PFUL	P-VOL	Yes	Yes
	S-VOL	Yes	Yes
PSUS, PFUS	P-VOL	Yes	Yes
	S-VOL	Yes	Yes
SMPL(PD)	P-VOL	Yes	Yes
	S-VOL	Yes	No
RCPY	P-VOL	Yes	No
	S-VOL	Yes	No

HTI volume		Access attribute to be assigned	
Pair status	Volume	Read/Write Read Only Protect	S-VOL Disable
PSUE	P-VOL	Yes	Yes
	S-VOL	Yes	No
Legend: Yes: You can perform the setting No: You cannot perform the setting.			

Sharing Thin Image volumes with Hitachi Volume Migration

You cannot do the following:

- Perform Thin Image tasks on volumes reserved for Volume Migration without regard to the migration plan status.
- Use Thin Image pair volumes or pool-VOLs as volumes reserved for Volume Migration V2.

For more information about the migration plan status and Volume Migration tasks, see the *Hitachi Volume Migration User Guide*.

Sharing Thin Image volumes with ShadowImage

You can share Thin Image (HTI) P-VOLs with ShadowImage (SI) P-VOL and S-VOLs.

Available Thin Image tasks

The following table lists the Thin Image tasks you can perform when sharing a Thin Image P-VOL with a ShadowImage P-VOL.

HTI task	SI pair status							
	COPY(PD)/ COPY	PAIR	COPY(SP)/ COPY	PSUS(SP)/ PSUS	PSUS	COPY(RS)/ COPY	COPY(RS-R)/ RCPY	PSUE
Create pair	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Store snapshot data	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Restore pair	No	No	No	No	Yes	No	No	Yes
Delete snapshot data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Release pair	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).								

The following table lists the Thin Image tasks you can perform when sharing a Thin Image P-VOL with a ShadowImage S-VOL.

HTI task	SI pair status							
	COPY(PD)/ COPY	PAIR	COPY(SP)/ COPY	PSUS(SP)/ PSUS	PSUS	COPY(RS)/ COPY	COPY(RS-R)/ RCPY	PSUE
Create pair	No	No	No	No	Yes	No	No	No
Store snapshot data	N/A	No	No	No	Yes	No	No	No
Store snapshot data for a consistency group	N/A	No	No	No	Yes*	No	No	No
Restore pair	N/A	No	No	No	Yes	No	No	No
Delete snapshot data	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Release pair	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* The SI pair status must be "PSUS" during the period between when you create the HTI pair to store snapshot data and when HTI starts to store snapshot data for a consistency group, and when all of the pairs in the consistency group are split ("PSUS" status). If the SI pair status changes to a status other than "PSUS" while HTI is storing snapshot data for the consistency group, the snapshot data consistency cannot be guaranteed.

Legend:

Yes: You can perform the task.
No: You cannot perform the task (the command is rejected).
N/A: Not applicable.

Available ShadowImage tasks

The following table lists the ShadowImage tasks you can perform when sharing a Thin Image P-VOL with a ShadowImage P-VOL.

SI task	HTI pair status					
	COPY	PAIR, PFUL	PSUS, PFUS	SMPL(PD)	RCPY	PSUE
Create pair	Yes	Yes	Yes	Yes	No	Yes
Create and split pair	Yes	Yes	Yes	Yes	No	Yes
Split pair	Yes	Yes	Yes	Yes	No	Yes
Normal Copy	Yes	Yes	Yes	Yes	No	Yes
Reverse Copy	Yes	Yes	Yes	Yes	No	Yes
Quick Restore	No	No	No	No	No	No
Suspend replication	Yes	Yes	Yes	Yes	Yes	Yes
Delete pair	Yes	Yes	Yes	Yes	Yes	Yes

Legend:

Yes: You can perform the task.

SI task	HTI pair status					
	COPY	PAIR, PFUL	PSUS, PFUS	SMPL(PD)	RCPY	PSUE
No: You cannot perform the task (the command is rejected).						

The following table lists the ShadowImage tasks you can perform when sharing a Thin Image P-VOL with a ShadowImage S-VOL.

SI task	HTI pair status					
	COPY	PAIR, PFUL	PSUS, PFUS	SMPL(PD)	RCP Y	PSUE
Create pair	No	No	No	No	No	No
Create and split pair	No	No	No	No	No	No
Split pair	Yes	Yes	Yes	Yes	No	Yes
Normal Copy	Yes	Yes	Yes	Yes	No	Yes
Reverse Copy	Yes	Yes	Yes	Yes	No	Yes
Quick Restore	No	No	No	No	No	No
Suspend replication	Yes	Yes	Yes	Yes	No	Yes
Delete pair	Yes	Yes	Yes	Yes	Yes	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).						

You can perform ShadowImage pair tasks after you store snapshot data, but the consistency of the stored snapshot data is not guaranteed.

Thin Image S-VOLs use the data in the P-VOL. You cannot Quick Restore in ShadowImage.

For more information about ShadowImage tasks and pair statuses, see the *Hitachi ShadowImage® User Guide*.

Caution: Thin Image uses MU numbers 0 to 1,023, and they are assigned in the order of 3 to 1,023, followed by 0 to 2. ShadowImage uses MU numbers 0 to 2. Thin Image cannot use the MU numbers 0 to 2 if you want to share Thin Image volumes with ShadowImage.

To share Thin Image volumes with ShadowImage if Thin Image is using the MU numbers 0 to 2:

1. Delete the Thin Image pair of the MU number 0 to 2.
2. Create the ShadowImage pairs and Thin Image pairs.

Sharing Thin Image volumes with TrueCopy and Universal Replicator

You can share Thin Image (HTI) P-VOLs with TrueCopy (TC) and Universal Replicator (UR) pair volumes.

The following tables list the relationship between pair tasks and status.

The following table lists the Thin Image tasks you can perform when the P-VOL is shared with a TrueCopy or Universal Replicator P-VOL.

HTI task	TC/UR status					
	COPY	PAIR	PSUS	PSUE	Suspending	Deleting
Create pair	Yes	Yes	Yes	Yes	Yes	Yes
Store snapshot data	Yes	Yes	Yes	Yes	Yes	Yes
Restore pair	No	No	Yes	Yes	No	No
Delete snapshot data	Yes	Yes	Yes	Yes	Yes	Yes
Delete pair	Yes	Yes	Yes	Yes	Yes	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).						

The following table lists the Thin Image tasks you can perform when the P-VOL is shared with a TrueCopy or Universal Replicator S-VOL.

HTI task	TC/UR status						
	COPY	PAIR	PSUS	PSUE	SSWS	Suspending	Deleting
Create pair	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Store snapshot data	No	Yes	Yes	Yes	Yes	Yes	Yes
Restore pair*	No	No	No	No	No	No	No
Delete snapshot data	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Delete pair	Yes	Yes	Yes	Yes	Yes	Yes	Yes
*When restoring an HTI pair and you are using the P-VOL as a TC or UR S-VOL, switch tasks to the remote storage system using the **horctakeover** command. Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).							

The following table lists the TrueCopy/Universal Replicator tasks you can perform when the Thin Image P-VOL is shared with a TrueCopy or Universal Replicator P-VOL.

TC/UR task	HTI status				
	COPY	PAIR, PFUL	PSUS, PFUS	RCPY	PSUE
Create pair	Yes	Yes	Yes	No	Yes
Split pair	Yes	Yes	Yes	N/A	Yes
Resynchronize pair	Yes	Yes	Yes	No	Yes
Delete pair	Yes	Yes	Yes	Yes	Yes

TC/UR task	HTI status				
	COPY	PAIR, PFUL	PSUS, PFUS	RCPY	PSUE
Switch to remote storage	Yes	Yes	Yes	No	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected). N/A: Not applicable					

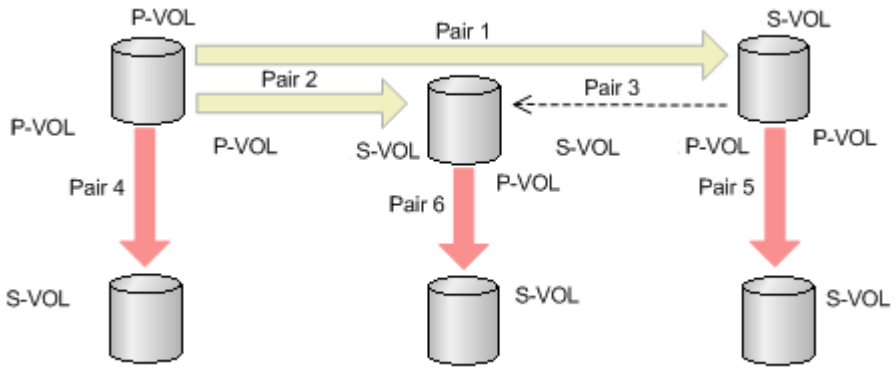
The following table lists the TrueCopy/Universal Replicator tasks you can perform when the Thin Image P-VOL is shared with a TrueCopy or Universal Replicator S-VOL.

TC/UR task	HTI status				
	COPY	PAIR, PFUL	PSUS, PFUS	RCPY	PSUE
Create pair	No	No	No	No	No
Split pair	Yes	Yes	Yes	N/A	Yes
Resynchronize pair	Yes	Yes	Yes	N/A	Yes
Delete pair	Yes	Yes	Yes	N/A	Yes
Switch to remote storage	Yes	Yes	Yes	N/A	Yes
*Use a TC/UR S-VOL as an HTI P-VOL. Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected). N/A: Not applicable					

Volume backup with Thin Image, TrueCopy, and Universal Replicator in a 3DC multitarget configuration workflow

You can use Thin Image to back up TrueCopy and Universal Replicator volumes on the remote sites in a 3DC multitarget configuration.

The following figure shows how to back up the volumes.



- Pair 1 is a TrueCopy pair.
- Pair 2 is a Universal Replicator pair.
- Pair 3 is a Universal Replicator pair for delta resync.
- Pairs 4, 5, and 6 are Thin Image pairs.

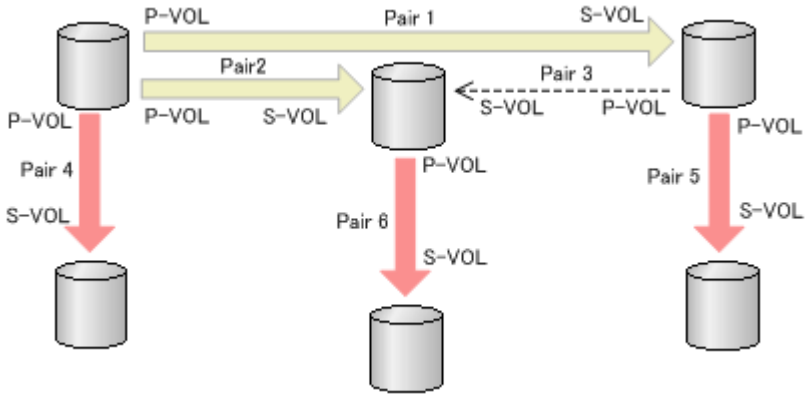
You must create 3DC multitarget and delta resync pairs (pairs 1, 2, and 3) before creating pairs 5 and 6, but pair 4 can be created at any time.

(VSP G200, G400, G600, G800 only) You cannot share 3DC volumes that use two mirrors with Thin Image.

Volume backup with Thin Image and Universal Replicator in a 3DC multitarget configuration workflow (VSP G1000, G1500, and VSP F1500)

You can use Thin Image to back up Universal Replicator volumes on the remote sites in a 3DC multitarget configuration.

The following figure shows how to back up the volumes.



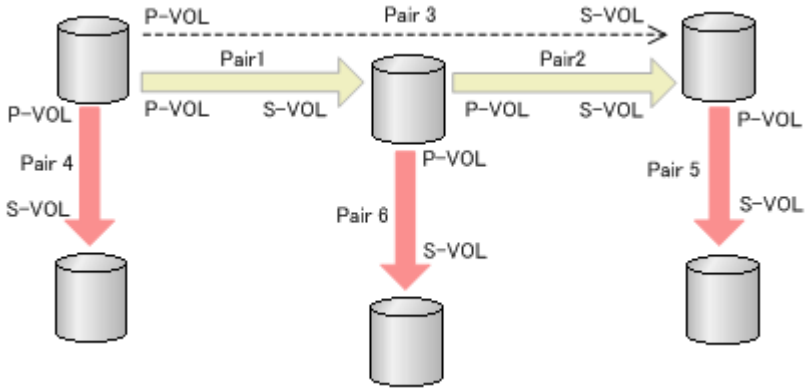
- Pairs 1 and 2 are Universal Replicator pairs.
- Pair 3 is a Universal Replicator pair for delta resync.
- Pairs 4, 5, and 6 are Thin Image pairs.

You must create pairs 1 and 2 before creating pairs 5 and 6, but pair 4 can be created at any time.

Volume backup with Thin Image and Universal Replicator in a 3DC cascade configuration workflow (VSP G1000, G1500, and VSP F1500)

You can use Thin Image to back up Universal Replicator volumes on the remote sites in a 3DC cascade configuration.

The following figure shows how to back up the volumes.



- Pairs 1 and 2 are Universal Replicator pairs.
- Pair 3 is a Universal Replicator pair for delta resync.
- Pairs 4, 5, and 6 are Thin Image pairs.

You must create pairs 1 and 2 before creating pairs 5 and 6, but pair 4 can be created at any time.

Sharing Thin Image volumes with global-active device

You can use a Thin Image (HTI) P-VOL as a global-active device (GAD) P-VOL or S-VOL.

The following tables list the relationship between Thin Image tasks and GAD pair status.

Note: If you share GAD volumes with Thin Image volumes, stop I/O to a volume before storing snapshot data. Snapshot consistency cannot be guaranteed if you store snapshot data without stopping I/O to the volume.

For more information about GAD, see the *Global-Active Device User Guide*.

The following table lists the Thin Image tasks you can perform when the P-VOL is shared with a GAD P-VOL.

GAD status	I/O mode	HTI task				
		Create pair	Store snapshot data	Restore pair	Delete snapshot data	Delete pair
COPY	Mirror (RL)	Yes	Yes	No	Yes	Yes
PAIR	Mirror (RL)	Yes	Yes	No	Yes	Yes
PSUS	Local	Yes	Yes	Yes	Yes	Yes
	Block	Yes	Yes	No	Yes	Yes
PSUE	Local	Yes	Yes	Yes	Yes	Yes

GAD status	I/O mode	HTI task				
		Create pair	Store snapshot data	Restore pair	Delete snapshot data	Delete pair
	Block	Yes	Yes	No	Yes	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).						

The following table lists the Thin Image tasks you can perform when the P-VOL is shared with a GAD S-VOL.

GAD status	I/O mode	HTI task				
		Create pair	Store snapshot data	Restore pair	Delete snapshot data	Delete pair
COPY	Block	No	No	No	No	Yes
PAIR	Mirror (RL)	Yes	Yes	No	Yes	Yes
SSUS	Block	Yes	Yes	No	Yes	Yes
PSUE	Block	Yes	Yes	No	Yes	Yes
SSWS	Local	Yes	Yes	No	Yes	Yes
Legend: Yes: You can perform the task. No: You cannot perform the task (the command is rejected).						

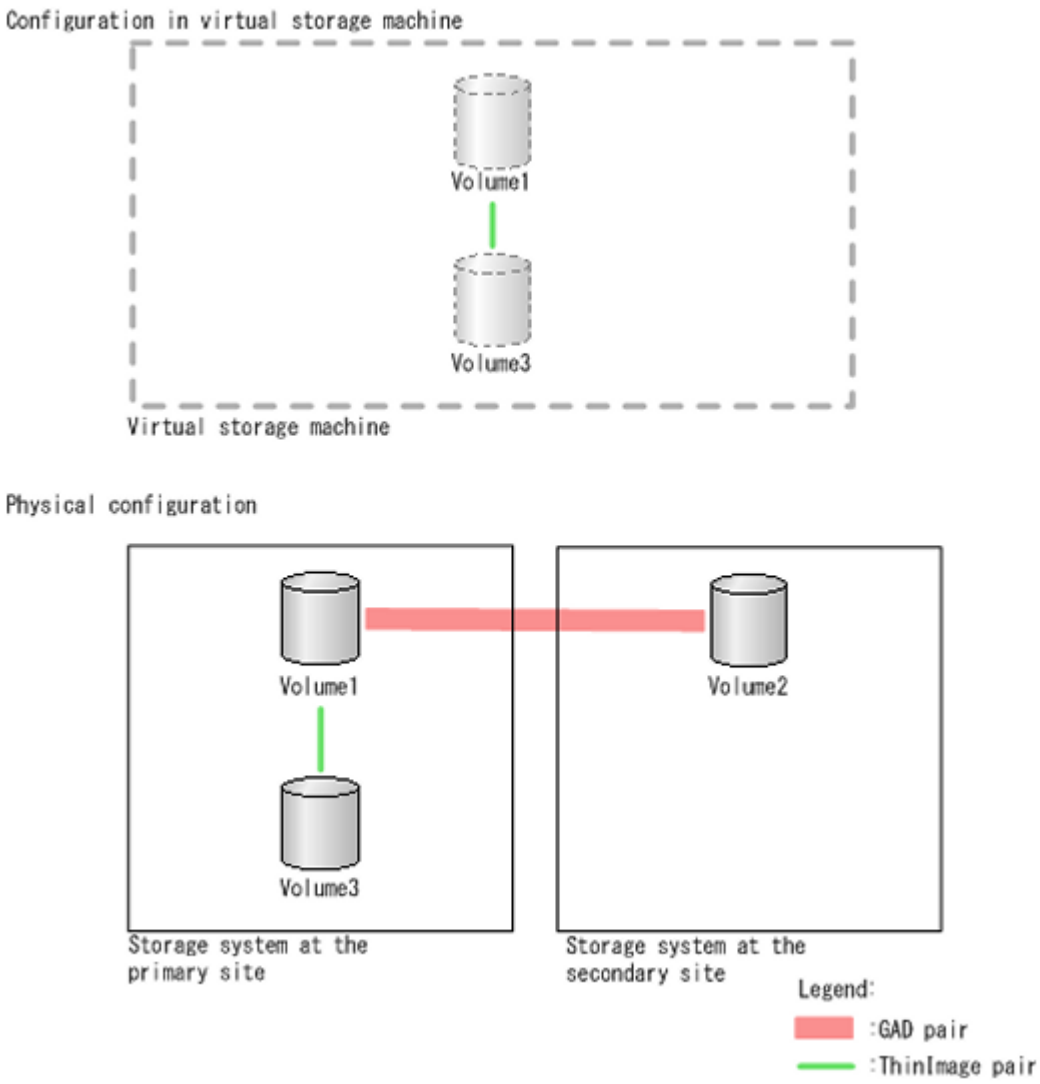
Storage system configuration with Thin Image and GAD

Not all storage system configurations are supported when sharing a Thin Image volume with a GAD volume.

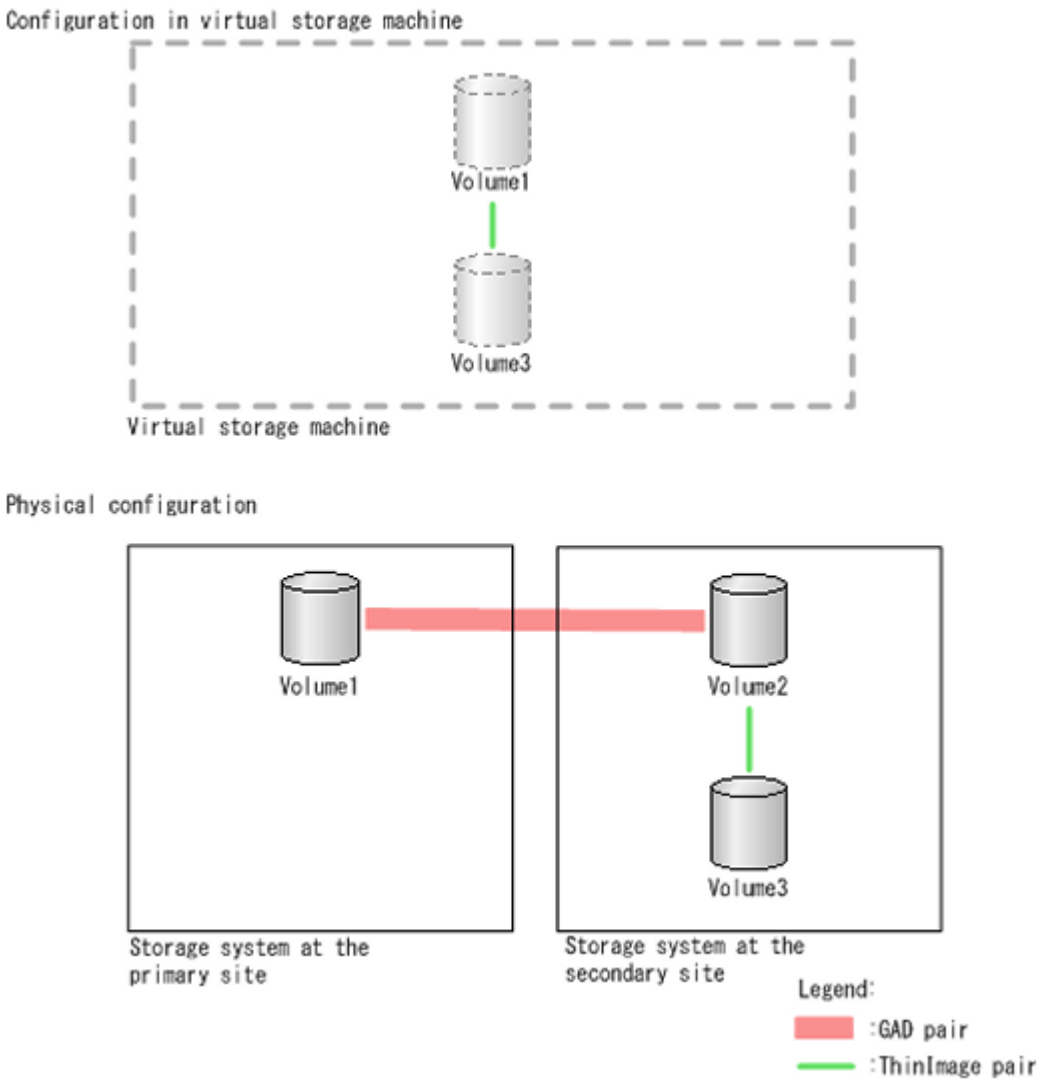
When you create a Thin Image pair using a volume from a GAD pair, the server recognizes the GAD P-VOL and S-VOL as a single volume. If you create Thin Image pairs using both the P-VOL and S-VOL of a GAD pair, the server recognizes the GAD P-VOL and S-VOL as a single volume being paired with multiple volumes by Thin Image.

Supported configurations

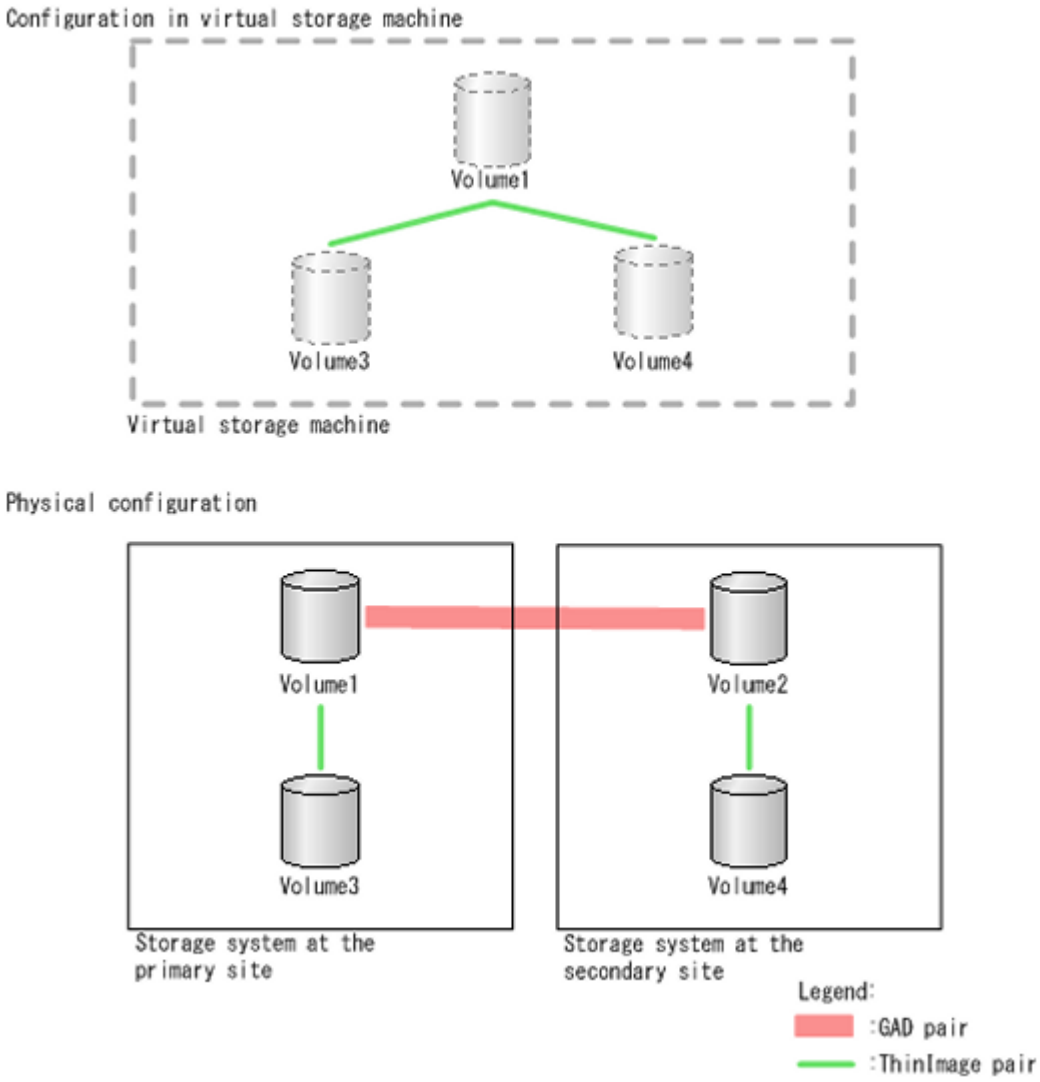
The following figure shows a supported storage system configuration with a Thin Image pair using a GAD P-VOL.



The following figure shows a supported storage system configuration with a Thin Image pair using a GAD S-VOL.

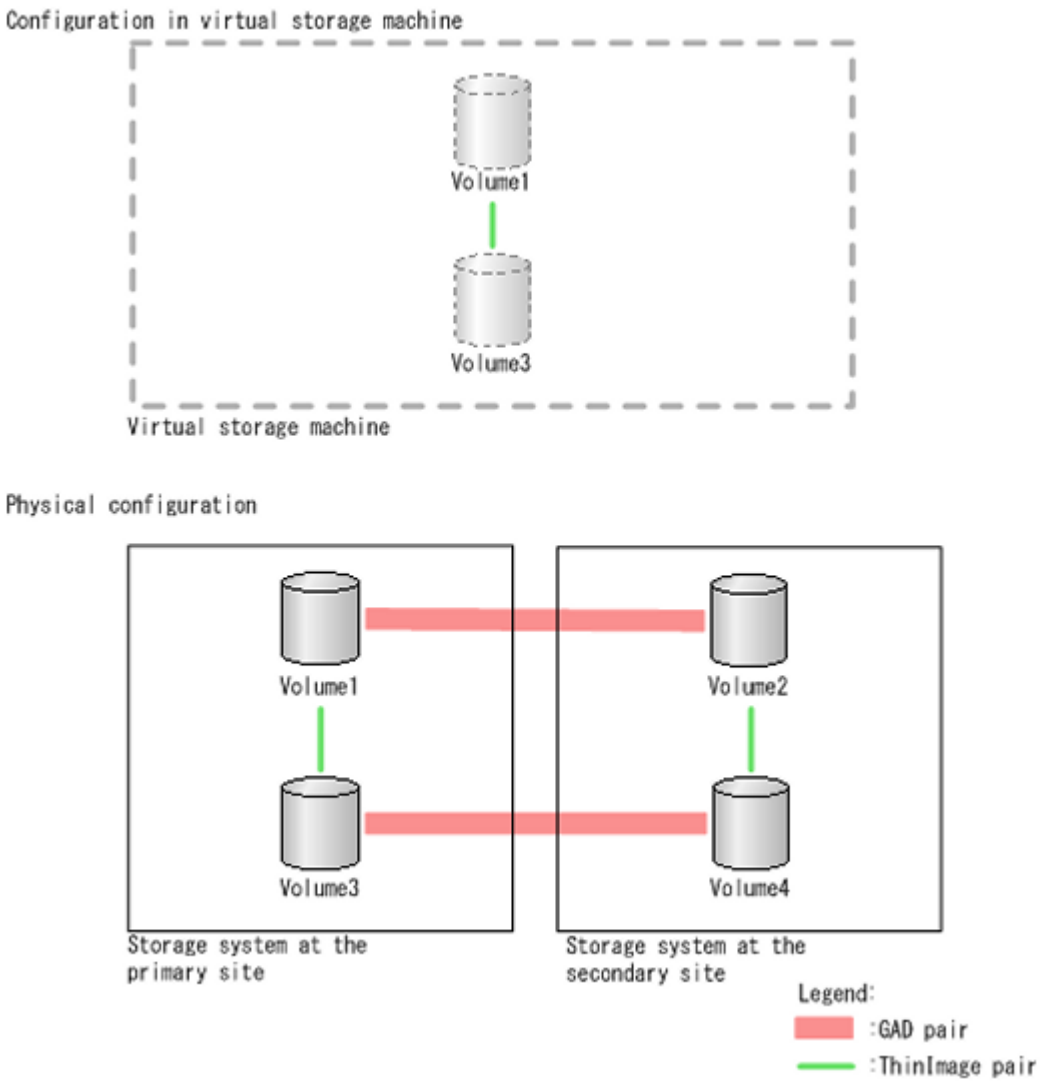


The following figure shows a supported storage system configuration with Thin Image pairs using a GAD P-VOL and S-VOL.



Unsupported configuration

You cannot create a GAD pair using Thin Image volumes that are already being used as a GAD P-VOL and S-VOL. The following figure shows this unsupported storage system configuration.



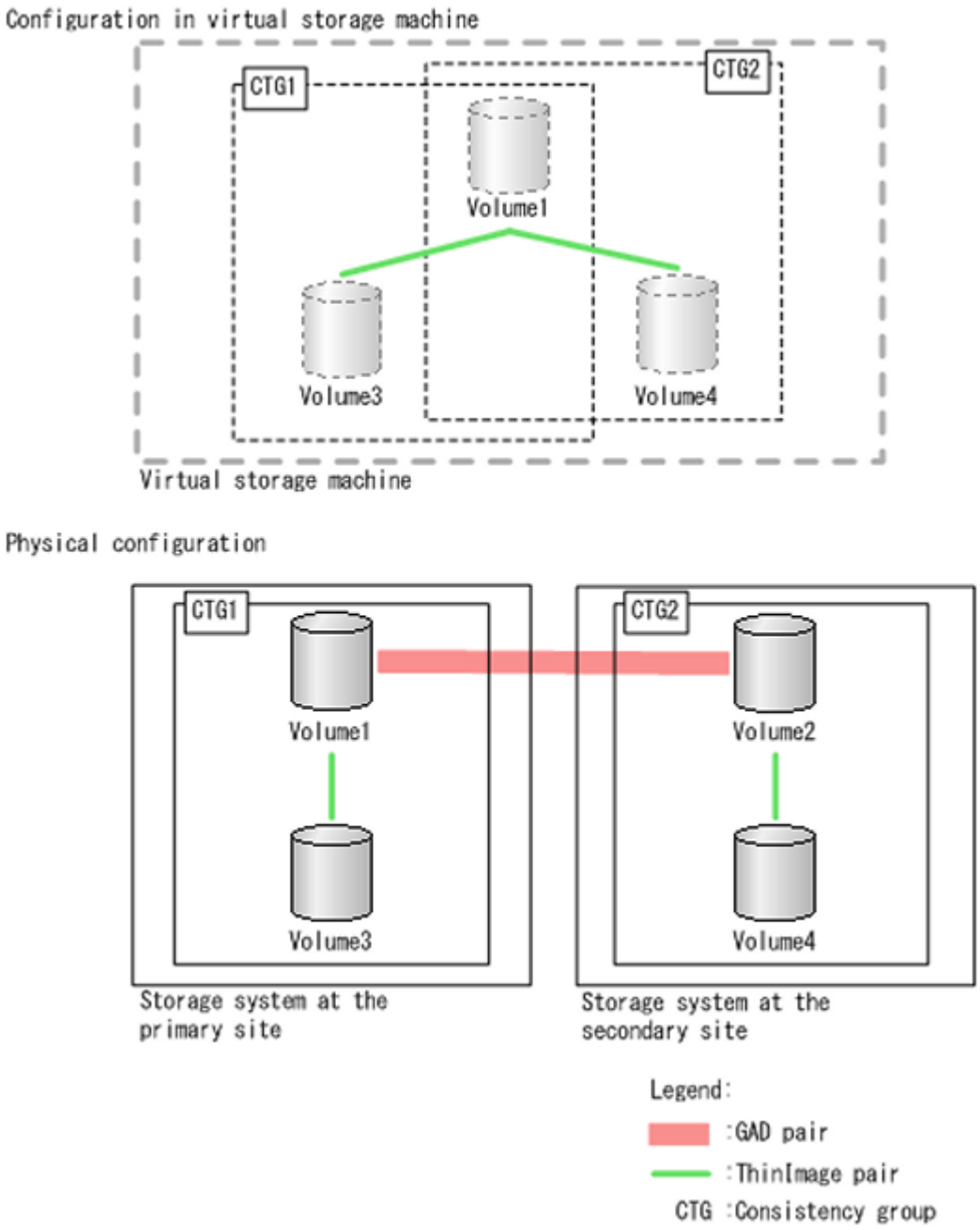
Consistency group configuration with Thin Image and GAD

Not all consistency group configurations are supported when sharing a Thin Image volume with a GAD volume.

Pairs in a Thin Image consistency group must be in the same storage system. Therefore, if a GAD P-VOL and S-VOL are each used in Thin Image pairs, the Thin Image pairs cannot be registered to the same consistency group.

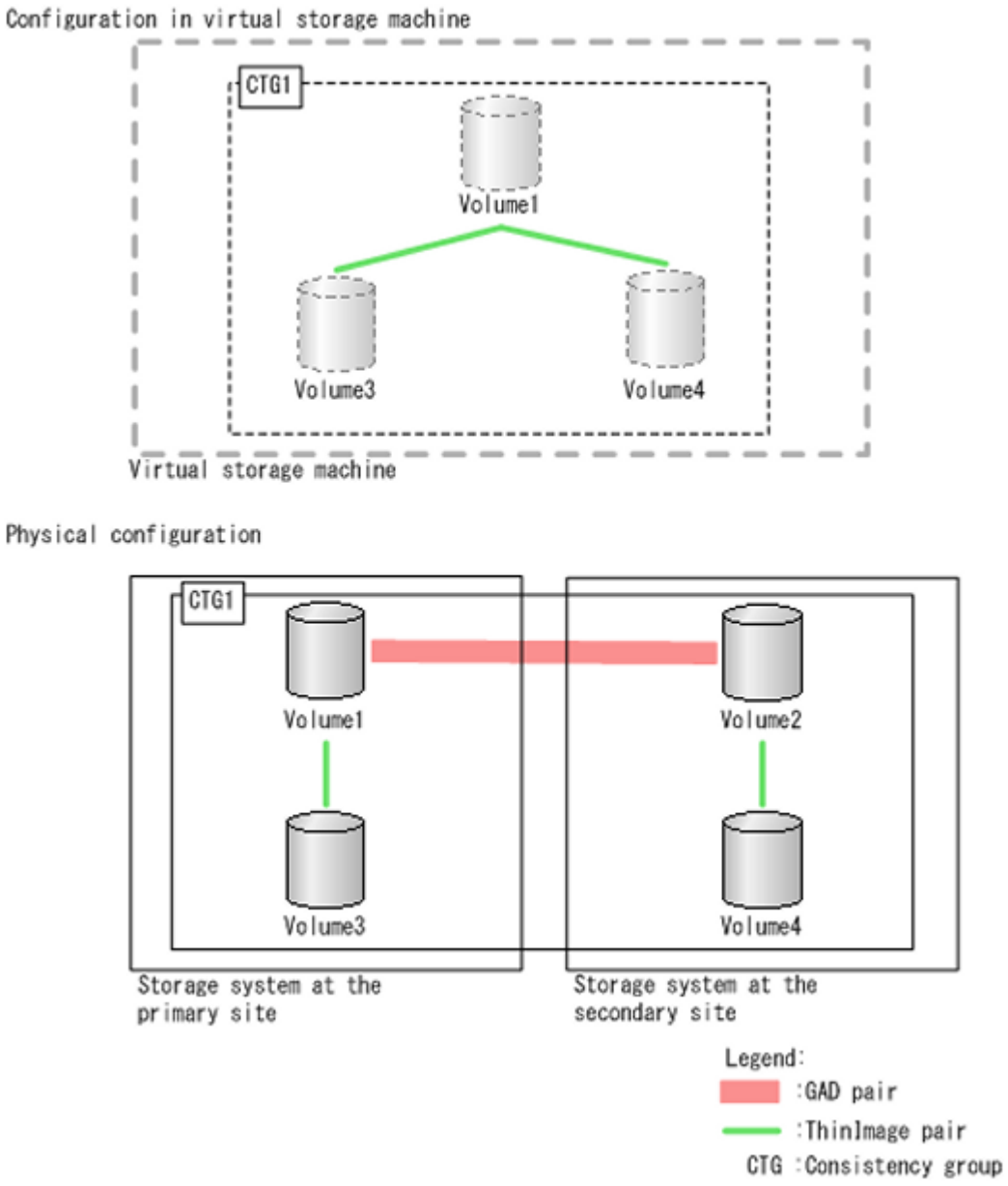
Supported configuration

The following figure shows a supported consistency group configuration.



Unsupported configuration

The following figure shows an unsupported consistency group configuration.



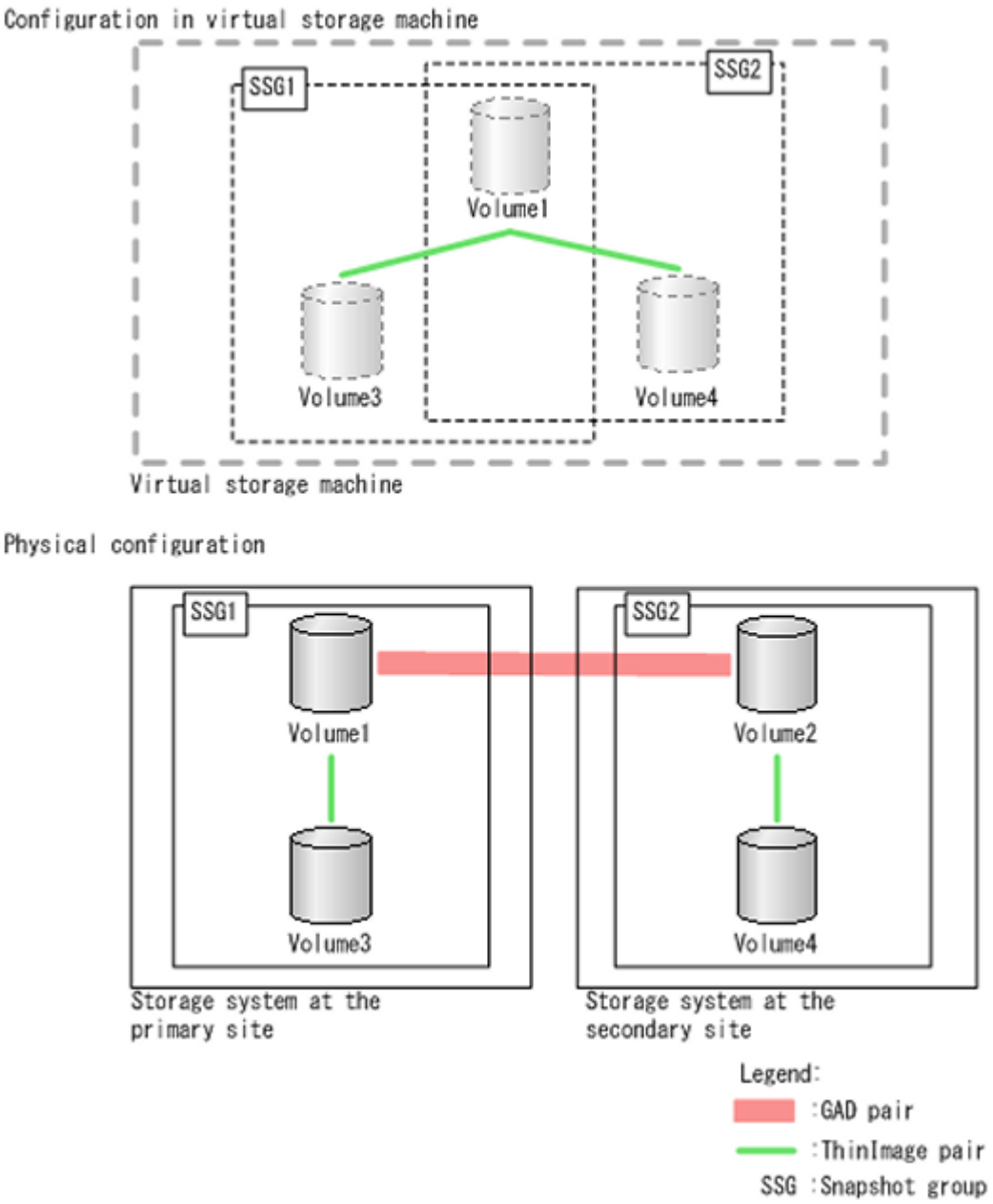
Snapshot group configuration with Thin Image and GAD

Not all snapshot group configurations are supported when sharing a Thin Image volume with a GAD volume.

Pairs in a Thin Image snapshot group must be in the same storage system. Therefore, if a GAD P-VOL and S-VOL are each used in Thin Image pairs, the Thin Image pairs cannot be registered to the same snapshot group.

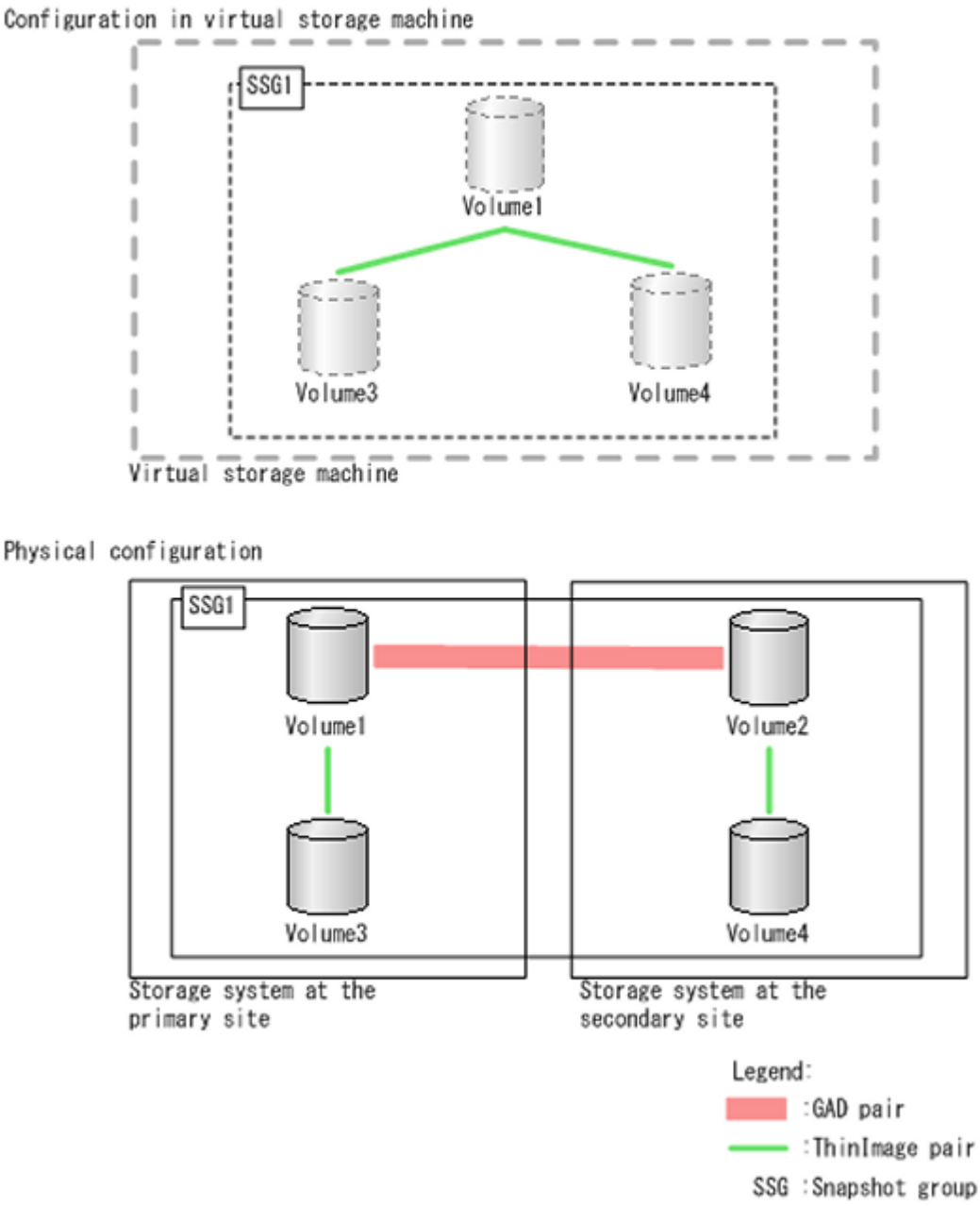
Supported configuration

The following figure shows a supported snapshot group configuration.



Unsupported configuration

The following figure shows an unsupported snapshot group configuration.



Sharing Thin Image volumes with Dynamic Provisioning and Dynamic Provisioning for Mainframe in a single storage system

If you are using Thin Image, Dynamic Provisioning, and Dynamic Provisioning for Mainframe in a single storage system, note the following when creating Thin Image pairs:

- Data compressed or deduplicated by the capacity saving function is copied to a volume. The capacity saving function is not performed immediately for copied data. Before creating or resynchronizing a Thin Image pair, make

sure that the available capacity in the copy destination volume is greater than the used capacity in the copy origination volume. For details, see the Provisioning Guide for Open Systems.

- If you create a Thin Image pair using a volume with the capacity saving function enabled, the compressed or deduplicated data is copied. Because of this, copy or I/O performance may be degraded.
- When the capacity saving function is used, management information is stored in a pool. As a result, there may be difference between a P-VOL and an S-VOL in the number of used pages or licensed capacity.
- (VSP G1000, G1500, and VSP F1500) The capacity saving function can be set on the P-VOL or S-VOL of a cascaded or clone pair, but only works on the clone pair. The deduplication system data volume cannot be used as a Thin Image P-VOL or S-VOL.
- (VSP Gx00 models and VSP Fx00 models) Although V-VOLs with the capacity saving function enabled can be used as P-VOLs, deduplication system data volumes cannot be used as P-VOLs.
- You can create a Thin Image pair whose P-VOL or S-VOL is a Dynamic Provisioning V-VOL only if you are not currently expanding the Dynamic Provisioning V-VOL capacity.
- Performing a Thin Image paircreate operation while zero pages are being reclaimed (including reclamation by Writesame, Unmap command, or rebalancing) results in the zero-page operation being interrupted.
- Thin Image pair creation might be rejected if the Unmap command operation is in progress with system option mode 905 ON. Wait a while and then retry the operation. If the operation still fails, set system option mode 905 to OFF and try again.
- You can use a maximum size Dynamic Provisioning volume as a Thin Image P-VOL or S-VOL. For information about the maximum size for Dynamic Provisioning volumes, see the *Provisioning Guide* for your storage system.

Related tasks

- Creating Thin Image V-VOLs on page 111
- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128

Sharing Thin Image volumes with Resource Partition Manager

You can create a Thin Image pair without regards to the resource group assignment of the P-VOL and S-VOLs. You must assign the pool you are using to the resource group where the P-VOL is assigned or to a resource group where you can create Thin Image pairs.

For more information about resource groups, see the *Provisioning Guide* for your storage system.

Acronyms and abbreviations for VSP family storage system software applications used in this guide

This user guide uses the following acronyms and abbreviations for software names.

- FCv2: Compatible FlashCopy® V2
- FCSE: Hitachi Compatible FlashCopy®
- GAD: global-active device
- SI: ShadowImage
- SIz: ShadowImage for Mainframe
- TC: TrueCopy
- TCz: TrueCopy for Mainframe
- HTI: Hitachi Thin Image
- UR: Universal Replicator
- URz: Universal Replicator for Mainframe

2

Thin Image system and planning requirements

This chapter discusses the planning and design requirements for using Thin Image. Read this before using Thin Image.

- Thin Image system requirements
- Thin Image planning requirements

Thin Image system requirements

The following is a list of requirements for performing HTI tasks:

- You have a VSP family storage system with P-VOL and S-VOLs.
- HTI and HDP, which run on HDvM - SN computers, are installed.
  HDP accesses data in pool-VOLs by way of V-VOLs. It can handle data in open-system servers such as UNIX and PC servers.
- The hardware and microcode (or firmware) is configured and set up.
- You have used HDvM - SN to install the license key for HDP.
  For more information about license keys and installing HDvM - SN and HDP, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system.

Installing Thin Image

Use this procedure to install Thin Image.

Procedure

1. Install Dynamic Provisioning.

   Note: Dynamic Provisioning is prerequisite software for Thin Image.

2. Install Thin Image.

Uninstalling Thin Image

Use this procedure to remove Thin Image from HDvM - SN.

Procedure

1. Delete the Thin Image pairs.
2. Delete all pools.
3. Remove Thin Image.

Related tasks

- Deleting Thin Image pairs on page 145
- Deleting pools on page 189

Thin Image licensed capacity requirements

Thin Image requires licensed capacity for the Thin Image P-VOLs and pools.

Thin Image uses a portion of the Dynamic Provisioning licensed capacity for its pool capacity. Make sure you have enough Dynamic Provisioning licensed capacity to run both HDP and Thin Image.

The following table shows the Thin Image volumes and capacity calculated as the Thin Image usage. The total amount of these values must not exceed the Thin Image licensed capacity.

Intended volumes			Intended capacity
Software application	**Volume type**	**Normal volume or DP-VOL**	
HTI	P-VOL	Normal volume	The volume capacity
		DP-VOL	The pool capacity used by the volume*
	Pool-VOL	Normal volume	The volume capacity
*For the volume with capacity saving enabled, HTI licensed capacity is the data capacity before saving.			

For more information about licenses, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system.

Related concepts

- VSP family software applications for Thin Image on page 26

Thin Image shared memory requirements

Thin Image requires dedicated shared memory (SM) for the Thin Image pair management area.

The Thin Image pair management area is an area used to store information for associating Thin Image pairs that is automatically created when you install shared memory.

Additional shared memory is required when the total capacity of all pools exceeds certain values. The following table shows the shared memory requirements for VSP G1000 and G1500, and VSP F1500:

Capacity of all pools	Capacity required for additional SM
Under 1.1 PB	None*
From 1.1 PB to 3.4 PB	8 GB
From 3.4 PB to 7.9 PB	24 GB
From 7.9 PB to 12.3 PB	40 GB
*You must expand SM when pool capacity is more than 1.1 PB.	

For VSP Gx00 models and VSP Fx00 models, additional shared memory is required when the total capacity of all pools exceeds the following values:

- VSP G200: 0.12 PB
- VSP G400, G600, G800, VSP F400, F600, F800: 0.2 PB

For more information about capacity available for additional shared memory for VSP Gx00 models and VSP Fx00 models, see the hardware guide for your storage system.

You can reduce or remove shared memory if the pools for Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image have been deleted.

For more information about how to expand, reduce, or remove shared memory, contact customer support.

Related concepts

- Switching off the power supply on page 196

Related tasks

- Deleting pools on page 189

Thin Image volume requirements

Thin Image requires three types of volumes.

The following types of volumes are required:

- P-VOLs
- S-VOLs
- Pool-VOLs

An S-VOL is only required if you want to create a Thin Image pair with an S-VOL specified. If you create a Thin Image pair without an S-VOL specified, an S-VOL is not necessary.

The following table lists the requirements for Thin Image P-VOLs.

Item	Requirement
Volume type	Logical volumes (LDEVs). You cannot specify the following volumes as HTI P-VOLs: • Pool-VOLs • HTI S-VOLs • Volumes that belong to parity groups for which accelerated compression is enabled • Deduplication system data volume For more information about creating pairs using other software applications, see Sharing Thin Image volumes with other software applications on page 43.
Emulation type	OPEN-V
Volume limit	32,768 For more information about the maximum number of HTI pairs, see Thin Image planning requirements on page 75.
Path definitions	Required. (Not required for cascaded pairs and pairs with the clone attribute)

Item	Requirement
Volume capacity limit	256 TB
Maximum number of cascades	64 layers (L64). For each primary volume, 1,024 S-VOLs can be used.
Maximum number of clones	1,024. When storing snapshot data, this number includes the number of snapshots.

The following table lists the requirements for Thin Image S-VOLs.

Item	Requirement
Volume type	Thin Image V-VOL (V-VOLs of provisioning type Snapshot) or DP-VOL. You cannot specify the following volumes as HTI S-VOLs: • Volumes that are already used as S-VOLs. • Volumes that other software applications are using for pairs or migration plans. • Deduplication system data volume.
Emulation type	OPEN-V
Maximum number of volumes	32,768 For more information about the maximum number of HTI pairs, see Thin Image planning requirements on page 75.
Path definitions	Required. (Not required for cascaded pairs and pairs with the clone attribute)

The following table lists the requirements for Thin Image pool-VOLs.

Item	Requirement
Volume type	Logical volumes (LDEVs). To maintain performance levels, use the following configurations: • Place normal volumes and pool-VOLs in separate parity groups (see Thin Image licensed capacity requirements on page 68). • Ensure that pool-VOLs consist of LDEVs from more than one parity group. You cannot specify the following volumes as HTI pool-VOLs: • LDEV whose LDEV status is other than Normal, Correction Access, or Copying. • Volumes that are already being used as HTI P-VOL or S-VOLs. • Volumes that are already contained in HTI, HDP, HDT, or active flash pools. • Volumes used as migration plans or pair volumes for another product. • Volumes for which you have used the Data Retention Utility to set Read Only, Protect, or S-VOL Disable attributes. • (VSP G1000, G1500, and VSP F1500) Cache Residency Manager volumes. • Command device volumes. • GAD volumes with the reservation attribute.

Item	Requirement
	• GAD volumes for quorum disks. • External volumes with the Data Direct Mapping attribute. • DP-VOLs with the Data Direct Mapping attribute. **Note:** The following restrictions apply to volumes used in the same data pool: • Volumes must be in the same resource group. • External pool-VOLs must have the same cache mode, either enabled or disabled. • When using both internal and external volumes, the external volumes must have cache mode enabled.
Emulation type	OPEN-V
RAID level	All RAID levels are supported.
Data drive type	You can use SAS and SSD.* Regardless of the type of the volume (internal volume or external volume), you can use pool-VOLs with different drive types in the same pool. For best performance, use pool-VOLs with the same drive type in the same pool. For more information about data drive type, see Pool creation and data drive type priority on page 104.
CLPR	Registering pool-VOLs to Cache Logical Partition Numbers (CLPRs) in pools: You can register pool-VOLs assigned to different CLPRs in a pool (see Workflow for registering virtual volumes on page 104). Changing CLPRs: You can change CLPRs in the parity group belonging to the pool-VOL. In this case, regardless of the CLPR in the pool-VOL, the CLPR ID in the parity must be the same as that of the P-VOL that you are using.
Pool limit	1,024
Volume capacity	8 GB to 4 TB
Path definition	Define only needed paths to a volume so that you can specify the volume as a pool-VOL.
*SSD contains SSD (SLC, MLC) and FMD.	

Thin Image data pool requirements

The following table lists the requirements for Thin Image data pools.

Item	Requirement
Pool capacity	Calculate the pool capacity (see Calculating and assigning pool capacity on page 78). The following are the maximum total capacity of pools in a storage system: • VSP G200: 3.5 PB (if Extension1 or Extension2 is added in the shared memory capacity).

Item	Requirement
	• VSP G400, G600, G800 and VSP F400, F600, F800: 6.5 PB (if Extension1, Extension2, Extension3, or Extension4 is added in the shared memory capacity). • Hitachi Virtual Storage Platform G1000 and G1500, and Virtual Storage Platform F1500: 12.3 PB (if DP/HDT/Active Flash/TI Extension1, DP/HDT/Active Flash/TI Extension2, or DP/HDT/Active Flash/TI Extension3 is added in the shared memory capacity). The maximum pool capacity that can be used for each primary volume is 768 TB.
Pool-VOL limit per pool	1,024 **Note:** You cannot assign a volume that is already assigned to a pool as a pool-VOL to another pool.
Pool limit per storage system	• VSP G200, VSP G400, G600: 64 Pool IDs are assigned from 0 to 63. • VSP G800, VSP G1000, G1500, and VSP F1500: 128 Pool IDs are assigned from 0 to 127. This can include HDP (including HDT and active flash), HDPz (including HDTz and active flash for mainframe), and HTI pool types.
Increasing capacity	Dynamically increase the pool-VOL capacity. To do this, increase the capacity for at least one parity group.
Decreasing pool capacity	Use the following workflow to decrease pool capacity: **1.** Delete the pool-VOLs (see Decreasing pool capacity on page 179). **2.** Reconfigure the pool (see Creating Thin Image data pools on page 98).
Deleting pools	The pool is not used by an HTI pair. For more information about deleting pools, see Deleting pools on page 189.
Data pool warning threshold	Value: *Warning Threshold* Range: 20 - 95%, in 1% increments. Default: 80% **Note:** If you exceed the data pool warning threshold, a warning is issued through a service information message (SIM) and an SNMP trap reporting excessive pool usage. For more information: • About editing the data pool warning threshold, see Editing the data pool warning threshold on page 183. • About checking alerts and checking the details of a SIM, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system. • About SNMP traps, see the *Hitachi SNMP Agent User Guide*.

Thin Image consistency group requirements

The following table explains requirements for Thin Image consistency groups.

Item	Requirement
Consistency group ID	Value: 0 to 2,047 With SI, SIz, and HTI, you can create up to 2,048 consistency groups in a VSP G1000, G1500, and VSP F1500 storage system. Manual assignment of a consistency group ID to an HTI pair using the **`paircreate`** command: • Specify a consistency group ID from 0 to 255. Automatic assignment of a consistency group ID to an HTI pair using the **`paircreate`** or **`raidcom add snapshot`** commands: • Using the **`paircreate`** command, if a number is not specified, an unassigned number from 0 to 255 is automatically assigned.[1] • Using the **`raidcom add snapshot`** command, if a number is not specified, an unassigned number from 0 to 2,047 is automatically assigned.[2] Consistency group ID is displayed in the following windows: • **Consistency Groups** tab in **Local Replication** window. • **Consistency Group Properties** window.
Pair limit	8,192 pairs per consistency group.
Pair type	SI, SIz, and Thin Image pairs cannot be contained in a single consistency group. For Thin Image consistency groups, only Thin Image pairs can be defined in a group. Snapshot and cloned pairs cannot be contained in a single consistency group.
Notes: **1.** Thin Image assigns a number in ascending order from 0 to 255. **2.** ShadowImage uses numbers from 0 to 127. Because of this, Thin Image assigns an unassigned number from 128 to 2,047 first. If there is no unassigned number from 128 to 2,047, then Thin Image assigns an unassigned number from 0 to 127. For microcode versions earlier than 80-05-0X-XX/XX, Thin Image assigns a number from 0 to 2,047. Therefore, if a consistency group was created in an earlier version, a number from 0 to 127 may be used as its consistency group ID even if there is an unassigned number from 128 to 2,047.	

Consistency group restrictions:

- Thin Image pairs that share P-VOLs or are in higher and lower layers of a snapshot tree cannot be defined in the same consistency group. If they are defined in the same consistency group, the **`raidcom add snapshot`** command is rejected.
- Do not place pairs that are not in consistency groups, in a group defined by the CCI configuration definition file. If these pairs are in the same group, the **`pairsplit`** command may terminate and the snapshot data may not be the P-VOL data generated when VSP G1000 and G1500, and VSP F1500 received the **`pairsplit`** command.
- Only one consistency group can be specified for a group defined in the CCI configuration definition file.

- When a pair where a consistency group is specified and already created, if you specify another consistency group to create a pair, the pair is added to the same consistency group.
- To specify multiple consistency groups, use the CCI configuration definition file to define the same number of groups as the consistency groups you want to specify.

Thin Image snapshot group requirements

The following table explains requirements for Thin Image snapshot groups.

Item	Requirement
Name	Character limit: 32. After you create a snapshot group, you cannot change the name.
Group and HTI pair limit	• Snapshot groups per storage system: 2,048. • HTI pairs per snapshot group: 8,192.
Pair type	Snapshot and cloned pairs cannot be contained in a single snapshot group.

Restrictions for Snapshot groups:

- When creating a Thin Image cascaded pair with the CTG mode specified using CCI, a volume belonging to the snapshot group and the following volumes cannot be contained in the same snapshot group:
  - The P-VOL or S-VOL of a volume belonging to the snapshot group
  - A volume that uses the same P-VOL with a different MU number as the volume belonging to the snapshot group

Thin Image planning requirements

You must calculate the number of Thin Image pairs you can create.

When you create Thin Image pairs for a P-VOL for the first time, the number of pairs that you can create in a storage system depends on several variables.

- The number of Thin Image pairs that you can create based on the number of available pair tables.
- The snapshot estimated manageable capacity.
- The number of cache management devices that you must make available.

The smallest of the three calculations is the maximum number of Thin Image pairs that you can create in the storage system.

When you create Thin Image pairs again, you only need to know the number of pair tables to calculate the number of pairs that you can create. You do not need to know the snapshot estimated manageable capacity or the number of cache management devices.

If you have multiple P-VOLs, calculate the number of Thin Image pairs that you can create for each P-VOL in the storage system.

Calculating the number of Thin Image pairs based on pair tables

Pair tables contain information that is required to manage HTI pairs. Each HTI pair requires at least one pair table.

The number of HTI pairs that you will need is *maximum-number-of-existing-pair-tables - number-of-existing-pairs*.

Maximum number of pair tables:

- VSP Gx00 models and VSP Fx00 models: 102,400
- VSP G1000, G1500, and VSP F1500: 1,048,575

To view the number of existing HTI pairs, see Viewing local replication summary information on page 157.

Calculating Thin Image pairs based on the snapshot estimated manageable capacity

You can calculate the number of HTI pairs you can create based on the snapshot estimated manageable capacity.

To view the snapshot estimated manageable capacity, see Viewing local replication summary information on page 157.

Calculate the number of HTI pairs that you can create using the following formulas, where SM refers to shared memory:

```
Number of HTI pairs that you can create =
Snapshot estimated manageable capacity / Snapshot management
capacity in a P-VOL
```

```
Snapshot estimated manageable capacity in a P-VOL [GB] =
(P-VOL capacity of HTI pairs [TB] / 2.6) * 3,024 + (168 * 2
(consumed shared memory [GB]))
```

Related tasks

- Viewing the list of primary volumes on page 159

Calculating Thin Image pairs based on cache management devices

Cache management devices are the unit for controlling the cache in association with logical volumes (LDEVs). They are required to perform HTI tasks, such as creating HTI pairs for a volume.

To view the number of cache management devices, see Viewing the number of cache management devices on page 171.

Use the following formula to calculate the number of HTI pairs that you can create based on the number of cache management devices:

```
Number of HTI pairs that you can create =
Number of cache management devices / ceil (the P-VOL capacity of
HTI pairs [TB]) / 2.6)
```

Related concepts

- Calculating the number of remaining cache management devices on page 211

Calculating the number of cache management devices

You can calculate the number of cache management devices you must reserve to initially create a Thin Image pair for a volume.

Use the following formula:

```
Number of cache management devices that you must reserve =
ceil (Size of P-VOL [TB] / 2.6)
```

If the amount of pool usage for the P-VOL exceeds 70 percent of the total capacity of the cache management devices reserved for the P-VOL, you must reserve another cache management device. You can reserve a maximum of 256 cache management devices for each P-VOL.

Thin Image cache management device requirements

The following table shows the cache management device requirements for performing Thin Image tasks.

Task	Number of cache management devices required
Initially create an HTI pool.	• VSP G200: 3,840 • VSP G400, G600 and VSP F400, F600: 7,936 • VSP G800 and VSP F800: 32,512 • VSP G1000, G1500, and VSP F1500: 8,192* *HTI assigns 4,096 of the 8,192 devices that are available.
Create a volume.	1
Create a P-VOL.	256
Initially create an HTI pair for a volume. (VSP G1000, G1500, and VSP F1500)	4,097

(VSP G1000, G1500, and VSP F1500) You can manage up to 65,280 cache management devices in a storage system.

Calculating and assigning pool capacity

Use these formulas to calculate and assign pool capacity.

Use the following formula to calculate the capacity of the snapshot data that you can store in the pool:

```
Capacity of the snapshot data that you can store in the pool =
Total capacity of pool-VOLs in the pool - Capacity of V-VOL
management areas
```

The capacity of V-VOL management areas is 3% of the pool capacity.

Use the following formula to calculate the pool capacity:

```
Capacity of the pool [MB] =
Total number of pages * 42 - 4200
```

Use the following formula to calculate the total number of pages:

```
Total number of pages =
Sigma (floor (floor (pool-VOL number of blocks / 512) / 168))
for each pool-VOL
```

floor( ): Truncates the value calculated from the formula in parentheses after the decimal point.

Estimate pool-VOL capacity in multiples of 42 MB. Specifying a pool-VOL capacity in other multiples less than 42 MB truncates the fraction.

If you install HDP/HDT/HTI Extension in the shared memory, the available pool capacity per P-VOL is 768 TB, and the total capacity of all pools depends on the storage system model:

- VSP G200: 3.5 PB (when Extension1 and Extension2 are added to the shared memory capacity)
- VSP G400, G600, G800 and VSP F400, F600, F800: 6.5 PB (when Extension1, Extension2, Extension3, and Extension4 are added to the shared memory capacity)
- VSP G1000 and G1500, and VSP F1500: 12.3 PB

Related references

- Thin Image shared memory requirements on page 69

Resolving insufficient pool capacity

Make sure you have sufficient pool capacity. If the pool capacity is insufficient, the storage system can suspend Thin Image pairs ("PSUE" status).

Procedure

1. Estimate the capacity of snapshot data to be copied to the pool.
   If the capacity of snapshot data to be copied to the pool varies hour by hour, ensure that the largest capacity is your pool capacity.
2. Assign the pool capacity based on the estimate.

Pool capacity calculations

You can calculate the required pool capacity by estimating the capacity of snapshot data to be copied.

Use the following formula:

```
Capacity of snapshot data to be copied =
Capacity of data written to the same area in the P-VOL during
the period from when snapshot data is stored to when the
snapshot data is deleted
```

Although the pool capacity is decided according to the estimation, if the pool capacity exceeds the threshold, address the issue.

If multiple snapshot data are stored, the data may be shared in a pool. In this case, you can release Thin Image pairs, but the snapshot data cannot be deleted from the pool. If you release all Thin Image pairs that have snapshot data containing the shared data, the snapshot data are also deleted from the pool.

Creating a backup of data

You can create a backup of data using Thin Image. When creating a backup from the S-VOL after storing snapshot data, the target for the backup is only the areas where the snapshot data is stored. Therefore, you can create a backup copy even if the pool capacity is small.

During creation of a backup copy, a significant amount of data is read from the secondary volume. This may increase the accesses to the primary volume and degrade the host I/O performance.

Procedure

1. Store the snapshot data, or perform clones.
2. Use an S-VOL.

Related tasks

- Splitting Thin Image pairs to store snapshot data on page 135

Universal Volume Manager and external volumes used as pool-VOLs

You can use Universal Volume Manager (UVM) to connect a VSP family storage system to other storage systems.

In UVM, a VSP family storage system is referred to as a local storage system, and the other storage systems are referred to as external storage systems. With UVM installed, you can use external and internal volumes as pool-VOLs. Volumes in local storage systems are referred to as internal volumes, and volumes in external storage systems are referred to as external volumes.

Note: Using external volumes increases the likelihood of a failure, and disaster recovery is more complex and challenging. Using multiple external volumes as pool-VOLs in a pool increases the likelihood of the pool being blocked.

To minimize the adverse effects of failure, use only one pool per external storage system. An external pool-VOL that is blocked due to a failure blocks the pool. You must restore blocked pools.

For more information about external storage systems and disaster recovery methods for external volumes, see the *Hitachi Universal Volume Manager User Guide*.

Simultaneous processing of multiple Thin Image pair tasks

Some Thin Image pair task operations are processed in the background after the requested task is accepted. The total number of instances of each pair task that can be simultaneously processed in a storage system is limited by the number of MP blades (or units) in the storage system.

Note: The terms "blade" and "unit" refer to the same hardware on different VSP storage systems. The term "blade" is used for VSP G1000, G1500, and VSP F1500, and the term "unit" is used for VSP G200, G400, G600, G800.

For each of the following pair tasks, the number of simultaneous instances processed in the background is equal to the total number of MP blades (or units) in the storage system:

- Creating pairs.
- Restoring pairs.
- Deleting snapshot data and deleting pairs.

When you execute additional pair task operations above these limits, the tasks are processed in the order requested.

Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128
- Restoring Thin Image pairs on page 140
- Resynchronizing Thin Image pairs on page 143
- Deleting Thin Image pairs on page 145

Pair operations when pairs are cascaded (VSP G1000, G1500, and VSP F1500)

The following table explains pair operations according to the pair status. The status of pair B is SMPL.

Pair type	Pair A status	Operation for pair B						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N	N	N	N	N	N	YN
	PAIR	Y	N	N	N	Y	N	YN
	PSUS	Y	N	N	N	Y	N	YN
	COPY(RS)	N	N	N	N	N	N	YN
	COPY(RS-R)	N	N	N	N	N	N	YN
	PSUE	N	N	N	N	N	N	YN
	SMPL(PD)	N	N	N	N	N	N	YN
With the clone attribute	COPY(PD)	N	N	N	N	N	N	YN
	PAIR	Y	N	N	N	Y	N	YN
	PSUS(SP)	Y	N	N	N	Y	N	YN
	PSUE	N	N	N	N	N	N	YN
	SMPL(PD)	N	N	N	N	N	N	YN

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair B when pair B has the snapshot attribute, and its pair status is COPY(PD).

Pair Type	Pair A status	Operation for pair B						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PAIR	YN	N	YN	YN	N	N	N
	PSUS	YN	N	YN	YN	N	N	N
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	YN	N	YN	YN	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	YN	N	YN	YN	N	N	N
	PAIR	YN	N	YN	YN	N	N	N
	PSUS(SP)	YN	N	YN	YN	N	N	N
	PSUE	YN	N	YN	YN	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair A when pair B has the snapshot attribute, and its pair status is COPY(PD).

Pair Type	Pair A status	Operation for pair A						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PAIR	N	Y	YN	YN	N	N	N
	PSUS	N	YN	Y	Y	N	N	N
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	YN	N	YN	YN	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	N
	PAIR	N	N	N	N	N	Y	N
	PSUS(SP)	N	N	N	N	N	YN	N
	PSUE	N	N	N	N	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair B when pair B has the clone attribute, and its pair status is COPY(PD).

Pair Type	Pair A status	Operation for pair B						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PAIR	N	N	N	N	N	N	Y
	PSUS	N	N	N	N	N	N	Y
	COPY(RS)	N	N	N	N	N	N	Y
	COPY(RS-R)	N	N	N	N	N	N	Y
	PSUE	N	N	N	N	N	N	Y
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	Y
	PAIR	N	N	N	N	N	N	Y
	PSUS(SP)	N	N	N	N	N	N	Y
	PSUE	N	N	N	N	N	N	Y
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Y: Operation successful. N: Process terminated irregularly.								

The following table explains operations of cascaded pair A when pair B has the clone attribute, and its pair status is COPY(PD).

Pair type	Pair A status	Operation for pair A						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PAIR	N	Y	YN	YN	N	N	N
	PSUS	N	YN	Y	Y	N	N	N
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	N	N	N	N	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	N
	PAIR	N	N	N	N	N	Y	N
	PSUS(SP)	N	N	N	N	N	YN	N
	PSUE	N	N	N	N	N	N	N
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair B when pair B has the snapshot attribute and its pair status is PAIR.

Pair type	Pair A status	Operation for pair B						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N	N	YN	YN	N	N	Y
	PAIR	N	N	YN	YN	N	N	Y
	PSUS	N	Y	YN	YN	N	N	Y
	COPY(RS)	N	N	YN	YN	N	N	Y
	COPY(RS-R)	N	N	YN	YN	N	N	Y
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	YN	YN	N	N	Y
	PAIR	N	N	YN	YN	N	N	Y
	PSUS(SP)	N	Y	YN	YN	N	N	Y
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair A when pair B has the snapshot attribute, and its pair status is PAIR.

Pair type	Pair A status	Operation for pair A						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	YN	N	YN	YN	N	N	N
	PAIR	N	Y	YN	YN	N	N	N
	PSUS	N	YN	Y	Y	N	N	N
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	N
	PAIR	N	N	N	N	N	Y	N
	PSUS(SP)	N	N	N	N	N	YN	N
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair B when pair B has the clone attribute and its pair status is PAIR.

Pair type	Pair A status	Operation for pair B						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	N	N	N	N	N	N	Y
	PAIR	N	N	N	N	N	N	Y
	PSUS	N	N	N	N	N	Y	Y
	COPY(RS)	N	N	N	N	N	N	Y
	COPY(RS-R)	N	N	N	N	N	N	Y
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	Y
	PAIR	N	N	N	N	N	Y	Y
	PSUS(SP)	N	N	N	N	N	Y	Y
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair A when pair B has the clone attribute, and its pair status is PAIR.

Pair type	Pair A status	Operation for pair A						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	COPY(PD)	YN	N	YN	YN	N	N	N
	PAIR	N	Y	YN	YN	N	N	N
	PSUS	N	YN	Y	Y	N	N	N
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With the clone attribute	COPY(PD)	N	N	N	N	N	N	N
	PAIR	N	N	N	N	N	Y	N
	PSUS(SP)	N	N	N	N	N	YN	N
	PSUE	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SMPL(PD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

The following table explains operations of cascaded pair B when the status of pair B is not SMPL, COPY(PD), and PAIR.

Pair type	Pair A status	Pair B status	Operation for pair B						
			Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
			Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	PSUS	PSUS [1]	N	YN	Y	Y	N	N	Y
	PSUS	COPY(RS) [1]	YN	N	YN	YN	N	N	N
	PSUS	COPY(RS-R) [1]	YN	N	YN	YN	N	N	N
	PSUS	PSUE [1]	N	N	Y	N	N	N	Y
	PSUS	SMPL(PD) [1]	N	N	N	N	N	N	YN
	PSUS	PSUS(SP) [2]	N	N	N	N	N	N	Y
With the clone attribute	PSUS(SP)	PSUS(SP) [2]	N	N	N	N	N	N	Y
	PSUS(SP)	PSUE [2]	N	N	N	N	N	N	Y
	PSUS(SP)	SMPL(PD) [2]	N	N	N	N	N	N	YN
	PSUS(SP)	PSUS [1]	N	YN	Y	Y	N	N	N

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

Notes

1. Pair B has snapshot attribute.

2. Pair B has clone attribute.

The following table explains operations of cascaded pair A when the status of pair B is not SMPL, COPY(PD), and PAIR.

Pair type	Pair A status	Pair B status	Operation for pair A						
			Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
			Create	Split	Resync	Restore	Create	Split	Delete
With the snapshot attribute	PSUS	PSUS [1]	N	YN	N	N	N	N	N
	PSUS	COPY(RS) [1]	N	YN	N	N	N	N	N
	PSUS	COPY(RS-R) [1]	N	YN	N	N	N	N	N
	PSUS	PSUE [1]	N	YN	N	N	N	N	N
	PSUS	SMPL(PD) [1]	N	YN	N	N	N	N	N
	PSUS	PSUS(SP) [2]	N	YN	N	N	N	N	N
With the clone attribute	PSUS(SP)	PSUS(SP) [2]	N	N	N	N	N	YN	N
	PSUS(SP)	PSUE [2]	N	N	N	N	N	YN	N
	PSUS(SP)	SMPL(PD) [2]	N	N	N	N	N	YN	N
	PSUS(SP)	PSUS [1]	N	N	N	N	N	YN	N

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

Notes

1. Pair B has snapshot attribute.
2. Pair B has clone attribute.

Pair operations when pairs are not cascaded (VSP G1000, G1500, and VSP F1500)

The following table explains pair operations according to the pair status.

Pair type	Pair A status	Operation for pair A						
		Pair with snapshot attribute				Pair with clone attribute		Snapshot / clone attribute common
		Create	Split	Resync	Restore	Create	Split	Delete
N/A	SMPL	Y	N	N	N	Y	N	YN
With the snapshot attribute	COPY(PD)	YN	N	YN	YN	N	N	N
	PAIR	N	Y	YN	YN	N	N	Y
	PSUS	N	YN	Y	Y	N	N	Y
	COPY(RS)	YN	N	YN	YN	N	N	N
	COPY(RS-R)	YN	N	YN	YN	N	N	N
	PSUE	N	N	Y	N	N	N	Y
	SMPL(PD)	N	N	N	N	N	N	YN
With the clone attribute	COPY(PD)	N	N	N	N	N	N	Y
	PAIR	N	N	N	N	N	Y	Y
	PSUS(SP)	N	N	N	N	N	YN	Y
	PSUE	N	N	N	N	N	N	Y
	SMPL(PD)	N	N	N	N	N	N	YN

Y: Operation successful.

YN: Operation not performed, process terminated.

N: Process terminated irregularly.

Differences between Thin Image and ShadowImage

Item	Thin Image (HTI)	ShadowImage (SI)
P-VOL physical failures such as hard disks.	P-VOL data cannot be guaranteed.	P-VOL data can be recovered using the S-VOL.
P-VOL logical failures such as data update errors or viruses.	P-VOL data can be recovered using the S-VOL.	P-VOL data can be recovered using the S-VOL.

Item	Thin Image (HTI)	ShadowImage (SI)
Capacity required for backup.	Less capacity is required for backups because only differential data of the P-VOL is retained.[1]	More capacity is required for backup because all data in the P-VOL is retained.
Impact on P-VOL performance when accessing backed up data.	P-VOL performance is affected because data in the P-VOL is shared.[2]	P-VOL performance is not affected because the P-VOL and the S-VOL can be disconnected.

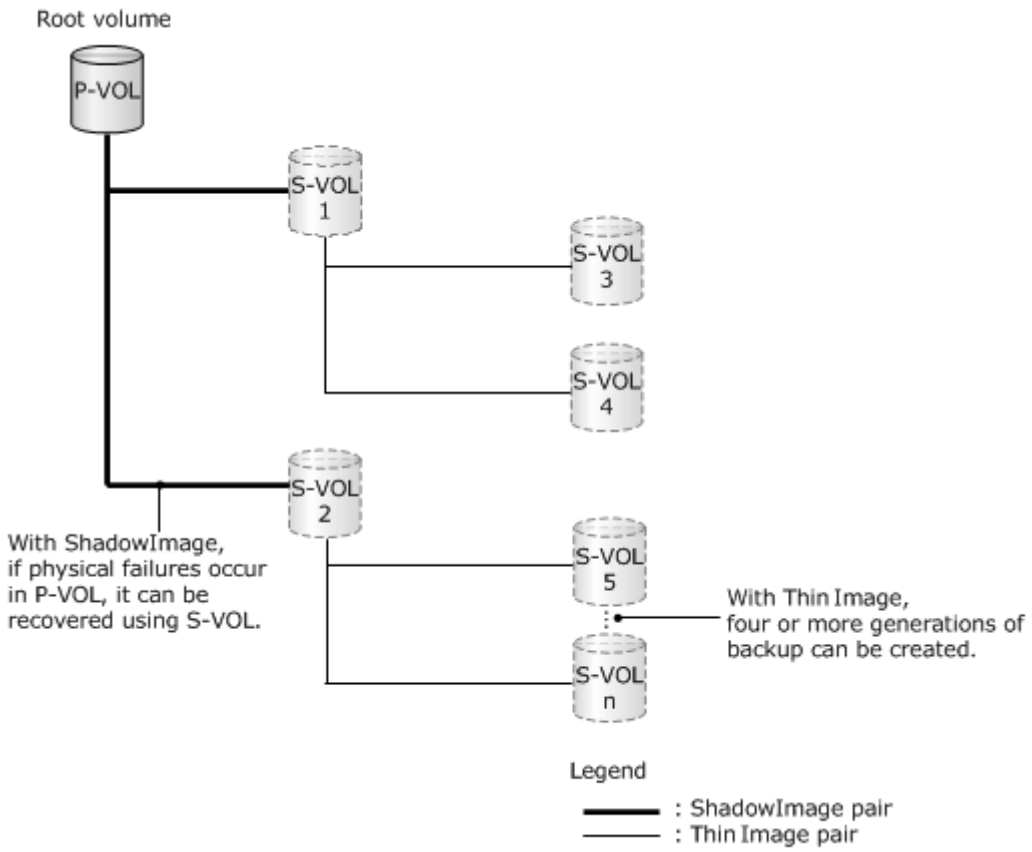
Notes:

1. (VSP G1000, G1500, and VSP F1500) For pairs with the snapshot attribute. When a cloned pair is created, all data in the P-VOL is retained and more capacity is required for backup.
2. (VSP G1000, G1500, and VSP F1500) For pairs with the snapshot attribute. When a cloned pair is created, the P-VOL and the S-VOL can be separated and the P-VOL performance is not affected.

Recommended usage

To maintain backed up data for long periods, save it on magnetic tapes or other media. For temporary backups use HTI or SI. When backing up data to magnetic tapes use SI. To reduce the capacity necessary for backups use HTI, but note that this affects P-VOL performance.

Use SI to minimize the impact from P-VOL physical failures. If you need four or more generations of backups, use both SI and HTI as shown in the following figure.



Use HTI to minimize P-VOL logical failures.

3

Configuring Thin Image

This chapter describes how to create data pools, create LDEVs, and use the settings of the command device to configure Thin Image.

- ☐ Prerequisites for configuring Thin Image
- ☐ Workflow for configuring Thin Image
- ☐ Workflow for registering virtual volumes
- ☐ Overview of using CCI to run commands through in-band connections
- ☐ Changing system options that affect Thin Image performance

Prerequisites for configuring Thin Image

Before you perform Thin Image configuration tasks, complete the following tasks:

- Install a sufficient amount of shared memory.
  For more information about installing shared memory, contact customer support.
- Create a V-VOL management area in the shared memory. This area is automatically created when you install additional shared memory.

Related references

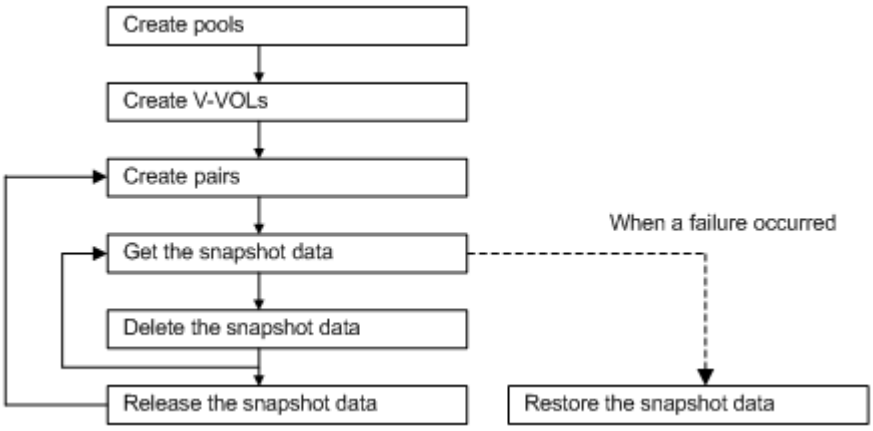
- Thin Image shared memory requirements on page 69

Workflow for configuring Thin Image

Use this workflow to configure Thin Image.

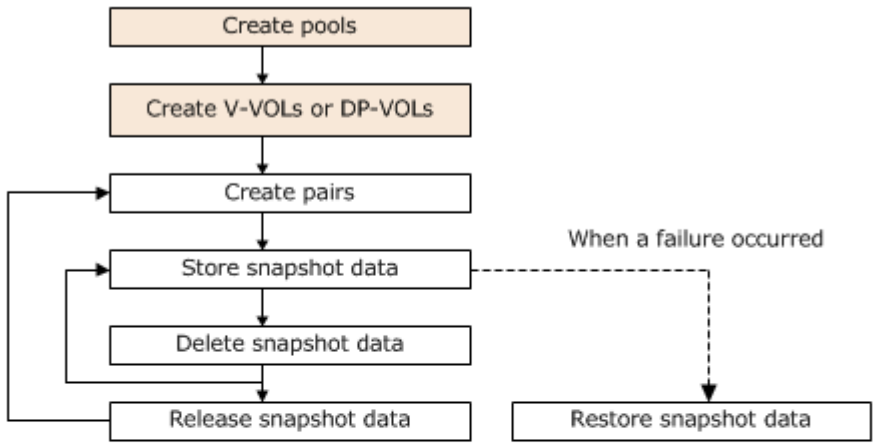
The following image shows the configuration tasks workflow and the workflow for creating and managing Thin Image pairs.

For VSP Gx00 models and VSP Fx00 models

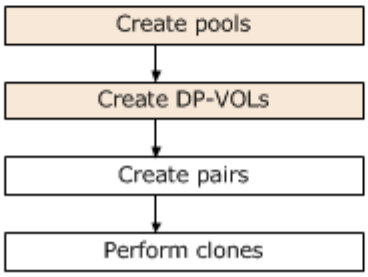


For Hitachi Virtual Storage Platform G1000 and G1500, and Virtual Storage Platform F1500

Pair with the snapshot attribute



Pair with the clone attribute



Steps for configuring Thin Image:

Note: The V-VOL management area must be created in shared memory. It is created automatically when you add shared memory. For details, contact customer support.

1. Create the Thin Image data pools (see Creating Thin Image data pools on page 98).
2. Create and register the V-VOLs for the pair (see Workflow for registering virtual volumes on page 104).
3. Create and manage the Thin Image pairs (see Workflow for creating and managing Thin Image pairs on page 97).

Workflow for creating and managing Thin Image pairs

Use this workflow to create and manage Thin Image pairs.

1. Create the Thin Image pairs (see Workflow for creating and managing Thin Image pairs on page 126).
2. Split the Thin Image pair to store the snapshot data using one of the available methods (see Storing snapshot data or cloning pairs on page 134).

3. If a failure occurs and the pair is suspended ("PSUE" status), complete the following:
   a. Recover the data by recovering the Thin Image pair (see Restoring suspended Thin Image pairs on page 142).
   b. Restore the pair, which writes snapshot data over the P-VOL (see Restoring Thin Image pairs on page 140).
4. Maintain the Thin Image pair status (see How Thin Image pair status changes on page 37).
5. Delete the Thin Image pairs (see Deleting Thin Image pairs on page 145).

For pairs with the snapshot attribute, create a Thin Image pair to store snapshot data. Note, however, that you can create up to 1,024 pairs for a P-VOL. Therefore, you must delete snapshot data or Thin Image pairs that are no longer necessary. When you delete a Thin Image pair, snapshot data stored by the pair is also deleted from the pool.

When a failure occurs, if you perform restoration, snapshot data can be overwritten in the P-VOL. If a Thin Image pair is already being restored, another Thin Image pair might not be restored.

For details about operations and statuses for Thin Image pairs, see How Thin Image pair status changes on page 37. For details about how to create DP pools, see the *Provisioning Guide for Open Systems*.

Creating Thin Image data pools

Use this task to create Thin Image data pools using HDvM - SN. You create Thin Image data pools by selecting the pool-VOL to add to the data pool.

Note: You can only register volumes that you have not already registered as a pool-VOL.

For more information about data pool requirements, including the maximum number of pool-VOLs, see Thin Image data pool requirements on page 72.

You can add external and internal volumes to data pools.

Note: There are limitations to adding external and internal volumes to data pools. For more information about these limitations, see the requirements for Thin Image pool-VOLs listed in Thin Image volume requirements on page 70.

Before you begin

You must have the Storage Administrator (Provisioning) role.

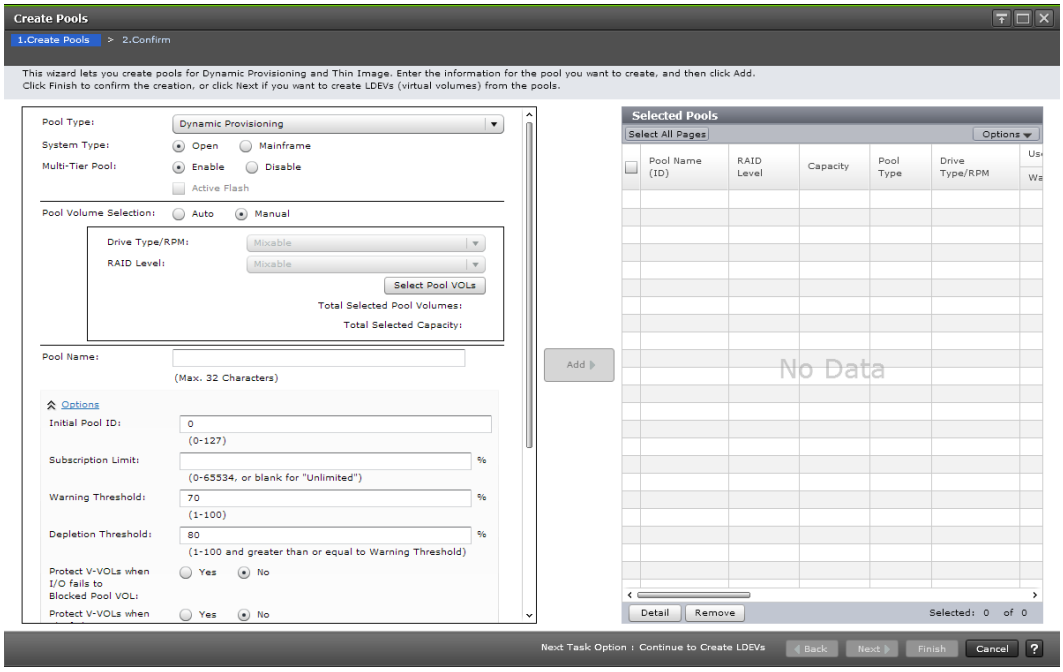
Procedure

1. Navigate to the **Create Pools** wizard.
   In Hitachi Command Suite:

a. On the **Resources** tab, expand the **Storage Systems** tree.
b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.
c. In the **Pools** window, select **Create Pools**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
b. In the **Pools** window, select **Create Pools**.



2. In the **Create Pools** window of the **Create Pools** wizard, complete the following items for the pool you want to create, and then click **Add**:

- **Pool Type**
  Select **Thin Image** as the pool type.
  Default: **Dynamic Provisioning**
  Required: Yes
- **System Type**
  Value: **Open**
  Default: **Open**
- **Pool Volume Selection**
  Select the pool volume you want to use for the pool. Complete the following:
  Drive Type/RPM: Select your pool-VOL's data drive type and RPM. Select **External Storage** when you use external volumes (for HTI pool-vols).

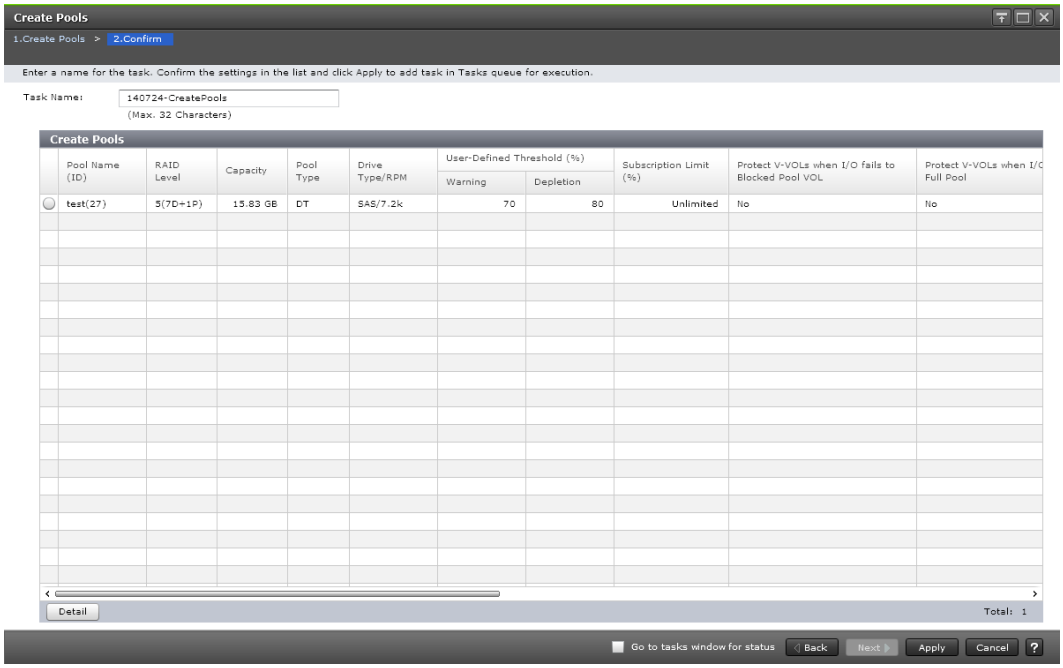
RAID Level: Select your pool-VOL's RAID level. If you selected **External Storage** as the **Drive Type/RPM**, a hyphen (-) is displayed for this item and this item is unavailable.
Default: **Mixable**
Required: Yes

- **Pool Name**
  Enter a name for the pool, using 32 alphanumeric characters or fewer. This field is case sensitive.
- **Initial Pool ID**
  The initial pool identifier. Enter 0 and an integer number.
  Integer number range: 0 - 127
  Default: The smallest available number displays as the default. If no available pool ID exists, no number appears. If an already registered pool ID is entered, the smallest available pool ID that is larger than the one entered is used.
- **Warning Threshold**
  The data pool capacity threshold.
  Range (%): 20 - 95
  Default (%): 80

The pool-VOL is added to the **Selected Pools** table of the **Create Pools** window. Up to 1,024 volumes can be added to a pool.

Note: If you are adding an LDEV belonging to a parity group for which accelerated compression is enabled, see the related section in Provisioning Guide for your storage system.

3. Click **Finish**, and then confirm the settings.



4. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

5. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
6. Click **Apply** to submit the task.

Next steps

Select the pool volumes.

Related tasks

- Selecting pool volumes on page 101
- Increasing pool capacity on page 175

Selecting pool volumes

You can select a pool-VOL to add when creating pools. The selected pool-VOL's information is used to calculate Total Selected Pool Volumes and Total Selected Capacity in the **Create Pools** window.

Procedure

1. Navigate to the **Create Pools** wizard.

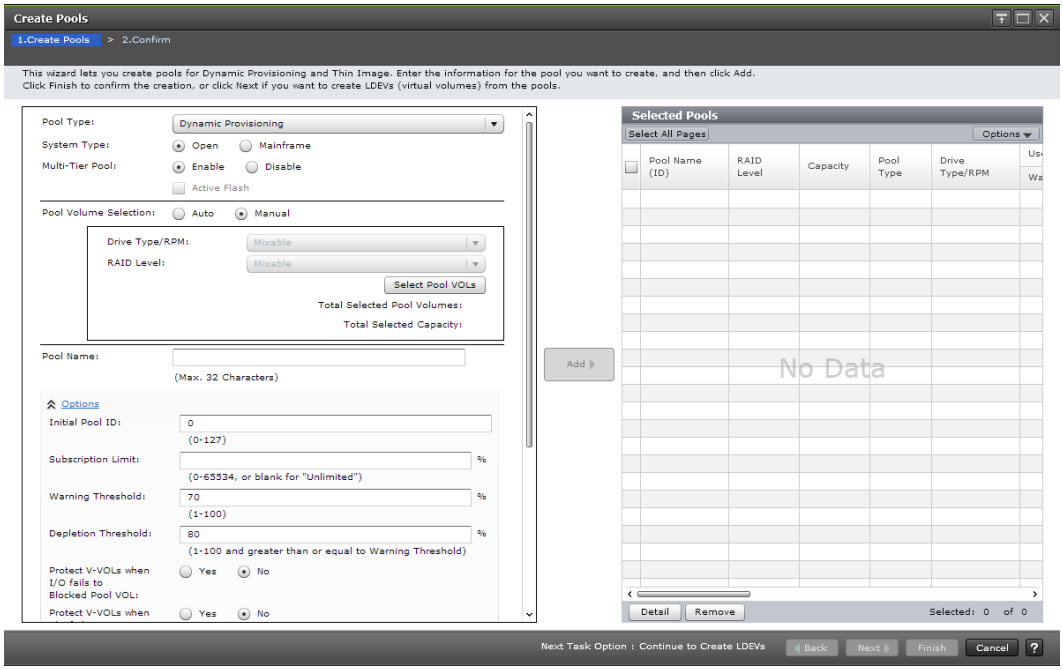
   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

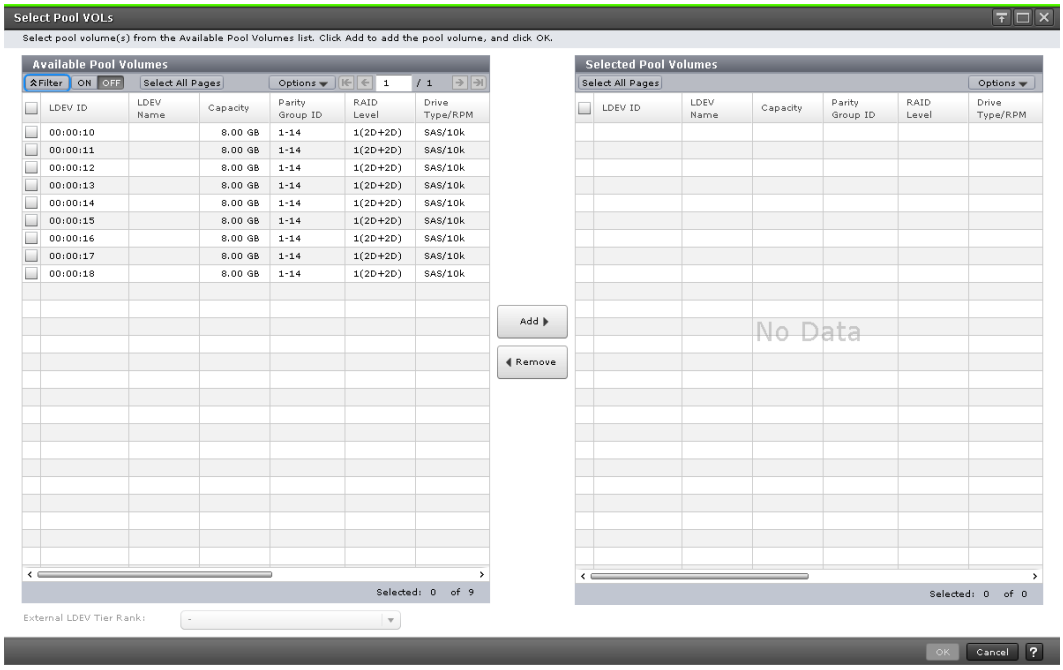
b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.
c. In the **Pools** window, select **Create Pools**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
b. In the **Pools** window, select **Create Pools**.



2. In the **Create Pools** window of the **Create Pools** wizard, in the **Pool Volume Selection** section, click **Select Pool VOLs**.



3. In the **Select Pool VOLs** window, from the **Available Pool Volumes** table, select the pool-VOL you want to add to the pool, and then click **Add**.
   The pool-VOL is added to the **Selected Pool Volumes** table. You can add a maximum of 1,024 volumes in a pool.

Note: Before you add an LDEV belonging to a parity group which has the accelerated compression setting enabled, see the information about whether accelerated compression can be enabled in the *Provisioning Guide for Open Systems*.

Note: Note the following when you add an external volume:

- External volumes with cache mode enabled and external volumes with cache mode disabled cannot be contained in the same pool.
- External volumes with cache mode disabled and internal volumes cannot be contained in the same pool.
- When setting the tier rank of an external volume to a value other than **Middle**, select the tier rank from **External LDEV Tier Rank**, and then click **Add**.

Note:

- To specify conditions to display pool volumes, click **Filter** to open the menu, specify the filtering conditions, and then click **Apply**.
- To select all pool-VOLs in the table, click **Select All Pages**. To cancel the selection, click **Select All Pages** again.
- To specify the unit or the number of rows to be displayed, click **Options**.

4. Click **OK**.

Result

The selected pool-VOL is shown in the Selected Pools table in the **Create Pools** window.

Pool creation and data drive type priority

Creating pools automatically sets the new pool-VOL with system area according to the priority of data drive types.

The following table shows the priority of pool-VOLs with system area when creating pools.

Priority	Data drive type
1	SAS7.2K
2	SAS10K
3	SAS15K
4	SSD
5	External volume

If more than one pool-VOL of the same data drive type exists in the storage system, the pool-VOL priority is determined according to the storage system's internal index information.

Related references

- Thin Image volume requirements on page 70

Workflow for registering virtual volumes

Use this workflow to register virtual volumes.

1. (Optional)(VSP G1000, G1500, and VSP F1500) Edit the SSID of the V-VOL you want to register to the pool-VOL's paired volume (see Editing the SSID for virtual volumes (VSP G1000, G1500, and VSP F1500) on page 105).
2. (Optional) Change the V-VOL settings (see Changing V-VOL settings on page 108).

3. Register the V-VOL (see Creating Thin Image V-VOLs on page 111).

Editing the SSID for virtual volumes (VSP G1000, G1500, and VSP F1500)

Before registering a V-VOL, you may need to edit the control unit's (CU) SSID, which you use to create new LDEVs. Use the Change SSIDs window to edit a V-VOL's SSID.

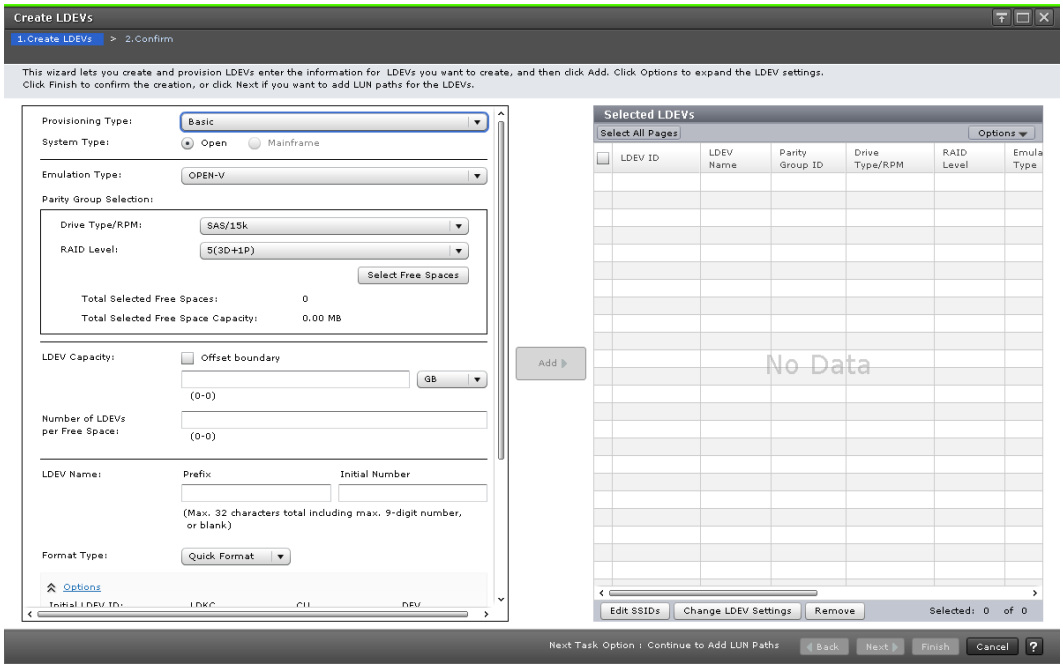
Before you begin

You must have the Storage Administrator (Provisioning) role.

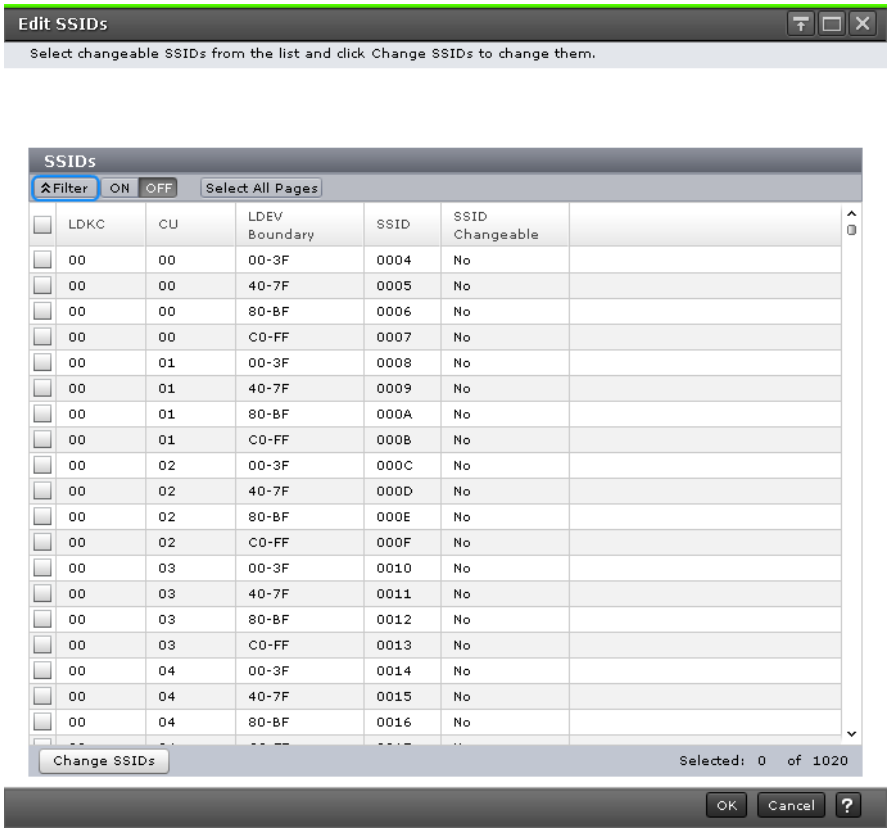
For more information about registering V-VOLs, see Creating Thin Image V-VOLs on page 111.

Procedure

1. Navigate to the **Pools** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
2. In the **Pools** window, in the **Pools** tab, click **Create LDEVs**.

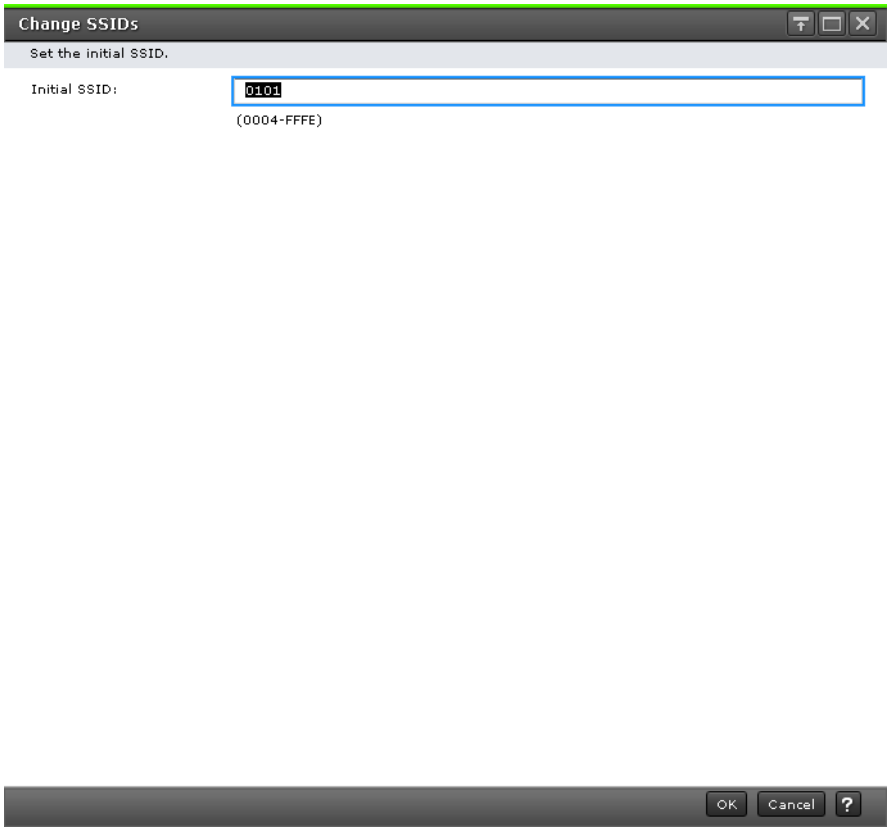


3. In the **Create LDEVs** window of the **Create LDEVs** wizard, in the **Selected LDEVs** table, click **Edit SSIDs**.

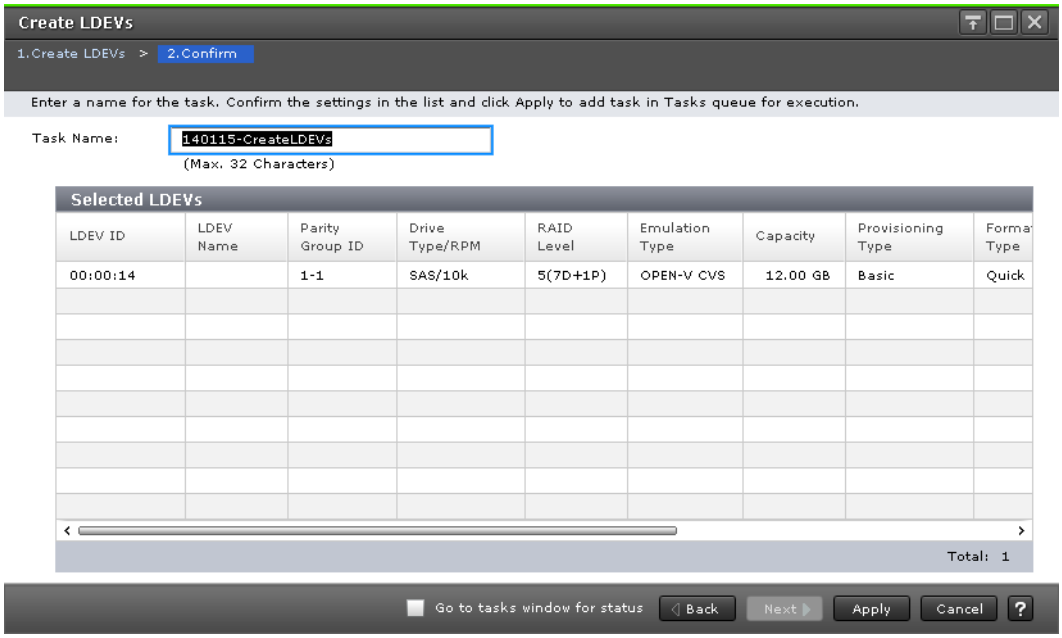


In the **Edit SSIDs** window, in the **SSIDs** table, existing SSIDs and those to be generated are shown in the list.

4. In the **Edit SSIDs** window, select the row of the SSID you want to edit, and then click **Change SSIDs**.



5. In the **Change SSIDs** window, for **Initial SSID**, enter the new SSID and click **OK**.
6. In the **Edit SSIDs** window, click **OK**.
7. Click **Finish**, and then confirm the settings.



8. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

9. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
10. Click **Apply** to submit the task.

Related tasks

- Monitoring pool information on page 171

Related references

- Replication window on page 230

Changing V-VOL settings

You can edit the V-VOL settings before registering a V-VOL.

Before you begin

You must have the Storage Administrator (Provisioning) role.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

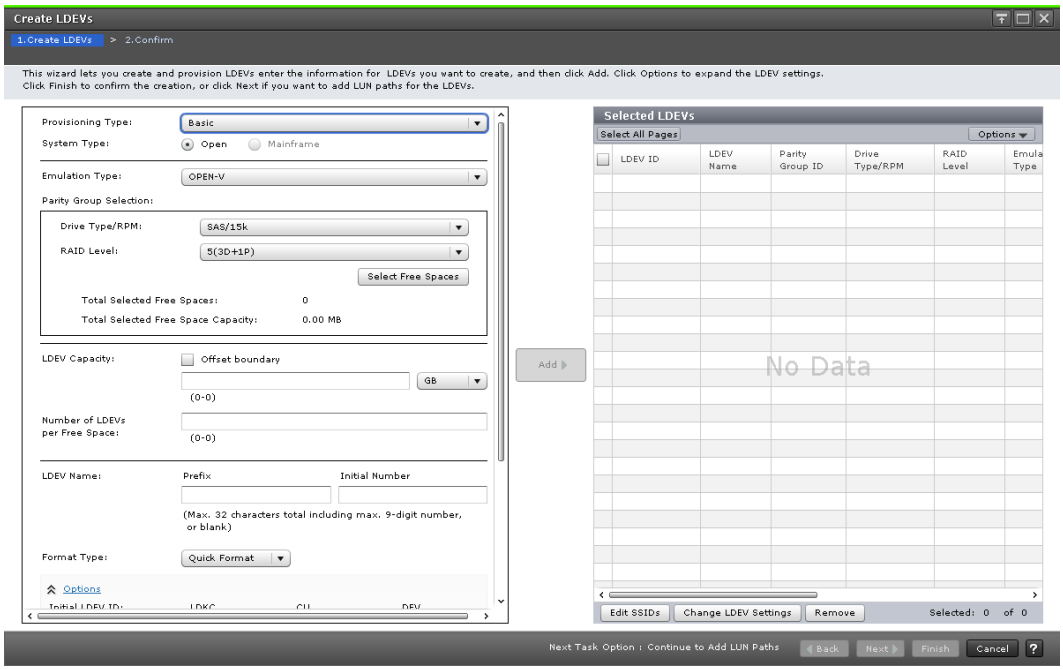
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

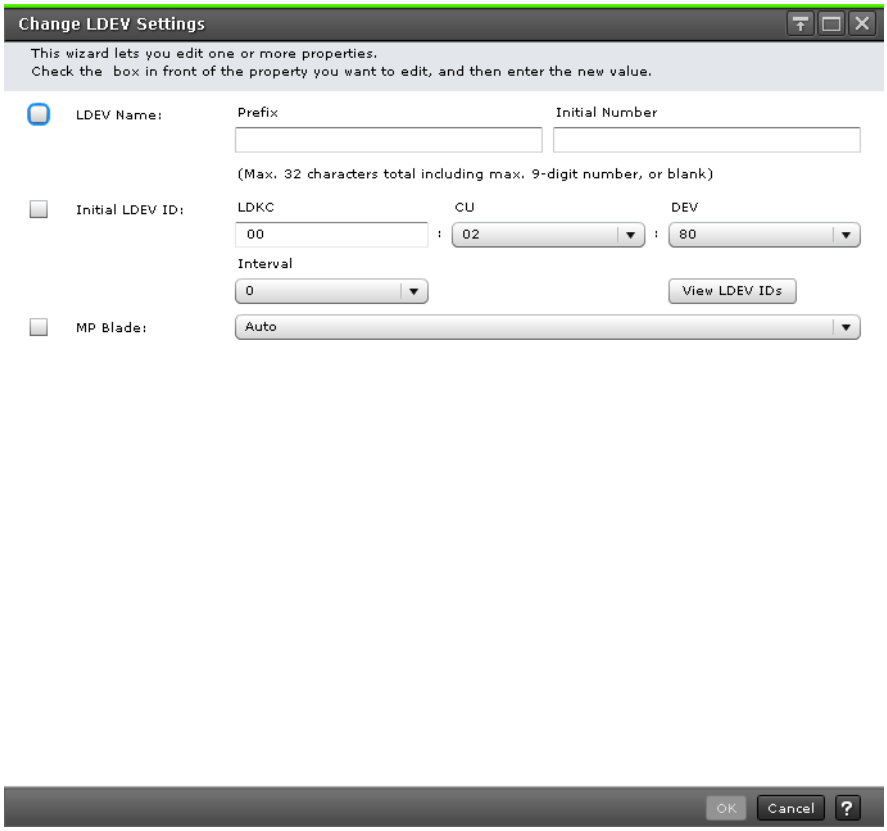
In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** window, in the **Pools** tab, click **Create LDEVs**.



3. In the **Create LDEVs** window of the **Create LDEVs** wizard, in the **Selected LDEVs** table, select an LDEV, and then click **Change LDEV Settings**.



4. In the **Change LDEV Settings** window, complete the following items, and then click **OK**:
   - **LDEV Name**
     Enter the prefix characters and the initial number for the LDEV.
   - **Initial LDEV ID**
     Enter the LDKC, CU, and LDEV numbers, and the interval. To confirm used LDEVs, click **View LDEV IDs**.
   - **MP Blade** (VSP G1000, G1500, and VSP F1500)
     Select the MP blade identifier to which you want to assign the LDEV. To specify an MP blade identifier, select the MP blade ID. To assign an arbitrary MP blade identifier, click **Auto**.
   - **MP Unit ID** (VSP Gx00 models and VSP Fx00 models)
     Select the MP Unit ID to which you want to assign the LDEV. To specify an MP Unit ID, select the MP Unit ID. To assign an arbitrary MP Unit ID, click **Auto**. The MP Unit ID that you can select depends on the storage system model.
5. Click **Finish**, and then confirm the settings.
6. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

Creating Thin Image V-VOLs

Thin Image virtual volumes are paired with pool volumes. You must create virtual volumes before creating pairs.

Before you begin

You must have the Storage Administrator (Provisioning) role.

Procedure

1. Navigate to the **Pools** window.

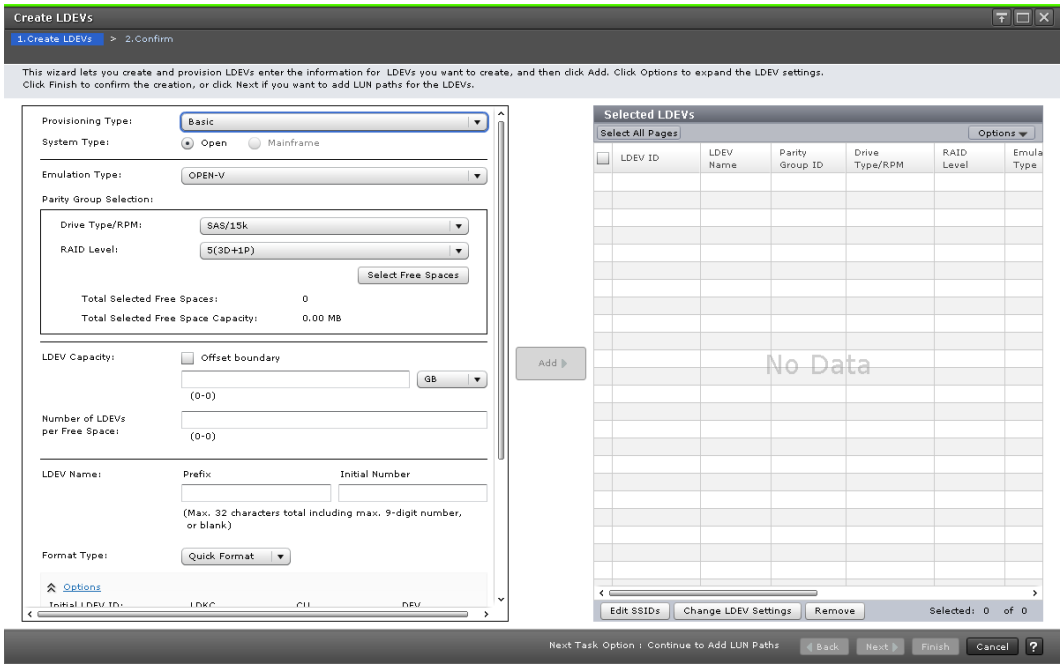
   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
2. In the **Pools** window, in the **Pools** tab, click **Create LDEVs**.



3. In the **Create LDEVs** window of the **Create LDEVs** wizard, complete or review the following items, and then click **Options**:

- **Provisioning Type**
  Confirm that **Snapshot** is selected.
  Required: Yes
- **System Type**
  Verify that **Open** is selected.
  Required: Yes
- **Emulation Type**
  Confirm that **OPEN-V** is selected.
  Required: Yes
- **Capacity Compatibility Mode (Offset boundary)**
  Specify if you want to offset the specified LDEV capacity by boundary.
  Values: **ON** or **OFF**
  Default: **OFF**
- **LDEV Capacity**
  Complete the following:
  - Enter the amount of the LDEV capacity you want to create. Then enter a number within the range of the figures displayed under the text box. You can enter values up to two decimal places.
  - Click the unit capacity menu to choose the capacity unit, TB, GB, MB, or block.
- **Number of LDEVs**
  Enter the number of LDEVs you want to create.
  Range: (Shown below the text box.)
  Required: Yes
- **LDEV Name**
  Enter a name for the V-VOL.
  - For **Prefix**, enter the case-sensitive alphanumeric characters, which become the fixed characters that precede the V-VOL number.
  - For **Initial Number**, enter the initial number for V-VOL, up to 9 digits.
  - You can enter up to 32 characters in total for **Prefix** and **Initial Number**.

4. In the **Create LDEVs** window of the **Create LDEVs** wizard, complete the following additional items, and then click **Add**:
   - **Initial LDEV ID**
     Confirm that an LDEV identification number has been set. To confirm the used number and unavailable number, complete the following steps:
     a. Click **View LDEV IDs**.
     b. In the **View LDEV IDs** window, confirm the LDEV ID, and then click **Close**.
   - **Initial SSID**
     Enter a 4-digit representation of a hexadecimal number.
     Range: 0004 to FFFE

Default: 0004

- Complete the following steps to confirm generated SSIDs:
  a. Click **View SSIDs**.
  b. In the **View SSIDs** window, confirm the SSID, and then click **Close**.
- **CLPR**
  Select **CLPR**.
  Required: No
- **MP Blade** (VSP G1000, G1500, and VSP F1500)
  Select the MP blade identifier to which you want to assign the LDEV. To specify an MP blade identifier, select the MP blade ID. To assign an arbitrary MP blade identifier, click **Auto**.
  Required: No
- **MP Unit ID** (VSP Gx00 models and VSP Fx00 models)
  Select the MP Unit ID to which you want to assign the LDEV. To specify an MP Unit ID, select the MP Unit ID. To assign an arbitrary MP Unit ID, click **Auto**. The MP Unit ID that you can select depends on the VSP storage system model.
  Required: No

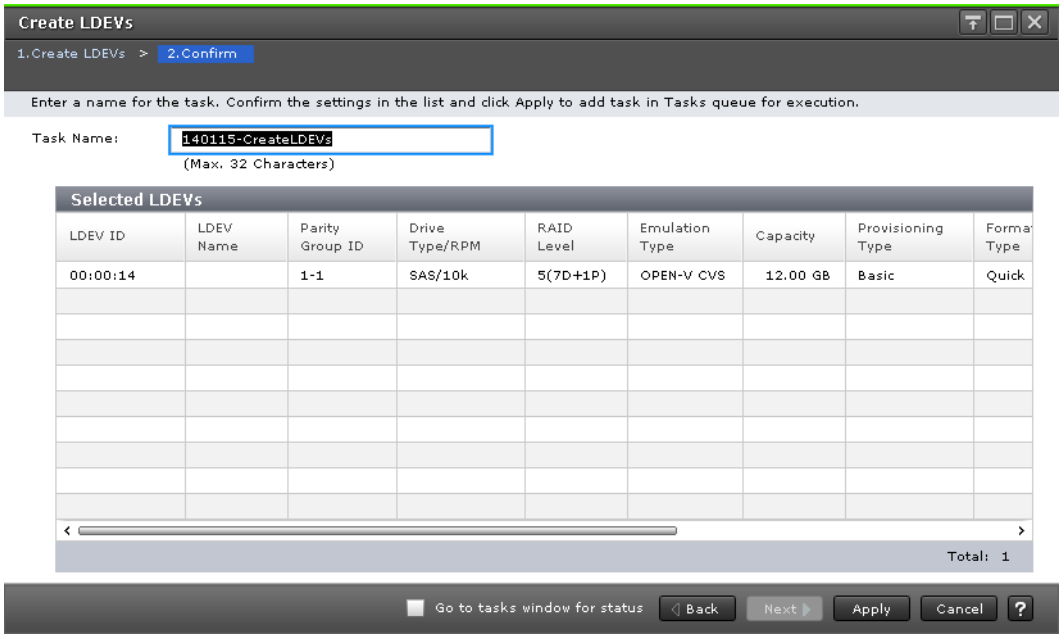
The created LDEVs are added to the **Selected LDEVs** table.

Note: The **Provisioning Type**, **System Type**, **Emulation Type**, **LDEV Capacity**, and **Number of LDEVs** fields must be set. If these items are not set, you cannot click **Add**.

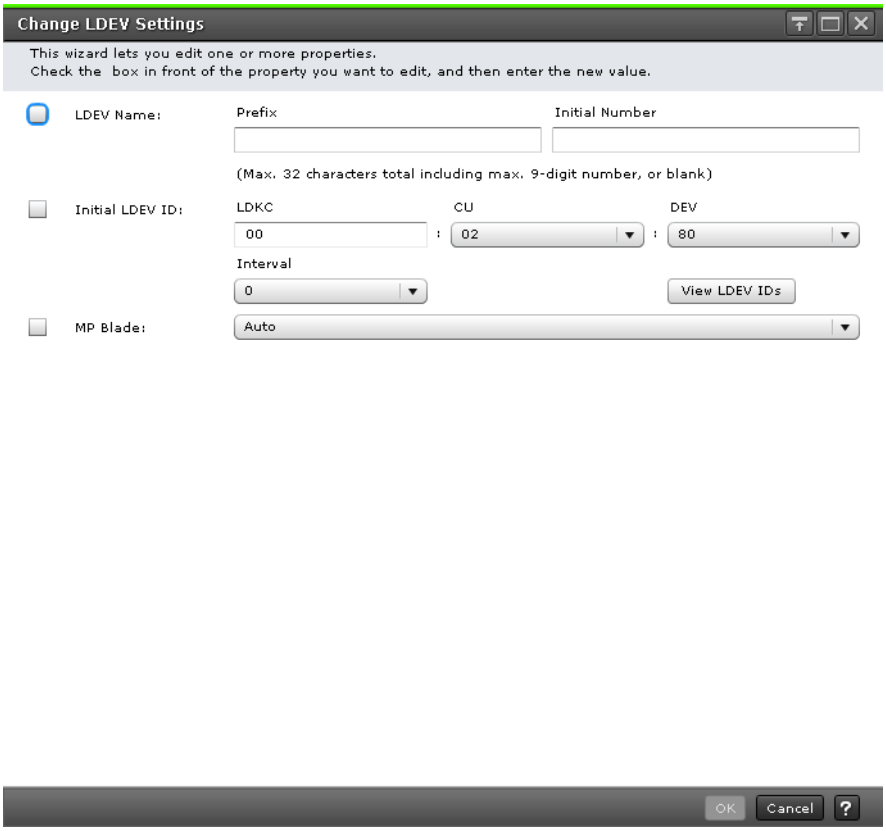
5. Click **Finish**, and then confirm the settings.

Note: To continue setting the LU path, click **Next**.

For more information about setting the LU path, see the *Provisioning Guide* for your storage system.



6. (Optional) To change the settings of the V-VOLs, you can complete the following:
   a. (VSP G1000, G1500, and VSP F1500) To select a storage system identifier and edit the SSID properties, click **Edit SSIDs**. For details on how to edit SSIDs, see Editing the SSID for virtual volumes (VSP G1000, G1500, and VSP F1500) on page 105.
   b. To change the LDEV settings, click **Change LDEV Settings**. For details on how to change LDEV settings, see Changing V-VOL settings on page 108.



c. In the **Change LDEV Settings** window, change the desired settings, and then click **OK**:

d. Click **Finish**, and then confirm the settings.

7. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Related references

- Sharing Thin Image volumes with Dynamic Provisioning and Dynamic Provisioning for Mainframe in a single storage system on page 63

Removing LDEVs from registering tasks

The LDEVs that are shown in the Selected LDEVs table in the **Create LDEVs** window are those that are set to be registered and created. You can choose to not register the LDEV by removing the LDEV from the registering task.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

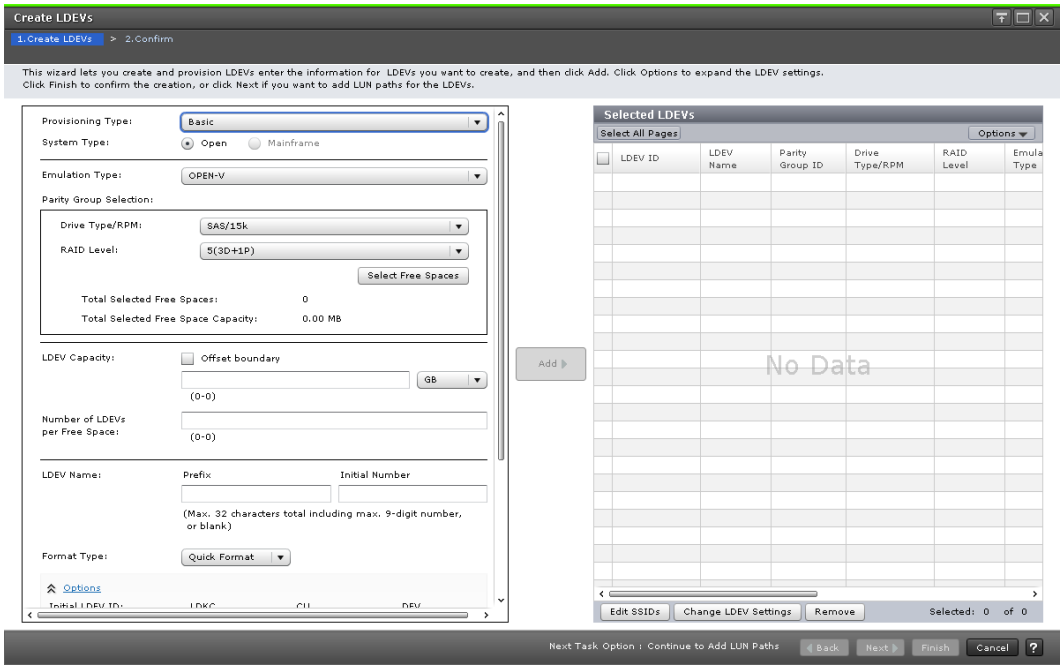
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** window, click **Create LDEVs**.

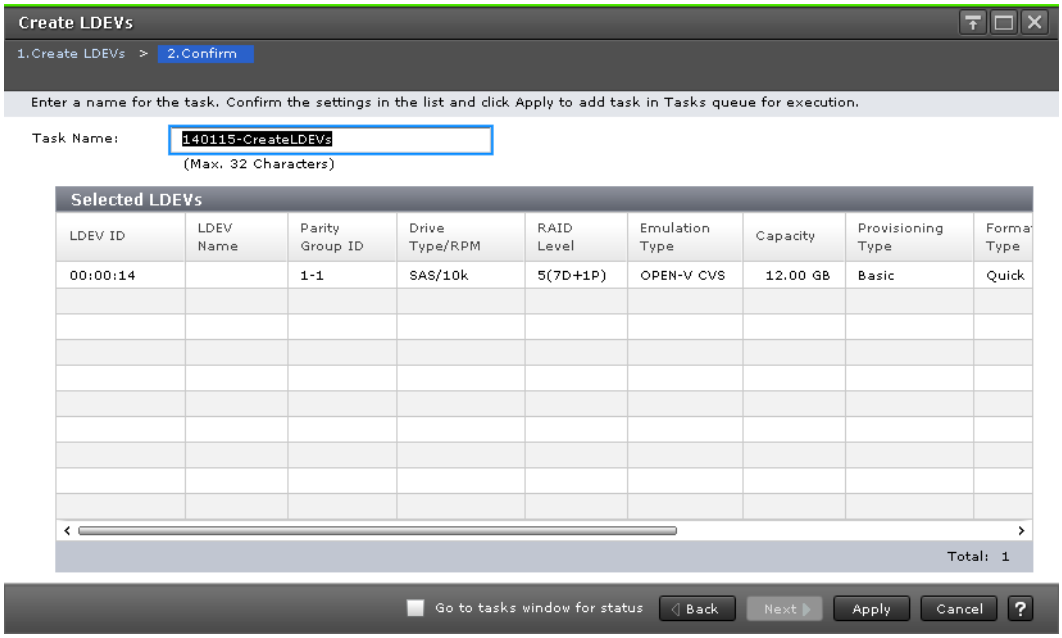


3. In the **Create LDEVs** window, in the **Selected LDEVs** table, complete the following:

   a. Select the check box for the LDEV you want to remove from the registering task, and then click **Remove**.

   b. In the warning message that appears, click **OK** to confirm that you want to remove the selected LDEV.

4. Click **Finish**, and then confirm the settings.



5. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
6. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
7. (Optional) To open the next task window, click **Next**.
8. To register the settings to the storage system, click **Apply**.
   The LDEV is removed from the registering task. The LDEV is not registered and created.

Recognizing devices from the host server

Complete these steps to restart a host server, such as HP-UX or Solaris, or to run commands to V-VOLs to recognize devices from the host server.

Note: Do not change the volume of the recognized device by the host server to a V-VOL.

Procedure

1. Create the Thin Image pairs.
2. Split the pair to store the snapshot data using one of the available methods.
3. Ensure that the V-VOL recognized by the host server is in "PSUS" status.
4. Complete one of the following:
   - Boot or reboot the host server.
   - Run the command for recognizing devices.

Related references

- Workflow for creating and managing Thin Image pairs on page 126
- Storing snapshot data or cloning pairs on page 134

Host server stoppages and device recognition issues

If you boot or reboot host servers, such as HP-UX or Solaris, or if you use the host server to run the read command on a V-VOL to recognize a device, keep the following items in mind.

- You cannot change the volume of the device recognized by the host server to a V-VOL.
- Before booting or rebooting the host server or running the command for recognizing devices, complete the following:
  1. Create the Thin Image pair.
  2. Store the snapshot data (or clone pairs).
  3. Ensure the V-VOL pair recognized by the host server is in "PSUS" status or an unpaired volume.

If you do not fulfill all of the conditions listed above, the devices may not be recognized, or failures can occur and the host server can stop.

If you booted or rebooted host servers, or if you used the host server to run the commands to recognize devices and the host server was stopped, use the following workflow to run the commands:

1. Forcibly stop the process of the command and those of its parent process.
2. Create the Thin Image pair.
3. Store the snapshot data (or clone pairs).
4. Rerun the command to recognize devices.

On the server (including CCI), the emulation type of the V-VOL is shown with a zero (0), such as OPEN-0V. If you create a Thin Image pair, specify a volume whose emulation type is shown with a zero (0) for the S-VOL, such as OPEN-0V.

Overview of using CCI to run commands through in-band connections

Use CCI to run commands through an in-band connection to perform Thin Image tasks. To run the command through an in-band connection, reserve a volume for use as a command device.

If you use CCI to run commands through an out-of-band connection, you do not need to reserve a volume.

Caution: For maximum host I/O performance, use CCI to run commands through an in-band connection.

For more information about reserving a volume for use as a command device, see the *Command Control Interface User and Reference Guide*.

For more information about CCI commands that correspond to actions in the HDvM - SN GUI, see CCI command reference for Thin Image on page 215.

Changing system options that affect Thin Image performance

You can set the system options that affect Thin Image performance using Device Manager - Storage Navigator, as described here, or Command Control Interface.

For details about how to change system options using Command Control Interface, see the *Command Control Interface User and Reference Guide*.

Procedure

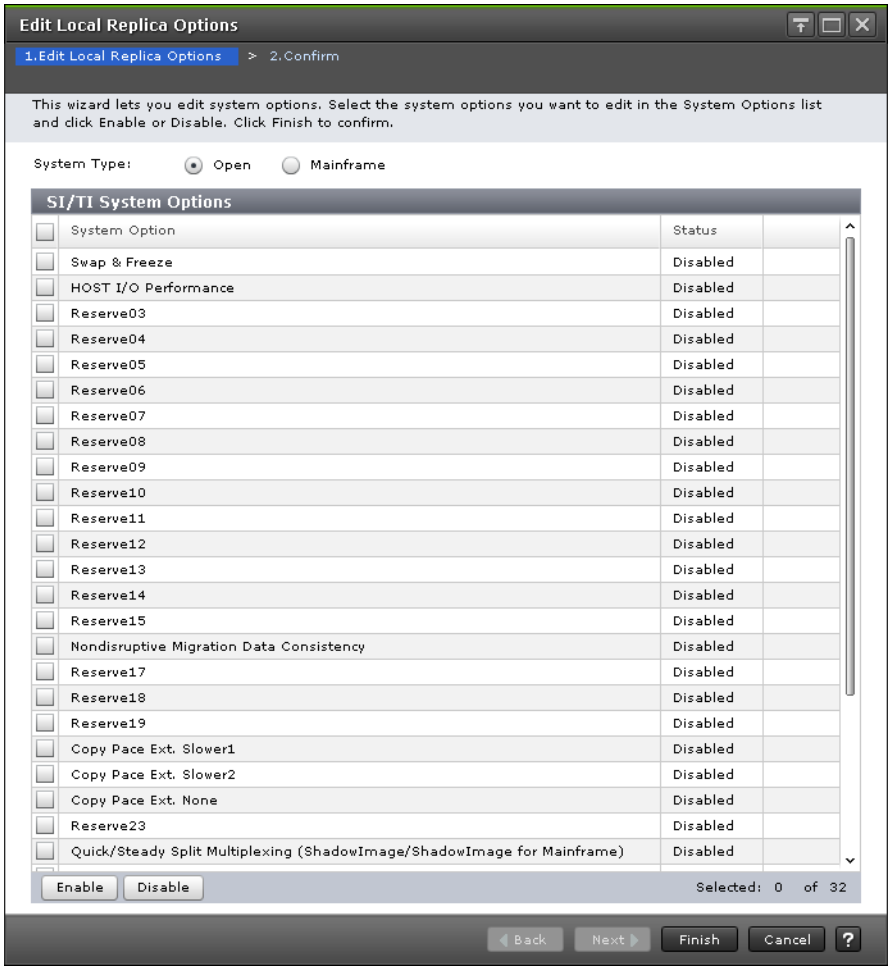
1. Navigate to the **Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Replication Dashboard**.

   In Device Manager - Storage Navigator:

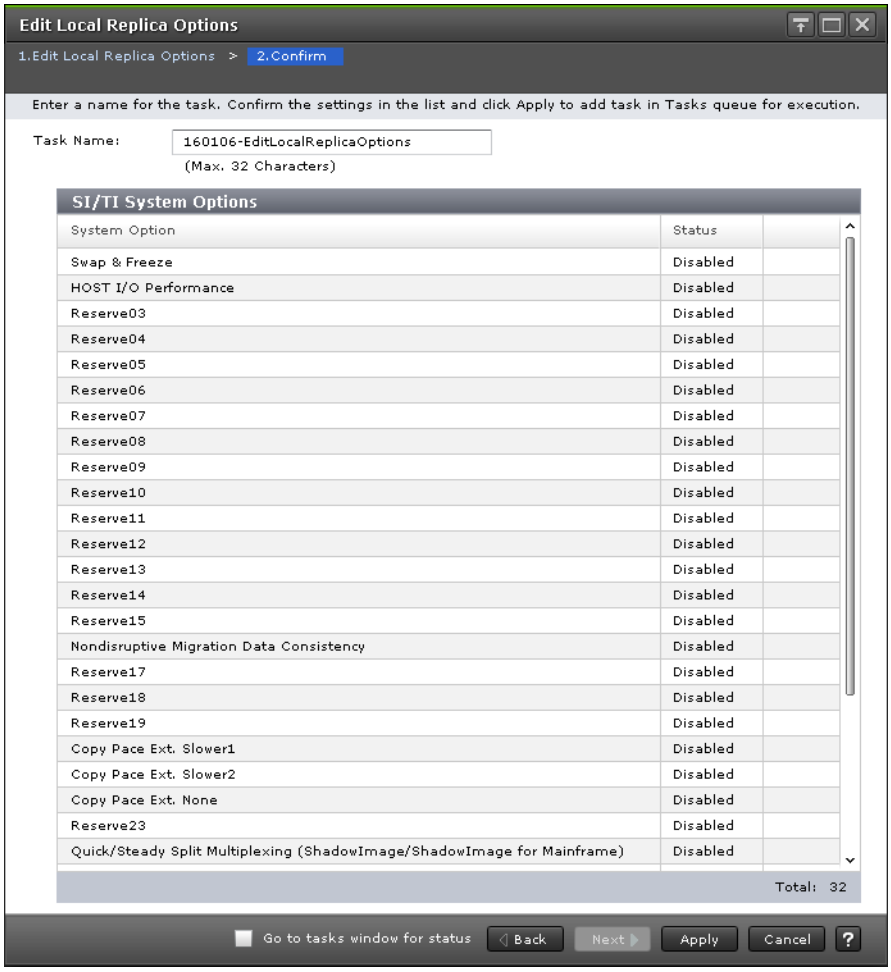
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication**.
2. In the **Replication** window, click **Edit Options > Local Replication**.



3. (VSP G1000, G1500, and VSP F1500) In the **Edit Local Replica Options** window of the **Edit Local Replica Options** wizard, for **System Type**, confirm that **Open** is selected.

   Default: Open

4. In the **SI/TI System Options** table, select the system option you want to change, and then click **Enable** or **Disable**.



5. Click **Finish**, and then confirm the settings.
6. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

4

Managing Thin Image Pairs

This chapter provides instructions for completing Thin Image pair user tasks using HDvM - SN.

- Thin Image pair tasks
- Checking Thin Image pair status
- Reloading Thin Image configuration information
- Workflow for creating and managing Thin Image pairs
- Workflow for creating Thin Image pairs using Device Manager - Storage Navigator
- Creating Thin Image pairs using Device Manager - Storage Navigator
- Example of creating complex Thin Image pairs
- Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI
- Workflow for defining Thin Image pairs and defining them in snapshot or consistency groups using Device Manager - Storage Navigator
- Storing snapshot data or cloning pairs
- Splitting Thin Image pairs to store snapshot data
- Workflow for splitting Thin Image pairs (VSP Gx00 models and VSP Fx00 models) or storing snapshot data or clone pairs (VSP G1000, G1500, and VSP F1500) in consistency groups

- Restoring Thin Image pairs
- Thin Image pair resynchronization
- Assigning MU numbers to deleted snapshot data
- Deleting snapshot data
- Deleting Thin Image pairs
- Assigning secondary volumes to Thin Image pair snapshot data
- Releasing assignment of secondary volumes from Thin Image pair snapshot data
- Changing assignment of secondary volumes to Thin Image pair snapshot data

Thin Image pair tasks

You can perform the following tasks on Thin Image pairs.

- Check Thin Image pair status.
- Create Thin Image pairs.
- Split Thin Image pairs to store snapshot data.
- Change the Thin Image pair status, if the pair is defined in a consistency group.
- Restore Thin Image pairs.
- Restore suspended Thin Image pairs, if the storage system suspends the pair ("PSUE" status) while you are restoring the pair.
- Resynchronize Thin Image pairs.
- Delete Thin Image pairs.

Related concepts

- Workflow for creating and managing Thin Image pairs on page 126
- Workflow for creating Thin Image pairs using Device Manager - Storage Navigator on page 127
- Workflow for splitting Thin Image pairs (VSP Gx00 models and VSP Fx00 models) or storing snapshot data or clone pairs (VSP G1000, G1500, and VSP F1500) in consistency groups on page 136
- Workflow for defining Thin Image pairs and defining them in snapshot or consistency groups using Device Manager - Storage Navigator on page 134

Related tasks

- Checking Thin Image pair status on page 125
- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128
- Splitting Thin Image pairs to store snapshot data on page 135
- Restoring Thin Image pairs on page 140
- Resynchronizing Thin Image pairs on page 143
- Deleting Thin Image pairs on page 145

Checking Thin Image pair status

Each Thin Image pair task requires a pair to have a specific status.

Check the pairs' status before performing a pair task, to ensure that the task completes successfully, and to ensure that the data is current.

Procedure

Click **Refresh**.

Related tasks

- Viewing summary replication information on page 156

Reloading Thin Image configuration information

After creating a Thin Image pair, you can reload the configuration information if data shown in windows are different.

For example, the number of pairs shown in the summary section in the **Local Replication** window and the number of pairs shown in the list in the TI Root Volumes or TI Primary Volumes tab or tab can be different.

Procedure

1. Wait until the configuration information has completed processing.
2. If the numbers remain different, click **File > Refresh All**.

Workflow for creating and managing Thin Image pairs

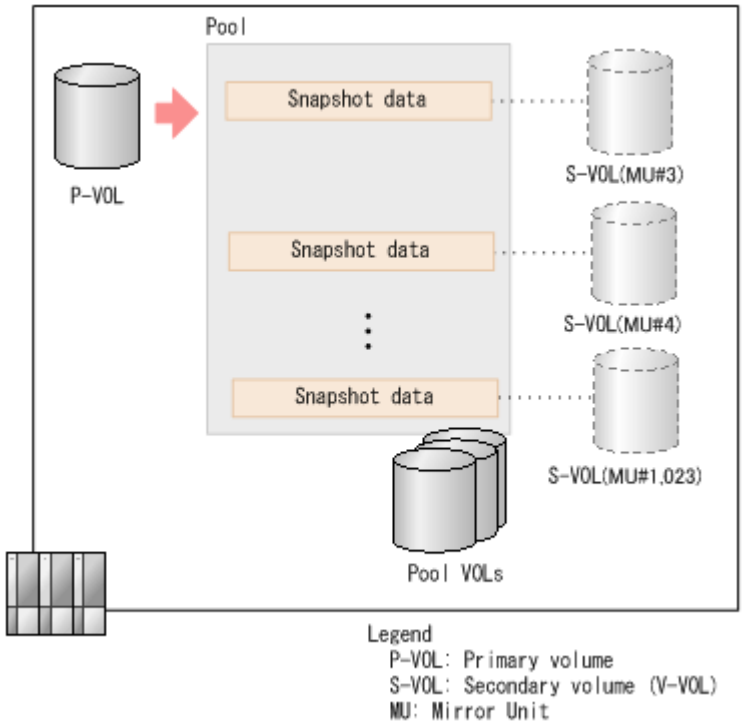
Use this workflow to create and manage a Thin Image pair.

1. Create the data pool (see Creating Thin Image data pools on page 98).
2. Create the V-VOL for the pair (see Creating Thin Image V-VOLs on page 111).
3. Check the pair status (see Checking Thin Image pair status on page 125).
4. Create the Thin Image pair in one of the following ways.
   - Create the pair using HDvM - SN.
     For more information about how to create HTI pairs using HDvM - SN, see Workflow for creating Thin Image pairs using Device Manager - Storage Navigator on page 127.
   - Create the pair using CCI and assign the pair to a snapshot group.
     For more information about how to create Thin Image pairs using CCI, see Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI on page 133.
5. If you have assigned the pairs to a consistency group, split the Thin Image pair using the consistency group to store snapshot data.
6. Delete the snapshot data in one of the following ways.
   - Delete the Thin Image pairs (see Deleting Thin Image pairs on page 145).
   - Delete only the snapshot data (see Resynchronizing Thin Image pairs on page 143).

Workflow for creating Thin Image pairs using Device Manager - Storage Navigator

The pairs shown in the HDvM - SN main window are configured based on the amount of snapshot data corresponding to the P-VOL, or the number of S-VOLs that are assigned to snapshot data corresponding to the P-VOL.

The following image shows this configuration.



Creating Thin Image pairs using HDvM - SN involves the following steps.

1. Select the P-VOL.
2. Assign the S-VOL to snapshot data.
3. Confirm that you want to create the pair.

Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128

Creating Thin Image pairs using Device Manager - Storage Navigator

You can create a Thin Image pair and define the pair in a consistency group. You can create 1,024 Thin Image pairs at the same time for VSP G1000, G1500, and VSP F1500, and 32,768 for VSP G200, G400, G600, G800. To create more than 1,024 (or 32,768) pairs, repeat this task.

When you create a pair, you specify the pool to be used. A Thin Image pair consists of a P-VOL and up to 1,024 S-VOLs. The MU numbers are assigned in the order of 3 to 1,023, followed by 0 to 2.

Note: After creating a Thin Image pair, the number of pairs shown in the summary section in the **Local Replication** window and the number of pairs shown in the list in the TI Pairs tab can be different. Wait until the configuration information has completed processing. If the numbers of pairs do not match, reload the configuration information (see Reloading Thin Image configuration information on page 126).

Caution: To prevent the Thin Image pair from being suspended ("PSUE" status), do not create Thin Image pairs while you are shutting down the storage system.

Requirements:

- The P-VOL and S-VOLs you select must be the same size in blocks, if you create a Thin Image pair with an S-VOL specified. If the capacity is displayed in GB or TB, a small difference between P-VOL and S-VOL capacity might not be displayed.
  To view the capacity in blocks, click Options > Capacity Unit > block in the **Logical Devices** window.
- If you select a P-VOL that you are already using as the P-VOL for another Thin Image pair, you must specify the same pool for both pairs. For example, if you specify three S-VOLs for one P-VOL, specify the same pool for the three Thin Image pairs.
- The value of the T10 PI attribute must be the same for the P-VOL and S-VOL.

Before you begin

- You must have the Storage Administrator (Local Copy) role.
- If you are sharing ShadowImage volumes with Thin Image volumes, the SI pair must exist.
- If you want to use a ShadowImage volume as a Thin Image P-VOL when an available MU number does not exist, you must have completed the following:
  1. Deleted the Thin Image pairs of MU numbers 0 to 2.

2. Created the ShadowImage pair.
3. Re-created the Thin Image pair with an MU number of 3 or greater assigned.

Procedure

1. Navigate to the **Create TI Pairs** wizard.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**.
   b. Expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL on the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab, and then click **Create TI Pairs**.
3. In **Create Pairs using Volumes as Root Volumes** or **Use Primary Volumes of Thin Image Pairs**, select **Yes** or **No**.
4. (VSP G1000, G1500, and VSP F1500) In **Select By**, select **LUN** to create a pair by specifying LUN. Select **LDEV** to create a pair without specifying LUN.
5. From the **Available Primary Volumes** table, select the LDEV you want to assign as the P-VOL.

   Note: (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.

6. (VSP G1000, G1500, and VSP F1500) In **Cascade**, select **Enable** to create a cascaded pair.
7. (VSP G1000, G1500, and VSP F1500) In **Pair Type**, select **Snapshot** to create a pair with the snapshot attribute. Select **Clone** to create cloned pairs. Skip to step 11 if you selected **No** for **Create Pairs using Volumes as Root Volumes**.
8. Click **Select Pool**.
9. In the **Select Pool** window, select a pool from the **Available Pools** table.
10. Click **OK**.
11. For **Snapshot Group**, select either **Create New** to assign the pair to a new snapshot group, or **Use Existing** to assign the pair to an existing snapshot group. When you create a Thin Image pair, you must assign it to a snapshot group.

    Complete one of the following:

- For **Create New**, enter values for **Number of Snapshot Data per Primary Volume**, **Prefix**, and **Initial Number**, and then select **Snapshot Group Configuration**.
- For **Use Existing**, select **Snapshot Group Configuration**, and then select the snapshot group to which you want to assign the pair from the **Available Snapshot Groups** table. If you select **All**, enter a value in **Number of Snapshot Data per Primary Volume**.

Note: To create pairs and assign the pairs to a snapshot group by using CCI, see Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI on page 133.

12. Click **Add**.
    The selected LDEV is moved to the **Selected Primary Volumes** table.
13. Click **Next**.
14. From the **Available LDEVs** table, select the LDEV you want to assign as the S-VOL, and then click **Set**.
    The selected LDEV is displayed in the **Secondary Volumes** column of the **Selected Pairs** table.

Note:
- (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.
- If you select a capacity in **Capacity**, the **Available LDEVs** and **Selected Pairs** tables display the LDEVs that match the selected capacity.
- If you select a row in the **Available LDEVs** table and a row in the **Selected Pairs** table, and then click **Set**, you can configure a pair.
- If you select LDEVs which were assigned to an S-VOL with the **Exclude Assigned Volumes** check box unchecked, you can change the S-VOL to which snapshot data is assigned.

15. Click **Finish**, and then confirm the settings.
16. Accept the default task name or enter a unique name.
    You can enter up to 32 letters, numbers, and symbols, except the following:

    \ / : , ; * ? " < > |
17. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
18. Click **Apply** to submit the task.

Related concepts

- Workflow for creating Thin Image pairs using Device Manager - Storage Navigator on page 127

Related tasks

- Simultaneous processing of multiple Thin Image pair tasks on page 80
- Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI on page 133
- Accelerating the Thin Image pair deletion process on page 147

Related references

- Create TI Pairs wizard on page 255

Selecting a pool as your primary volume

You select a pool when you are creating a Thin Image pair if you are not using the P-VOL of a Thin Image pair (that is, you have selected No for Use Primary Volumes of Thin Image Pairs in the Create TI Pairs window of the Create TI Pairs wizard).

Procedure

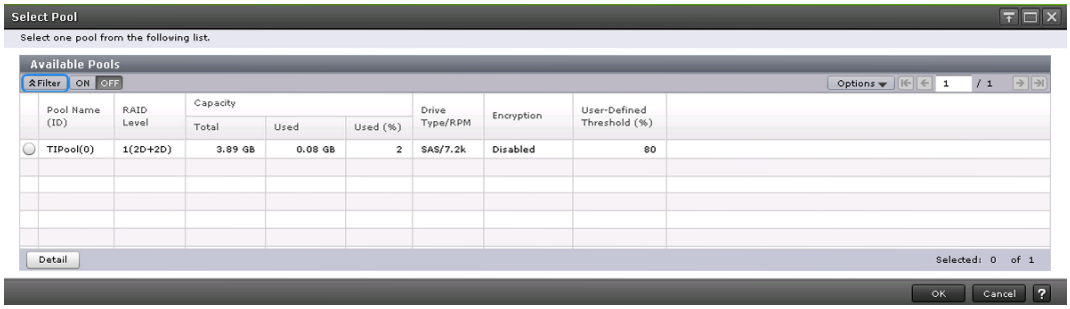
1. Navigate to the **Create TI Pairs** wizard.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   c. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab, and then click **Create TI Pairs**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
   b. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab, and then click **Create TI Pairs**.
2. In the **Create TI Pairs** window of the **Create TI Pairs** wizard, click **Select Pool**.



3. In the **Select Pool** window, from the **Available Pools** table, select the pool you want to add, and then click **OK**.
   The selected pool is displayed in **Select Pool** on the **Create TI Pairs** window.

Example of creating complex Thin Image pairs

A complex Thin Image pair is a pair where the P-VOL and S-VOL are not connected one to one. The following is an example of how to create Thin Image pairs of different configurations simultaneously.

In this example, one pair of two S-VOLs and another pair of one S-VOL are created simultaneously. Each pair's configuration is specified in the Create TI Pairs window.

1. (VSP G1000, G1500, and VSP F1500) In Create Pairs using Volumes as Root Volumes, select Yes.
2. Select two primary volumes from the Available Primary Volumes table.
3. (VSP G1000, G1500, and VSP F1500) In Cascade, select Enable to create a cascaded pair.
4. (VSP G1000, G1500, and VSP F1500) In Pair Type, select Snapshot to create a pair with the snapshot attribute. Select Clone to create cloned pairs.
5. Click Select Pool, and then select a pool in the **Select Pool** window.
6. Select Create New in Snapshot Group.
7. Enter `1` for Number of Snapshot Data per Primary Volume.
8. Select Snapshot Group Configuration.
9. Enter values for Prefix and Initial Number.
10. Click Add.
11. (VSP G1000, G1500, and VSP F1500) Select No for Create Pairs using Volumes as Root Volumes.
12. (VSP Gx00 models and VSP Fx00 models) Select Yes in Use Primary Volumes of Thin Image Pairs.
13. Select a primary volume for which you want to specify two secondary volumes from the Available Primary Volumes table.
14. Select Create New in Snapshot Group.
15. Enter `1` for Number of Snapshot Data per Primary Volume.

16. Select Snapshot Group Configuration.
17. Enter values for Prefix and Initial Number.
18. Click Add.
19. Click Next.
20. Select three secondary volumes in the **Assign Secondary Volumes** window, and then click Set.

Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI

You can create pairs and define the pairs in a snapshot group or in a consistency group. Define pairs to consistency groups to perform pair tasks on all of the pairs within the group. This task describes how to do this using CCI.

Note: If the host is down, the CCI command might be rejected and the pair not defined in the group. In this case, you can use Device Manager - Storage Navigator to create the pair and assign it to a group.

Procedure

Create the Thin Image pair and define the pair in a snapshot or consistency group. To do this using CCI, run the **`raidcom add snapshot`** command.

Note: Define pairs that share the same P-VOL in different snapshot groups.

The following is an example of using the CCI **`raidcom`** command to create a pair specifying the P-VOL (LDEV#10:10), the S-VOL (LDEV#20:20), the pool (SnapPool00) in the snapshot group (db1), and the consistency group (CTG):

```
raidcom add snapshot -ldev_id 0x1010 0x2020 -pool SnapPool00 -
snapshotgroup db1 -snap_mode CTG
```

Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128

Related references

- Thin Image consistency group requirements on page 73

Workflow for defining Thin Image pairs and defining them in snapshot or consistency groups using Device Manager - Storage Navigator

If you use a CCI command to create a pair that should be a target of the consistency group pair-split, and the host is down, the CCI command might be rejected and the pair not defined in the group.

If the command is rejected, use the following process to define the pair to the consistency group:

1. View a list of the consistency groups and locate the consistency group to which you want to assign the pair.
   For more information about how to view a list of consistency groups, see Viewing the list of consistency groups on page 165.
2. Create a pair and define it to a consistency group.
   For more information about how to create pairs and define them in consistency groups, see Creating Thin Image pairs using Device Manager - Storage Navigator on page 128.

Related concepts

- Storing snapshot data or cloning pairs on page 134
- Workflow for creating groups and storing snapshot data using CCI on page 33

Related tasks

- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128

Storing snapshot data or cloning pairs

From a P-VOL, a maximum of 1,024 snapshots can be stored or pairs can be cloned. Use one of these two methods to store Thin Image snapshot data or clone pairs.

- Split the Thin Image pair.
  For more information about storing snapshot data by splitting pairs, see Splitting Thin Image pairs to store snapshot data on page 135.
- Split the Thin Image pair within the consistency group using consistency group pair-split. Complete one of the following:
  - If you are not sharing Thin Image P-VOLs with Universal Replicator or TrueCopy S-VOLs within a storage system, see Workflow for splitting Thin Image pairs (VSP Gx00 models and VSP Fx00 models) or storing snapshot data or clone pairs (VSP G1000, G1500, and VSP F1500) in consistency groups on page 136.

- If you are sharing Thin Image P-VOLs with Universal Replicator or TrueCopy S-VOLs within a storage system, see Using consistency group pair-split with shared volumes on page 137.

Splitting Thin Image pairs to store snapshot data

This topic explains how to split pairs. Splitting pairs stores snapshot data.

A maximum of 1,024 snapshots can be stored or pairs can be cloned from a P-VOL. If you reach the maximum, delete the unneeded or unused snapshots.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.
- The Thin Image pair status must be "PAIR".

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, specify the pair you want to split and then click **Split Pairs**.

   You can specify P-VOLs in Device Manager - Storage Navigator until the total number of snapshots or clones reaches 32,768. You can also specify snapshot groups until the total number of pairs reaches 32,768. For cascaded pairs with layers, start with pairs at the higher layers.
5. Click **Finish**, and then confirm the settings.
6. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

Related tasks

- Resynchronizing Thin Image pairs on page 143

Related references

- Split Pairs wizard on page 273

Splitting Thin Image pairs to store snapshot data using CCI

Contain only Thin Image pairs that are either assigned to consistency groups or pairs that are not assigned to consistency groups in a group defined by the configuration definition file for CCI.

To specify more than one consistency group, define the same number of groups using the configuration definition file for CCI.

Procedure

Run the CCI **`pairsplit`** command.

Workflow for splitting Thin Image pairs (VSP Gx00 models and VSP Fx00 models) or storing snapshot data or clone pairs (VSP G1000, G1500, and VSP F1500) in consistency groups

You can split pairs to store snapshot data or clone pairs for a consistency group using CCI. This process explains how to use CCI's consistency group pair-split to split Thin Image pairs (VSP Gx00 models and VSP Fx00 models) or store snapshot data or clone pairs. (VSP G1000, G1500, and VSP F1500)

Use the following process to split Thin Image pairs to store snapshot data or clone pairs:

1. (If the pairs are not created) Create two Thin Image pairs and assign both pairs to the same consistency group. To do this, using CCI, run the following **`raidcom`** command twice using an option to specify the consistency group ID:
   ```
   raidcom add snapshot
   ```
   A pair is created and defined in a consistency group. This group is the target of the consistency group pair-split. The consistency group ID option you specified automatically enables the consistency group pair-split.
2. Create the pair to store snapshot data for a group. To do this, using CCI, specify the same consistency group ID as step 1 to run either of the following **`raidcom`** commands:

```
raidcom modify snapshot -snapshot_data create
raidcom modify snapshot -snapshot_data clone
```

3. The storage system receives the command. Then it stores the snapshot data for the consistency group that is the target of the consistency group pair-split, or clones pairs when a host issues a write request to the Thin Image pair's P-VOL that is assigned to the consistency group.
4. A host issues a write request to the Thin Image pair's P-VOL that is assigned to the consistency group.
5. The pairs are split and the snapshot data is stored.

Related concepts

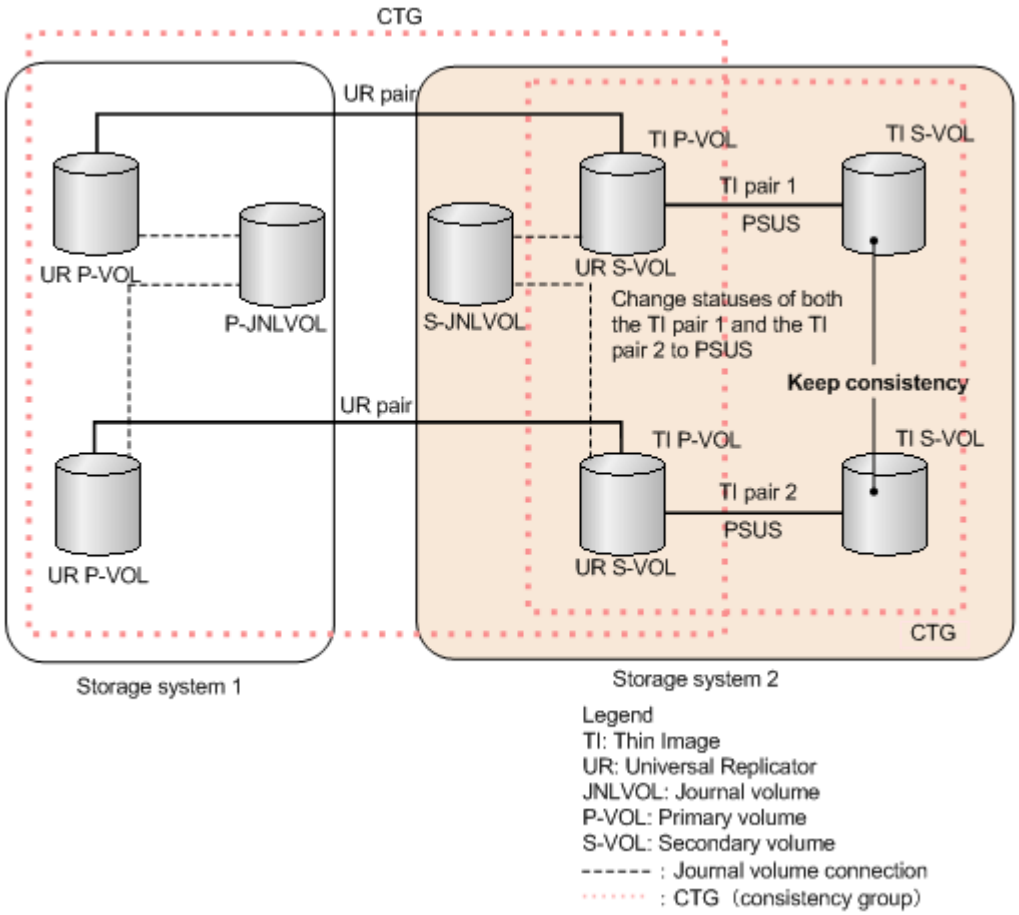
- Workflow for defining Thin Image pairs and defining them in snapshot or consistency groups using Device Manager - Storage Navigator on page 134
- Notes on storing snapshot data, and on cloning pairs (VSP G1000, G1500, and VSP F1500) on page 226

Using consistency group pair-split with shared volumes

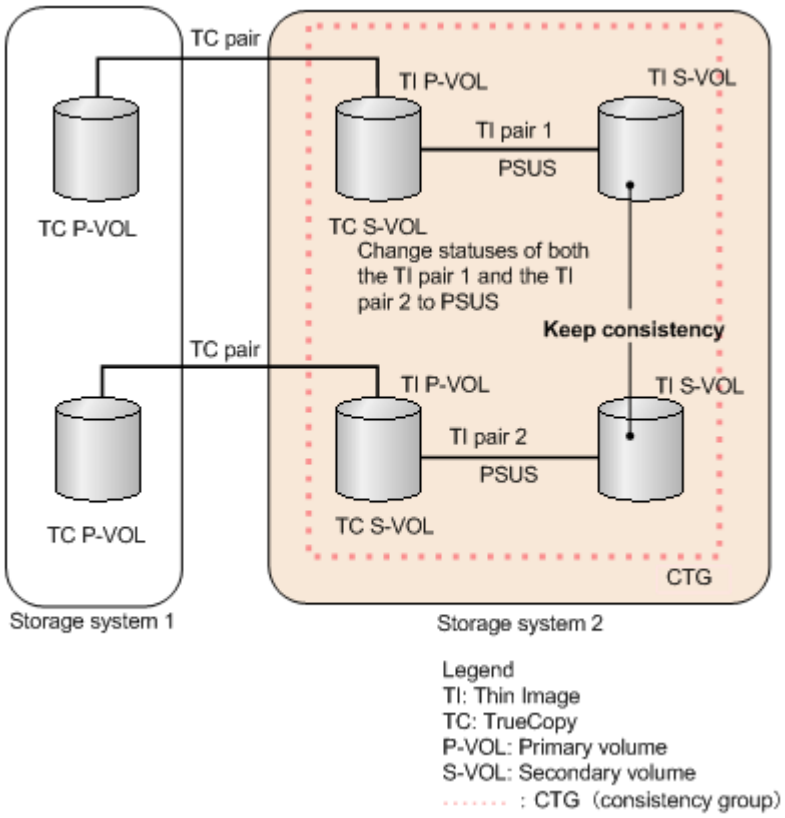
If you are sharing Thin Image P-VOLs with ShadowImage, Universal Replicator, or TrueCopy S-VOLs within a storage system, you can use consistency group pair-split to split the pairs that are defined in a consistency group to store the snapshot data. Consistency group pair-split maintains consistency for the Thin Image S-VOLs that are defined in the consistency group.

The following figures illustrate these configurations.

The following figure shows the consistency group pair-split configuration when you are sharing Thin Image P-VOLs with Universal Replicator S-VOLs.



The following figure show the consistency group pair-split configuration when sharing Thin Image P-VOLs with TrueCopy S-VOLs.



The following table explains when you can use consistency group pair-split with shared volumes.

HTI P-VOL used as	Pair status	Can you use consistency group pair-split?
UR S-VOL	COPY	No
	PAIR	Yes
	PSUS	Yes
TC S-VOL	COPY	No
	PAIR	Yes
	PSUS	Yes
SI S-VOL	COPY	No
	PAIR	No
	COPY(SP)	No
	PSUS(SP)	No
	PSUS	Yes
	COPY(RS)	No
	COPY(RS-R)	No
	PSUE	No

You cannot maintain the consistency of Thin Image S-VOLs that are defined in a consistency group in the following cases:

- You are sharing a Thin Image P-VOL with ShadowImage, TrueCopy, or Universal Replicator S-VOLs, and the statuses of those pairs are not the same.
- You are sharing a Thin Image P-VOL with a Universal Replicator S-VOL and they do not share the same journal.

For more information about Universal Replicator, see the *Hitachi Universal Replicator User Guide*.

Related concepts

- Notes on storing snapshot data, and on cloning pairs (VSP G1000, G1500, and VSP F1500) on page 226

Restoring Thin Image pairs

Restoring a Thin Image pair overwrites the existing P-VOL data with the differential data on the S-VOL.

Restoration of a Thin Image pair may end abnormally in either of the following conditions:

- You are storing snapshot data for a consistency group that already includes the pair.
- You are using the P-VOL of the pair as the P-VOL of another Thin Image pair and you are storing snapshot data for a consistency group including the latter pair.

Caution: Failures can occur while restoring Thin Image pairs, which suspends the pairs ("PSUE" status).

For more information about restoring suspended Thin Image pairs, see Restoring suspended Thin Image pairs on page 142.

The amount of time required for restoration depends on the following, even if the pair synchronization rate is 100 percent:

- The amount of capacity the pool is using.
- The number of pairs being resynchronized concurrently.

Note: The pair synchronization rate may not change when you view the rate while restoring the Thin Image pair. To view the up-to-date rate, wait until the task has completed.

For more information about monitoring the pair synchronization rates, see Viewing pair synchronization rates on page 162.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.
- The Thin Image pair must be split ("PSUS" status).

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, select the pairs you want to resynchronize, and then click **Resync Pairs**. You can specify P-VOLs until the number of snapshots or clones reaches 32,768. You can also specify snapshot groups until the number of pairs reaches 32,768. For cascaded pairs with layers, specify pairs at the lowest layer, and then higher layers.
5. For **Resync Type**, select **Reverse Copy (Secondary > Primary)** for a full restoration of P-VOL data from the S-VOL.
6. Click **Finish**, and then confirm the settings.
7. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Result

The Thin Image pair is restored ("PAIR" status).

Related concepts

- Thin Image pair restoration on page 37

Related tasks

- Simultaneous processing of multiple Thin Image pair tasks on page 80

Related references

- Resync Pairs wizard on page 276

Failure during Thin Image pair restore

If a failure occurs while restoring Thin Image pairs, the pairs are suspended.

During a failure, the storage system does the following:

- Blocks and suspends the Thin Image pair ("PSUE" status), including pairs that have snapshot data in the pool.
- Writes data to the Thin Image pair volumes.
- Exceeds the data pool capacity of snapshot data.

If a failure occurs, delete the unneeded snapshot data by restoring the suspended pairs.

Restoring suspended Thin Image pairs

When pairs are suspended ("PSUE" status) after a failure occurs, they need to be restored.

Note: You can only restore one Thin Image pair at a time.

Procedure

1. Delete the snapshot data by resynchronizing the pair.
2. Complete one of the following:
   - Overwrite the backup data to the P-VOL.
   - Format the P-VOL.

   For more information about overwriting backup data to the P-VOL or formatting LDEVs, see the *Provisioning Guide* for your storage system.

Related tasks

- Resynchronizing Thin Image pairs on page 143

Thin Image pair resynchronization

Resynchronizing a Thin Image pair updates the S-VOL with the differential data and deletes the replaced data, the data in the pool. Resynchronizing a pair maintains the relationship between the P-VOL and S-VOLs.

The amount of time required for resynchronization depends on the following, even if the pair resynchronization rate is 100 percent:

- The amount of capacity the pool is using.

- The number of pairs being resynchronized concurrently.

Pair resynchronization methods

You can forward or reverse resynchronize Thin Image pairs. A forward resynchronization resynchronizes the S-VOL from the P-VOL. A reverse resynchronization restores the P-VOL from the S-VOL.

Forward resynchronization

You can use the Normal Copy (Primary > Secondary) method to forward resynchronize pairs.

This method performs a full forward resynchronization of data from the P-VOL to the S-VOL. The differential data is copied to the S-VOL.

Reverse resynchronization

You can use the Reverse Copy (Secondary > Primary) method to restore pairs.

This method performs a full restoration of P-VOL data from the S-VOL.

Resynchronizing Thin Image pairs

You can resynchronize Thin Image pairs that you have split or that the storage system has suspended.

Resynchronizing pairs does the following:

- Updates the S-VOL so that it is again paired with the P-VOL.
- Frees up the P-VOL's snapshot differential data for that P-VOL to reuse.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, select the pair you want to resynchronize, and then click **Resync Pairs**.
5. For **Resync Type**, select **Normal Copy (Primary > Secondary)** for full forward resynchronization of data from the P-VOL to the S-VOL.
6. Click **Finish**, and then confirm the settings.
7. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Result

The Thin Image pair is resynchronized ("PAIR" status).

Related concepts

- Workflow for creating groups and storing snapshot data using CCI on page 33

Related tasks

- Simultaneous processing of multiple Thin Image pair tasks on page 80
- Splitting Thin Image pairs to store snapshot data on page 135

Related references

- Resync Pairs wizard on page 276

Assigning MU numbers to deleted snapshot data

Use this process to assign an MU number to deleted snapshot data.

Procedure

1. Resynchronize the pair using forward resynchronization.
2. Store the data for the Thin Image pair.

Related concepts

- Storing snapshot data or cloning pairs on page 134

Related tasks

- Resynchronizing Thin Image pairs on page 143

Deleting snapshot data

After writing data to a Thin Image pair volume, if the capacity of the snapshot data exceeds the pool capacity, the Thin Image pair changes to the PSUE status (indicating a failure occurred). In this case, you cannot create a new Thin Image pair, therefore, you must delete snapshot data which is no longer necessary. To delete snapshot data, perform either of the following methods:

- Deleting Thin Image pairs
  Deleting Thin Image pairs deletes snapshot data stored in a pool and cancels the relationship between the P-VOL and the S-VOL.
- Deleting snapshot data only
  To delete snapshot data only, use the **Resync Pairs** window to delete snapshot data or restore Thin Image pairs. If you deleted only snapshot data, the relationship between the P-VOL and the S-VOL is maintained. If you delete only snapshot data, you can assign the MU numbers of the snapshot data you deleted when you store snapshot data of the Thin Image pair later. For details about the **Resync Pairs** window, see Restoring Thin Image pairs on page 140 or Deleting Thin Image pairs on page 145.

When you delete snapshot data, the pair status changes to PAIR. Even if you update the primary volume from the host, the snapshot data is no longer stored. To resume storing snapshot data, split the Thin Image pair again.

The amount of time required for deleting snapshot data depends on the following, even if the pair synchronization ratio is 100 percent:

- The amount of pool capacity a pair is using.
- The number of pairs being operated concurrently.

The pair synchronization rate shows the rate that S-VOL data matches that of the next generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL with the P-VOL.

For the Thin Image pair where the cascade attribute is enabled, the information displayed in Synchronization Rate (%) of the View Pair Synchronization Rate window varies depending on the pair status.

Deleting Thin Image pairs

Delete Thin Image pairs when you do not need them or when you want to delete snapshot data.

When you delete a pair, the P-VOL and the S-VOL change to SMPL(PD) and they are unpaired. When volumes are unpaired, they are not displayed in the main window. After the deletion, you can use the unpaired volumes in other

pairs. You cannot create pairs in the SMPL(PD) status, and you cannot allocate an S-VOL to snapshot data, or cancel or change the allocation. To shorten the time in the SMPL(PD) status, delete snapshot data if any, and delete pairs after the pair status changes to PAIR. When you set a snapshot group, if all pairs in a snapshot group are unpaired, the snapshot group is automatically removed. Make sure that the snapshot group is removed before starting another pair task.

All snapshot data in a P-VOL must be deleted for there to be a decrease in the pool usage rate and an increase in unused capacity.

The amount of time required for deletion depends on the following, even if the pair resynchronization rate is 100 percent:

- The amount of pool capacity a pair is using.
- The number of pairs being operated concurrently.

The pair synchronization rate shows the rate that S-VOL data matches that of the next generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL with the P-VOL.

(VSP G1000, G1500, and VSP F1500) For the Thin Image pair where the cascade attribute is enabled, the information displayed in Synchronization Rate (%) of the View Pair Synchronization Rate window varies depending on the pair status. For details, see View Pair Synchronization Rate window on page 243.

(VSP G1000, G1500, and VSP F1500) If you cannot delete Thin Image pairs with Device Manager - Storage Navigator, you can use CCI commands to forcibly delete all Thin Image cascaded pairs in a snapshot tree. For details about CCI commands, see Pair tasks using CCI or Device Manager - Storage Navigator on page 216 and the *Command Control Interface Command Reference*.

Note: After deleting a Thin Image pair, the number of pairs shown in the summary section in the **Local Replication** window and in the list on the TI Root Volumes or TI Primary Volumes tab can be different. Wait until the configuration has completed processing. If the numbers do not match, reload the configuration information (see Reloading Thin Image configuration information on page 126).

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.
- The Thin Image pair must be suspended ("PSUE" status), paired ("PAIR" status), or split ("PSUS" status).

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, select the pair you want to delete, and then click **More Actions > Delete Pairs**.

   You can specify P-VOLs in Device Manager - Storage Navigator until the total number of snapshots or clones reaches 32,768. In addition, you can specify snapshot groups until the total number of pairs reaches 32,768. For cascaded pairs with layers, specify pairs at the lowest layer, and then higher layers.
5. Click **Finish**, and then confirm the settings.
6. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

Result

The pair deletion process begins ("SMPL(PD)" status), and then the pair is deleted.

Related tasks

- Simultaneous processing of multiple Thin Image pair tasks on page 80
- Recovering blocked pools on page 188

Accelerating the Thin Image pair deletion process

You can shorten the time that a Thin Image pair is in the process of being deleted ("SMPL(PD)" status). If the pair status is "SMPL(PD)", you cannot recreate a Thin Image pair, and you cannot assign an S-VOL to snapshot data, release an assignment, or change an assignment.

Procedure

1. Delete the snapshot data by resynchronizing the pair.
   This puts the pair in "PAIR" status.
2. Delete the pair.

Related tasks

- Resynchronizing Thin Image pairs on page 143

Removing Thin Image snapshot groups

You can remove snapshot groups by deleting all of the pairs in the group. Remove snapshot groups before performing the next pair task.

Note: You can use HDvM - SN only to reference consistency and snapshot groups and to remove snapshot groups. You cannot use HDvM - SN to delete consistency groups.

Procedure

Delete all of the Thin Image pairs that are assigned to the snapshot group.

Assigning secondary volumes to Thin Image pair snapshot data

This section explains how to assign secondary volumes to Thin Image snapshot data.

Assigning secondary volumes to snapshot data after creating new Thin Image pairs

You can assign an S-VOL to snapshot data after creating a new Thin Image pair.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

b. Right-click the target storage system, and then select **Local Replication**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, click **Create TI Pairs**.

   You can specify P-VOLs in Device Manager - Storage Navigator until the total number of snapshots or clones reaches 32,768. In addition, you can specify snapshot groups until the total number of pairs reaches 32,768.
5. In **Use Primary Volumes of Thin Image Pairs**, or **Create Pairs using Volumes as Root Volumes**, select **Yes** or **No**.
6. (VSP G1000, G1500, and VSP F1500) In **Select By**, select **LUN** to create a pair by specifying LUN. Select **LDEV** to create a pair without specifying LUN.
7. From the **Available Primary Volumes** table, select the LDEV you want to assign as the P-VOL.

   Note: (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.

8. (VSP G1000, G1500, and VSP F1500) In **Cascade**, select **Enable** to create a cascaded pair.
9. (VSP G1000, G1500, and VSP F1500) In **Pair Type**, select **Snapshot** to create a pair with the snapshot attribute. Select **Clone** to create a cloned pair. If you selected **No** for **Create Pairs using Volumes as Root Volumes**, go to step 13
10. Click **Select Pool**.
11. In the **Select Pool** window, select a pool from the **Available Pools** table.
12. Click **OK**.
13. For **Snapshot Group**, select either **Create New** to assign the pair to a new snapshot group, or **Use Existing** to assign the pair to an existing snapshot group. When you create a Thin Image pair, you must assign it to a snapshot group.

    Complete one of the following:
    - For **Create New**, enter values for **Number of Snapshot Data per Primary Volume**, **Prefix**, and **Initial Number**, and then select **Snapshot Group Configuration**.
    - For **Use Existing**, select **Snapshot Group Configuration**, and then select the snapshot group to which you want to assign the pair from

the **Available Snapshot Groups** table. If you select **All**, enter a value in **Number of Snapshot Data per Primary Volume**.

Note: To create pairs and assign the pairs to a snapshot group by using CCI, see Creating Thin Image pairs and defining them in snapshot or consistency groups using CCI on page 133.

14. Click **Add**.
    The selected LDEV is moved to the **Selected Primary Volumes** table.
15. Click **Next**.
16. From the **Available LDEVs** table, select the LDEV you want to assign as the S-VOL, and then click **Set**.
    The selected LDEV is displayed in the **Secondary Volumes** column of the **Selected Pairs** table.

Note:
- (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.
- If you select a capacity in **Capacity**, the **Available LDEVs** and **Selected Pairs** tables display the LDEVs that match the selected capacity.
- If you select a row in the **Available LDEVs** table and a row in the **Selected Pairs** table and then click **Set**, you can configure a pair.

17. Click **Finish**, and then confirm the settings.
18. Accept the default task name or enter a unique name.
    You can enter up to 32 letters, numbers, and symbols, except the following:

    \ / : , ; * ? " < > |
19. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
20. Click **Apply** to submit the task.

Related references

- Create TI Pairs window on page 256

Assigning secondary volumes to snapshot data of existing Thin Image pairs

You can assign an S-VOL to snapshot data of an existing Thin Image pair.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, click **More Actions > Assign Secondary Volumes**.

   You can specify P-VOLs in Device Manager - Storage Navigator until the total number of snapshots or clones reaches 32,768. In addition, you can specify snapshot groups until the total number of pairs reaches 32,768.
5. From the **Available LDEVs** table, select the LDEV you want to assign as the S-VOL, and then click **Set**.
   The selected LDEV is displayed in the **Secondary Volumes** column of the **Selected Pairs** table.

   Note:
   - (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.
   - If you select a capacity in **Capacity**, the **Available LDEVs** and **Selected Pairs** tables display the LDEVs that match the selected capacity.
   - If you select a row in the **Available LDEVs** table and a row in the **Selected Pairs** table and then click **Set**, you can configure a pair.
6. Click **Finish**, and then confirm the settings.
7. Accept the default task name or enter a unique name.

You can enter up to 32 letters, numbers, and symbols, except the following:

\ / : , ; * ? " < > |

8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Related references

- Assign Secondary Volumes window on page 290

Releasing assignment of secondary volumes from Thin Image pair snapshot data

You can release the assignment of S-VOLs from snapshot data of Thin Image pairs.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy Pair Unmap) role.

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, select the S-VOL pairs you want to delete, and then click **More Actions > Remove Secondary Volumes**.
5. In the **Remove Secondary Volumes** window, confirm the settings.
6. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

\ / : , ; * ? " < > |

7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

Related references

- Remove Secondary Volumes window on page 297

Changing assignment of secondary volumes to Thin Image pair snapshot data

You can change S-VOLs that are assigned to snapshot data.

Note: If the amount of snapshot data in selected P-VOLs or the total number of pairs in selected snapshot groups exceeds 37,768, an error message appears when attempting to perform pair tasks.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, click **More Actions > Assign Secondary Volumes**.
5. From the **Available LDEVs** table, select the LDEV you want to assign as the S-VOL, and then click **Set**.
   The selected LDEV is displayed in the **Secondary Volumes** column of the **Selected Pairs** table.

Note:

- (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not appear in the **Available Primary Volumes** table.
- If you select a capacity in **Capacity**, the **Available LDEVs** and **Selected Pairs** tables display the LDEVs that match the selected capacity.
- If you select a row in the **Available LDEVs** table and a row in the **Selected Pairs** table and then click **Set**, you can configure a pair.
- If you select LDEVs that were assigned to an S-VOL with the **Exclude Assigned Volumes** check box unchecked, the S-VOL to which snapshot data is assigned can be changed.

6. Click **Finish**, and then confirm the settings.
7. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Related references

- Assign Secondary Volumes window on page 290

5

Monitoring and maintaining Thin Image

This chapter provides information and instructions for monitoring and maintaining Thin Image.

- Monitoring pair information
- Monitoring consistency groups
- Viewing Thin Image pair task history
- Viewing licensed capacities
- Viewing the number of cache management devices
- Managing pools
- Managing virtual volumes
- Viewing snapshot data capacity (VSP G1000, G1500, and VSP F1500)
- Maintaining pairs during storage system maintenance
- Definition of failure

Monitoring pair information

Viewing summary replication information

You can view summary replication information in the **Replication** window. This window shows the summary section at the top of the window and the Replica LDEVs tab at the bottom.

From this window you can perform the following tasks:

- Open the window from which you can view local replication summary information.
- Open the window from which you can set the system options that affect performance in Thin Image.

Procedure

1. Navigate to the **Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Replication Dashboard**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication**.

2. In the summary section in the **Replication** window, view the following information:

   - **Licensed Capacity:** The used and licensed capacity of each software application.
   - **Number of Replica LDEVs:** The number of LDEVs used for replication.
   - **Number of FCv2/FCSE Relationships:** (VSP G1000, G1500, and VSP F1500) The number of FCv2 and FCSE relationships that are in use.
   - **Number of Differential Tables:** The number of differential tables that are in use and the differential table limit in the storage system. This number does not include the number of differential tables that FCv2/FCSE Relationships use.

     Note: Thin Image does not use differential tables.

3. In the **Replica LDEVs** tab, view the following information:

- **LDEV ID:** The selected LDEV's identification number. Click the ID to open the **LDEV Properties** window. Use this window to search for pool information.
- **LDEV Name:** The selected LDEV's name.
- **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The selected LDEV's emulation type.
- **Capacity:** The selected LDEV's capacity.
- **Copy Type:** The copy type for the pair you selected.
  Values:
  - **TI**: HTI pair
  HTI, SI, SIz, TC, TCz, UR, URz, and GAD volume status:
  - **Primary**: P-VOL
  - **Secondary**: S-VOL
  FCv2 and FCSE volume status (VSP G1000, G1500, and VSP F1500):
  - **S-Normal**: The source volume in the normal status. S means a source volume.
  - **T-Normal**: The target volume in the normal status. T means a target volume.
  - **ST-Normal**: The normal volume which is set for the source volume and the target volume.
  - **S-Failed, S-Full, S-Full & Failed**: The source volume in the abnormal status.
  - **T-Failed, T-Full, T-Full & Failed**: The target volume in the abnormal status.
  - **ST-Failed, ST-Full, ST-full & Failed**: The abnormal volume which is set for the source volume and the target volume.
  If you have not configured a pair, a hyphen (-) is displayed.

4. (Optional) To download table information to a file, click **Export**.

Related tasks

- Changing system options that affect Thin Image performance on page 119
- Viewing local replication summary information on page 157
- Viewing Thin Image pair task history on page 168

Related references

- Replication window on page 230

Viewing local replication summary information

You can view summary local replication information, such as the number of pairs for each software application you are using, in the summary section of the **Local Replication** window.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:

a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
b. Right-click the target storage system, and then select **Local Replication**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the summary section of the **Local Replication** window, view the following information:

Number of Pairs

The number of pairs for each local replication software application type. The total number of pairs is shown on the **Total** line.

Default: ShadowImage, ShadowImage for Mainframe, and Thin Image

Number of Consistency Groups

The number of consistency groups that are in use and the consistency groups limit in the storage system.

Snapshot Estimated Manageable Capacity

The Thin Image pair's estimated manageable capacity, which is the estimated pair capacity that you can create using the remaining shared memory capacity. This value varies depending on the number of Thin Image P-VOLs you add or delete and the number of Thin Image pairs you create.

If the value is less than 128.00 TB, the  icon is shown.

Note: This value is a rough estimation and changes as you add and delete Thin Image pool-VOLs or pairs. This value does not guarantee that the Thin Image pairs of the indicated capacity have been successfully created.

Number of Pair Tables

The number of pair tables. This number varies depending on the combination of software applications you are using.

Values:

- SI/SIMF/Volume Migration: The number of SI, SIz, and Volume Migration pair tables in use, and the SI, SIz, and Volume Migration pair table limit in the storage system.

- HTI: The number of HTI pair tables in use and the HTI pair table limit in the storage system.

Number of Differential Tables

The number of differential tables that are in use and the differential table limit in the storage system. This number does not include the number of differential tables that FCv2/FCSE Relationships use.

Note: Differential tables are not used in Thin Image.

Viewing the number of pairs

You can view the number of pairs.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the summary section in the **Local Replication** window, for **Number of Pairs**, view the number of pairs.

Related concepts

- Calculating Thin Image pairs based on the snapshot estimated manageable capacity on page 76

Related tasks

- Viewing local replication summary information on page 157

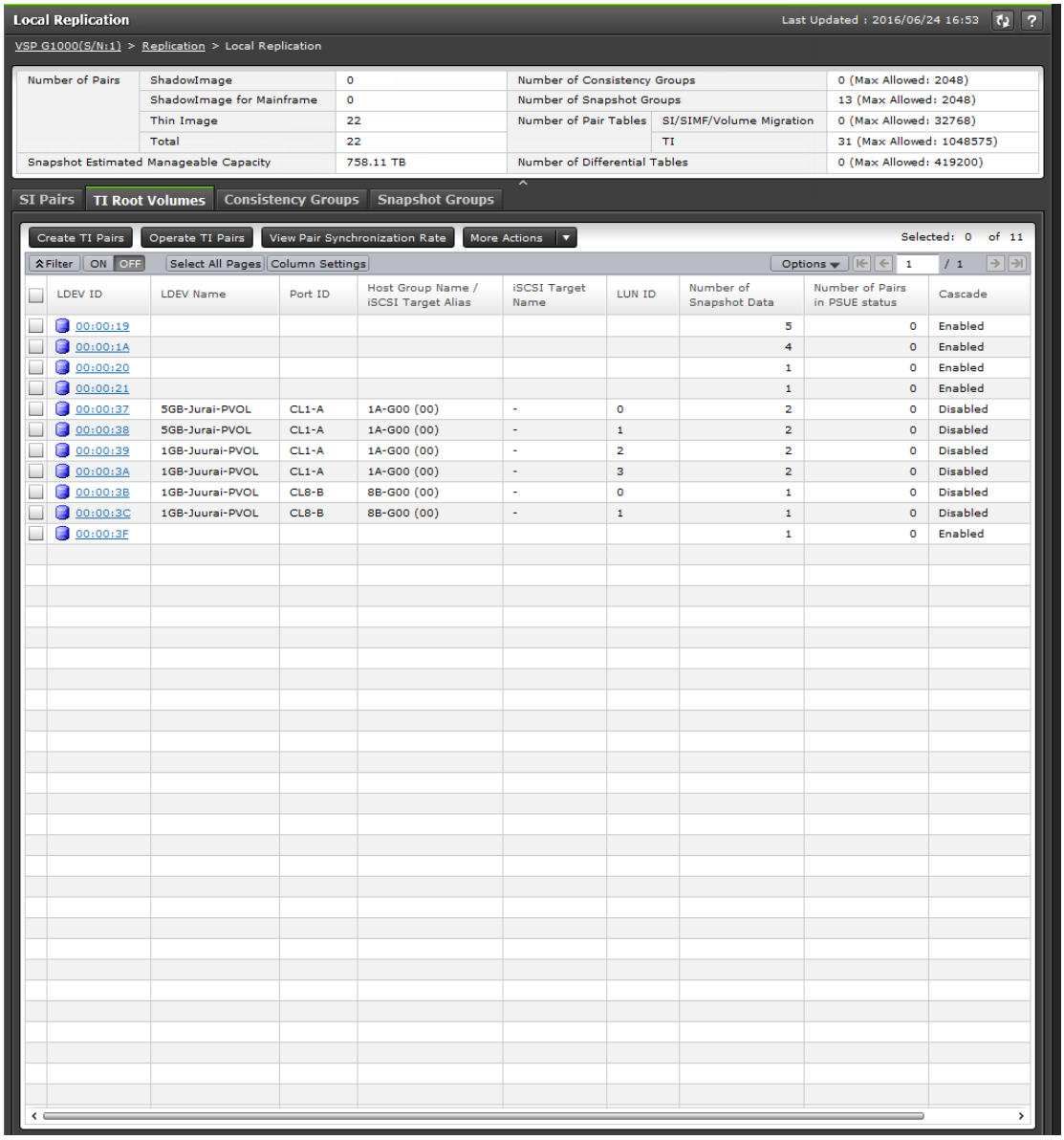
Viewing the list of primary volumes

You can view the list of primary volumes.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the **Local Replication** window, select the **TI Root Volumes** or **TI Primary Volumes** tab.



3. In the **TI Root Volumes** or **TI Primary Volumes** tab, view the list of Thin Image primary volumes.

Viewing pair properties

You can view pair properties and confirm the status of a volume in the **View Pair Properties** window.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.
4. In the **TI Pairs** window, select the pair you want to monitor, and then click **More Actions > View Pair Properties**.

Related references

- View Pair Properties window on page 246

Thin Image pair status definitions

The P-VOL and V-VOL access columns in the following table indicate whether the volumes accept read/write.

For more information about the corresponding CCI pair command results, see CCI pair command results on page 217.

The following table describes the Thin Image pair status definitions, the S-VOL access for the status, and the corresponding status that is shown in CCI.

Pair status	Description	S-VOL access	Status shown in CCI
SMPL(PD)	The pair is in the process of being deleted. You cannot perform pair tasks when the pair is in this status, and you cannot assign an S-VOL to snapshot data, release an assignment, or change an assignment. When the process completes, volumes are unpaired.	Read/write disabled.	SMPL[1]
SMPP (VSP G1000, G1500, and VSP F1500)	The cascaded pair or the pair with the clone attribute is in the process of being deleted. You cannot perform pair tasks when the pair is in this process. When the process completes, volumes are unpaired.	Read/write disabled.	SMPL[1]
COPY	The storage system has accepted the **`paircreate`** CCI command. The P-VOL accepts read/write operations, but the S-VOLs do not accept read/write operations.	Read/write disabled.	COPY
PAIR	The volumes are paired.	Read/write disabled.	PAIR

Pair status	Description	S-VOL access	Status shown in CCI
	The S-VOL does not accept read/write operations.		
PFUL	While the volumes are paired ("PAIR" status), you exceeded the data pool threshold.	Read/write disabled.	PFUL
PFUS	While the pair is split ("PSUS" status), you exceeded the data pool threshold.	Read/write enabled.	PFUS
PSUS	The pair with the snapshot attribute is split. The S-VOL can accept read/write operations. The storage system records differential data between the P-VOL and S-VOLs so that you can immediately resynchronize the pair.	Read/write enabled. Can be mounted.	PSUS for P-VOLs SSUS for S-VOLs
PSUS(SP) (VSP G1000, G1500, and VSP F1500)	The pair with the clone attribute is split. The S-VOL accepts read/write operations.	Read/write enabled. Can be mounted.	PSUP
RCPY	A Reverse Copy is in progress. The S-VOL does not accept read/write operations[2]. The starting time of the copy depends on the number of pairs in your storage system. Only S-VOL differential data is copied to the P-VOL. The Update Copy operation is not performed during Reverse Copy or Quick Restore.	Read/Write disabled.	RCPY
PSUE	The pair is suspended. The S-VOL does not accept read/write operations.	Read/Write disabled.	PSUE

Notes:

1. SMPL/SMPP is displayed if the **`-key opt`** option is specified for the **`raidcom get snapshot`** command. SMPP appears when cascaded or cloned pairs are being deleted.

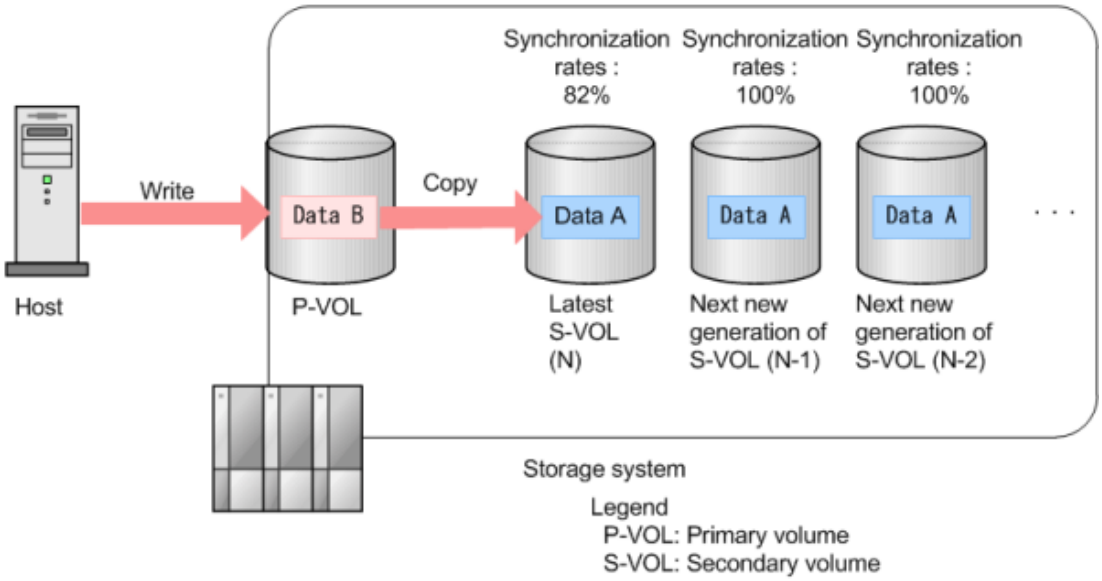
2. Starting time of the copy depends on numbers of pairs and your system environment.

Viewing pair synchronization rates

You can check the percentage of data that is synchronized between the P-VOL and S-VOLs. The Thin Image synchronization rate shows the rate that S-VOL data matches that of the next new generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL with the P-VOL.

The synchronization rate is a rough value, and can have a large margin of error. If the P-VOL is written to in the configuration of multiple generation (the configuration between the P-VOL and S-VOLs is 1:N), the synchronization rates for only the S-VOL of the newest generation decrease. If the S-VOL is written to, only the synchronization rates of the written generation decrease.

The following figure shows how to monitor the synchronization rates.



Note: During the Thin Image pair restoration process, the pair synchronization rate may not be up to date. The task must complete for the rate to be up to date.

For the Thin Image pair where the cascade attribute is enabled, the information displayed in Synchronization Rate (%) of the View Pair Synchronization Rate window varies depending on the pair status.

For more information about restoring Thin Image pairs, see Restoring Thin Image pairs on page 140.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.
2. In the **Local Replication** window, select a P-VOL in the **TI Root Volumes** or **TI Primary Volumes** tab or a snapshot group in the **Snapshot Groups** tab.
3. Click **Operate TI Pairs**.

4. In the **TI Pairs** window, select the pair for which you want to monitor synchronization rates, and then click **More Actions > View Pair Synchronization Rate**.
5. To check a pair's status and ensure the data is current, click **Refresh**. The latest synchronization rates are shown.

Related references

- View Pair Synchronization Rate window on page 243

Monitoring consistency groups

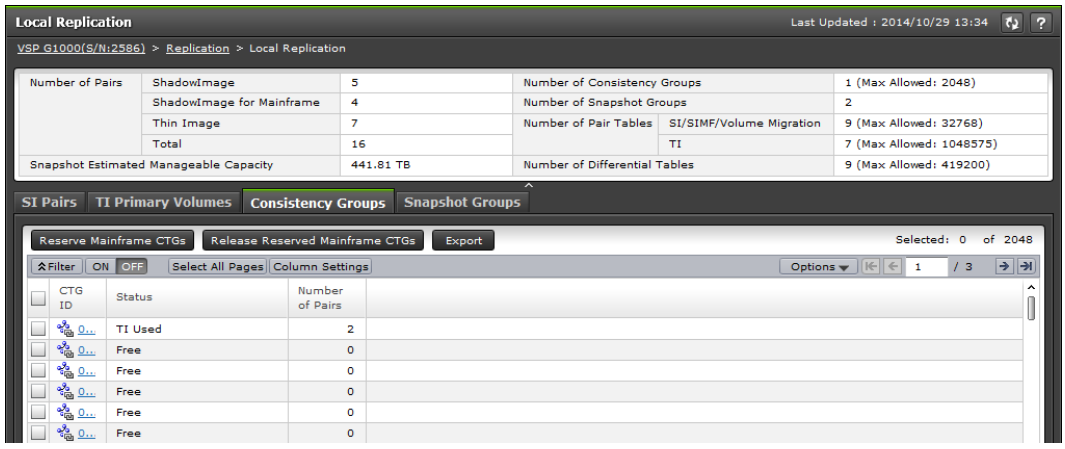
Viewing the number of consistency groups

You can view the number of consistency groups that are in use.

Procedure

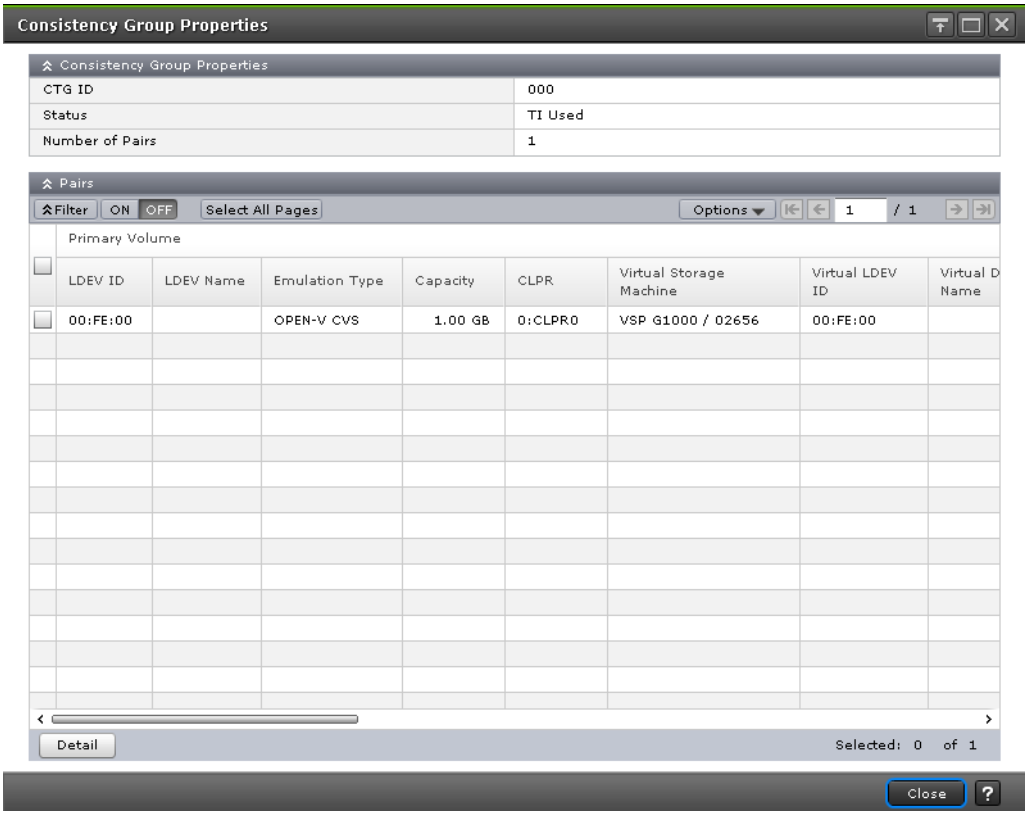
Navigate to one of the following windows:

- **Local Replication** window.



For more information about how to view this information on this window, see Viewing local replication summary information on page 157.

- **Consistency Group Properties** window.



For more information about viewing this information on this window, see Viewing consistency group properties on page 166.

Related references

- Local Replication window on page 232
- Consistency Group Properties window on page 252

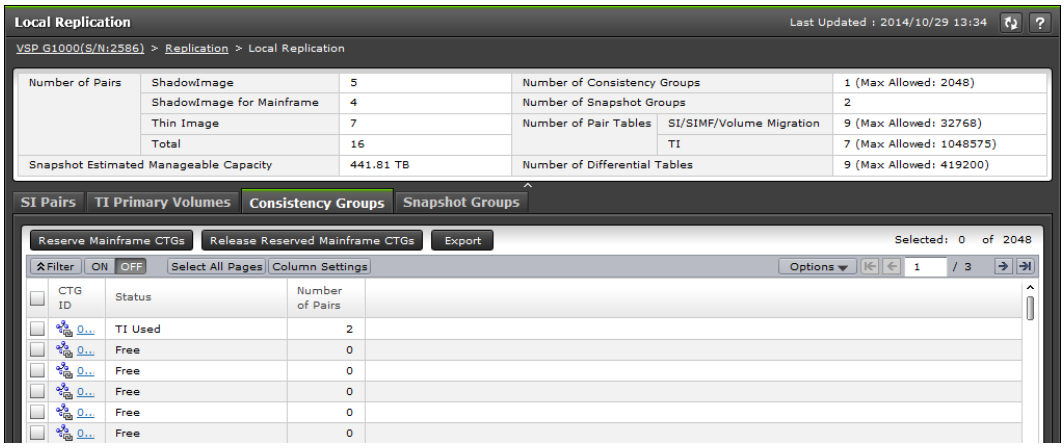
Viewing the list of consistency groups

You can view the list of consistency groups.

Procedure

1. Navigate to the **Local Replication** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Local Replication**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the **Local Replication** window, select the **Consistency Groups** tab.



A list of consistency groups is shown in the **Local Replication** window, in the **Consistency Groups** tab.

Related tasks

- Viewing local replication summary information on page 157

Related references

- Local Replication window on page 232

Viewing consistency group properties

You can view properties of a consistency group using the Consistency Group Properties window.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Local Replication** window.

   In Hitachi Command Suite:

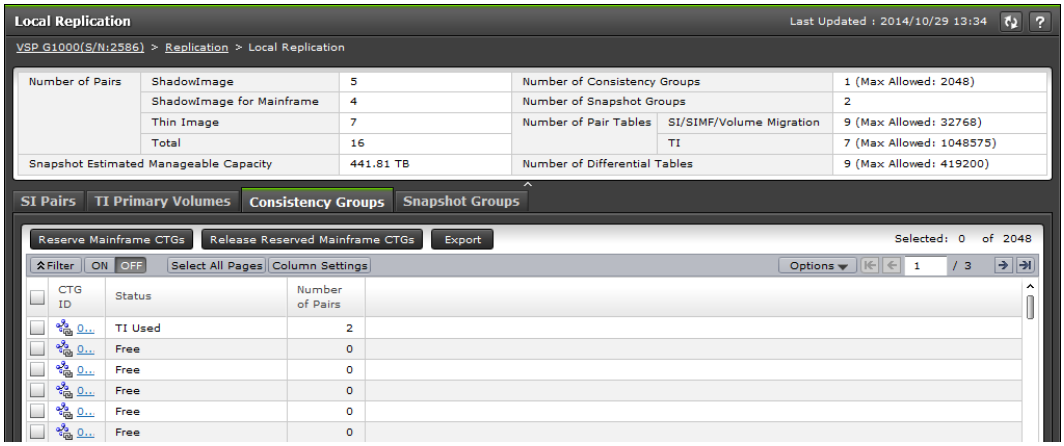
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Right-click the target storage system, and then select **Local Replication**.

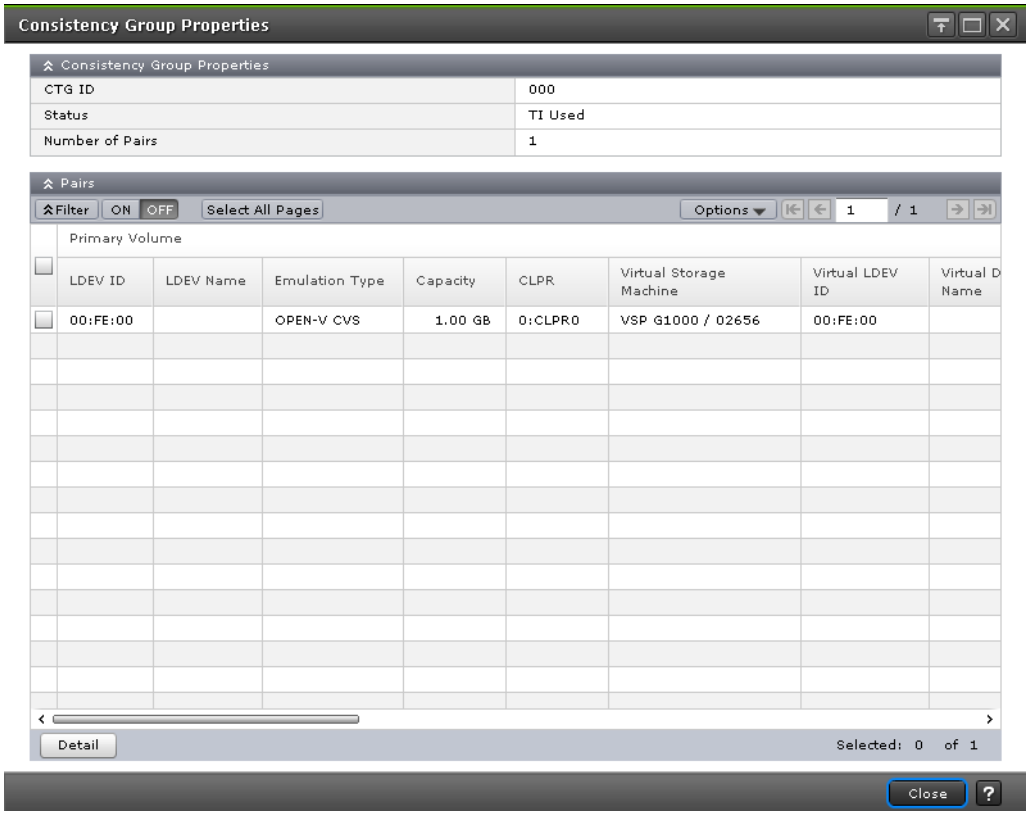
   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, expand **Replication**, and then click **Local Replication**.

2. In the **Local Replication** window, select the **Consistency Groups** tab.



3. In the **Consistency Groups** tab, click the CTG ID for the consistency group for which you want to view properties.



4. In the **Consistency Group Properties** window, view the following consistency group properties:

- **CTG ID:** The consistency group identification number.
- **Status:** The consistency group status.
  Values:

- **SI Used**: SI is using the consistency group.
- **SIMF Used (RAID Manager)**: (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group and CCI is managing the consistency group.
- **SIMF Used (PPRC/BCM)**: (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group and PPRC and Business Continuity Manager are managing the consistency group.
- **TI Used**: HTI is using the consistency group.
- **Mainframe Reserved**: (VSP G1000, G1500, and VSP F1500) PPRC and Business Continuity Manager are using the consistency group.
- **Free**: The consistency group is not being used and is not reserved.
- **(Changing...)**: The status is in the process of changing.

- **Number of Pairs:** The number of pairs that are assigned to the consistency group.

Related references

- Consistency Group Properties window on page 252

Viewing Thin Image pair task history

You can review task history, including which tasks you have performed on a pair, in the **History** window.

A VSP G1000, G1500, and VSP F1500 storage system saves a history of the last 1,024,000 Thin Image pair tasks. You can view a maximum of 16,384 pair tasks on each page. If there are more than 16,384 pair tasks available to view, you can view them on the next page. To view the next page, click the right arrow at the top of the page.

For a VSP G200, G400, G600, G800 storage system, you can view a maximum of the latest 8,192 pair tasks in the **History** window.

Note: If you use 1,000 or more pairs concurrently, some operation history might not be recorded.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Replication** window.

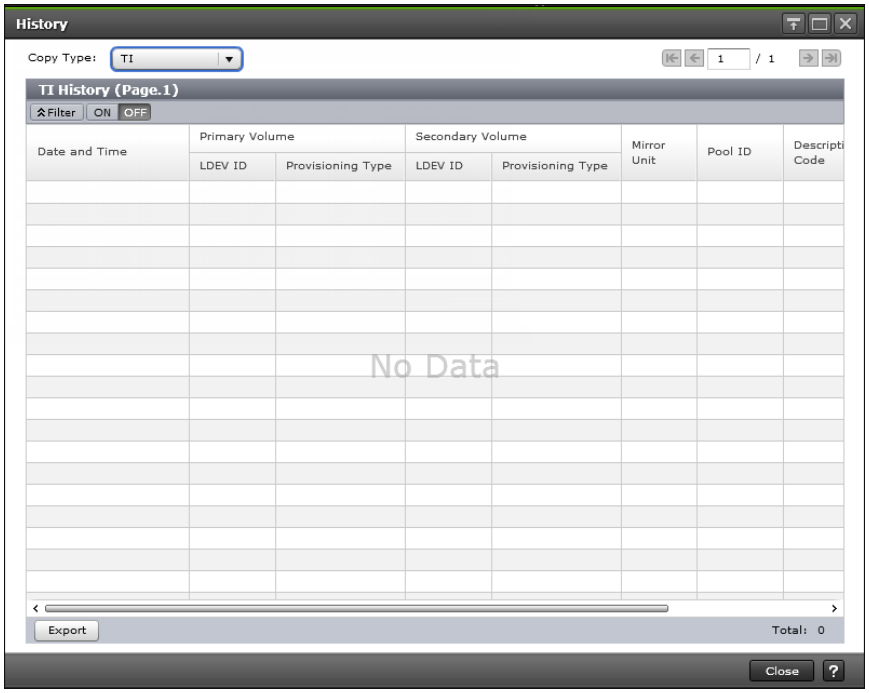
   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Right-click the target storage system, and then select **Replication Dashboard**.

   In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication**.

2. In the **Replication** window, click **View History > Local Replication**.



3. In the **History** window, for **Copy Type**, select **TI** as the copy type for the pair you selected.

   For more information about the values for **Copy Type**, see History window on page 250.

4. In the **TI History** table, view the following information:
   - **Date and Time:** The date and time you performed the task.
   - **LDEV ID:** The primary/source volume's LDEV identification number.
   - **Provisioning Type:** The P-VOL's provisioning type.
     Values:
     - **Basic**: Internal volume
     - **DP**: DP-VOL
     - **External**: External volume
   - **Secondary Volume:** Information about the S-VOL.
   - **Mirror Unit:** The mirror unit number.
   - **Pool ID:** The pool identification number.
   - **Description Code:** The code for the type of task you performed.
   - **Description:** The description of the task you performed.

Related references

- History window on page 250

Thin Image task code definitions

The following table shows a list of the codes for the type of tasks you perform, including the description of the tasks, that are shown in the TI History table.

Description Code	Description	Explanation
2001	PAIR	The volumes are paired. The pair has been created.
2011	PSUS	The pair was split.
2020	SMPL START	The pair deletion starts.
2021	SMPL END	The pair deletion ended normally.
2030	COPY(RS-R) START	The pair is in the process of being restored.
2031	COPY(RS-R) END	The pair was restored.
2032	COPY(RS-R) ENDED ABNORMAL	The pair restoration process has failed.
2040	INITIALIZE START	Initialization processing starts.
2041	INITIALIZE END	Initialization processing ended.
2042	INITIALIZE ENDED ABNORMAL	Initialization processing ended abnormally.
2050	COPY(RS) START	The pair is in the process of being resynchronized.
2051	COPY(RS) END	The pair resynchronization ended normally, and the snapshot data was deleted.
2052	COPY(RS) ENDED ABNORMAL	The pair resynchronization ended abnormally.
2070	PSUE(ABNORMAL END)	A failure occurred and the pair is suspended. The pair status changed to "PSUE".
2080	ASSIGN SECONDARY VOLUMES	An S-VOL is assigned to snapshot data.
2081	REMOVE SECONDARY VOLUMES	The assignment of an S-VOL to snapshot data is released.
2082	REPLACE SECONDARY VOLUMES	The assignment of an S-VOL to snapshot data is changed.

Viewing licensed capacities

You can view the licensed capacities using the **Replication** window.

Before you begin

- You must have the Storage Administrator (Local Copy) role.

Procedure

1. Navigate to the **Replication** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

b. Right-click the target storage system, and then select **Replication Dashboard**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication**.

2. View a list of licensed capacity in the summary section of the **Replication** window.

Viewing the number of cache management devices

You can view the current number of cache management devices that are available and in use and the maximum amount of cache management devices you can create in the storage system in the **View Management Resource Usage** window.

For more information, see the **View Management Resource Usage** window in the *Provisioning Guide* for your storage system.

Procedure

Navigate to the **View Management Resource Usage** window.

In Hitachi Command Suite:

a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and the select **Other Functions**.

b. From the **Actions** menu, select **View Management Resource Usage**.

In Device Manager - Storage Navigator:

a. From the **Actions** menu, select **View Management Resource Usage**.

Related concepts

- Calculating Thin Image pairs based on cache management devices on page 76
- Calculating the number of remaining cache management devices on page 211

Related references

- Thin Image cache management device requirements on page 77

Managing pools

Monitoring pool information

You can monitor pool information, such as used pool capacity, in the **Summary** section of the **Pools** window and in the **Primary Volumes** tab in the selected pool window.

This task shows how to monitor pool information in the **Primary Volumes** tab in the selected pool window.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

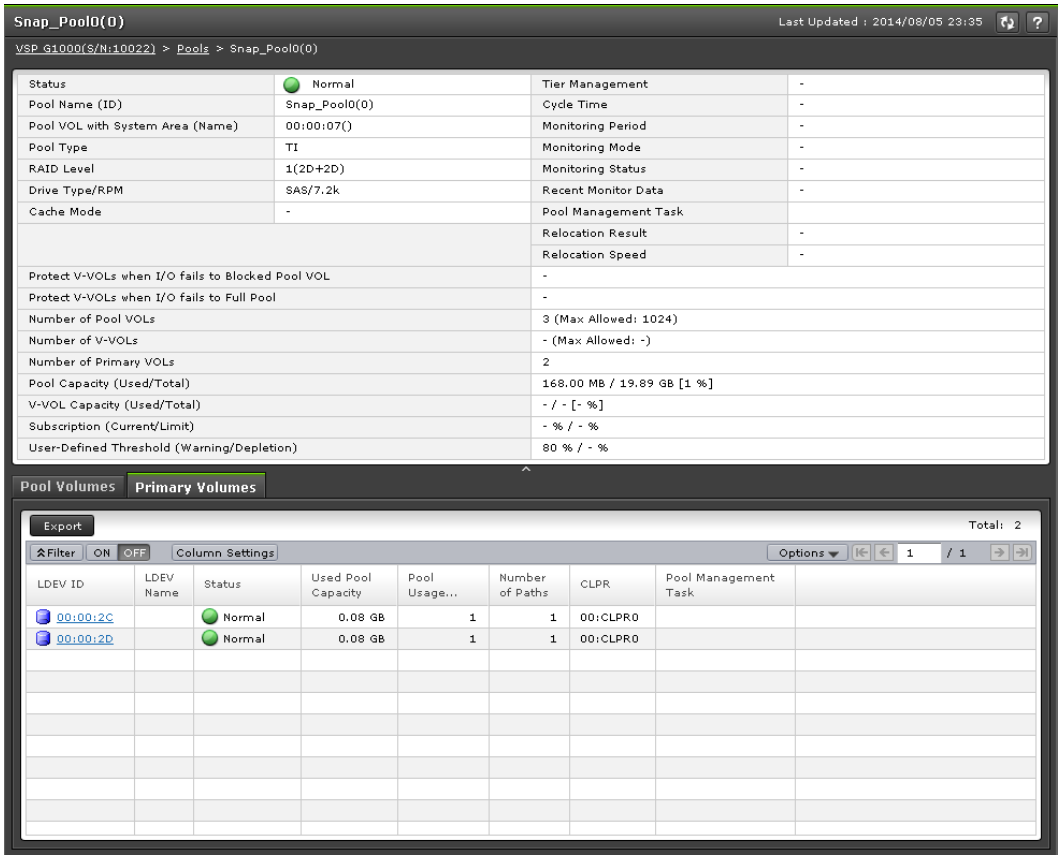
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** window, in the **Pools** tab, select the pool name for the pool you want to monitor.



3. In the selected pool window, in the **Primary Volumes** tab, view the following information about the selected pool:

- **LDEV ID:** Shows the combination of the LDKC, CU, and LDEV. Clicking the ID opens the **LDEV Properties** window. Use this window to search for P-VOL information.
- **LDEV Name:** Shows the LDEV name.
- **Status:** For more information about this item, see the *Provisioning Guide* for your storage system.
- **Used Pool Capacity:** Shows the used pool capacity.
- **Pool Usage(%):** Shows the pool usage rate.
- **Number of Paths:** Shows the number of alternate paths.
- **CLPR:** Shows the identifier and name of the CLPR in *ID*:*CLPR* format.
- **Pool Management Task:** Shows the pool management task being performed on the pool.
- **Virtual Storage Machine:** Shows information about the virtual storage machine.

4. (Optional) To export the information in the table, click **Export**.

Related tasks

- Editing the data pool warning threshold on page 183

Viewing used pool capacity

You can view used pool capacity by pool or by Thin Image P-VOL.

Viewing used capacity by pool

You can view used pool capacity by pool.

For more information, see the **Pools** window in the *Provisioning Guide* for your storage system.

Before you begin

- You must have the Storage Administrator (Provisioning) role.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. View the used capacity of the pool in the **Used** column of the **Pools** tab.

Viewing used capacity of the physical capacity by pool

You can view the used capacity of the physical capacity by the pool.

For more information, see the **Pools** window in the *Provisioning Guide* for your storage system.

Before you begin

- You must have the Storage Administrator (Provisioning) role.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. View the used capacity of the pool in the **Physical Capacity** column of the **Pools** tab. This column is not displayed by default. To see this column, add this using the Column Settings window.

Viewing used pool capacity by Thin Image P-VOL

You can view used pool capacity by P-VOL.

For more information, see the volume tabs on the **Pools** window in the *Provisioning Guide* for your storage system.

Before you begin

- You must have the Storage Administrator (Provisioning) role.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** table, click the name of the pool for which you want to see the used capacity.
3. Select the **TI Root Volumes** or **TI Primary Volumes** tab.

Result

The used pool capacity of the Thin Image P-VOLs (used capacity of the pool which has the Thin Image pool type) appears in the Used or Used Pool Capacity column, depending on your storage system.

Viewing formatted pool capacity and pool usage rates

You can view the progress of rebalancing the pool usage rates among parity groups using the **View Pool Management Status** window.

For more information about the formatted pool capacity and pool usage rates, and the **View Pool Management Status** window, see the *Provisioning Guide* for your storage system.

Procedure

1. Navigate to the **Pools** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
2. In the **Pools** window, in the **Pools** tab, select the check box for the pool for which you want to view capacity from the list, and then click **More Actions > View Pool Management Status**.
3. In the **View Pool Management Status** window, view the following items:
   Capacity
   - **Used/Total:** The formatted pool capacity.
   - **Free:** The pool usage rate.
4. Click **Close**.

Related tasks

- Editing the data pool warning threshold on page 183

Increasing pool capacity

Adding pool-VOLs to a pool increases, or expands, the pool's capacity. Check the pool's available capacity and expand the pool as needed.

Use the following formula to calculate the pool capacity:

```
Pool capacity = Total capacity of pool-VOLs in the pool -
Management area size of the pool-VOL with the system area
```

You can add up to 1,024 pool-VOLs (including volumes already in a pool) to a pool.

Adding pool-VOLs to pools to expand pool capacity moves data to the added space on a per-page basis, which rebalances the usage rate among parity groups of the pool-VOLs.

Caution: Moving existing data to the added space on a per-page basis can decrease host I/O performance.

Note: You can only increase the capacity for one pool at a time.

Before you begin

You must not be currently decreasing the pool capacity.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

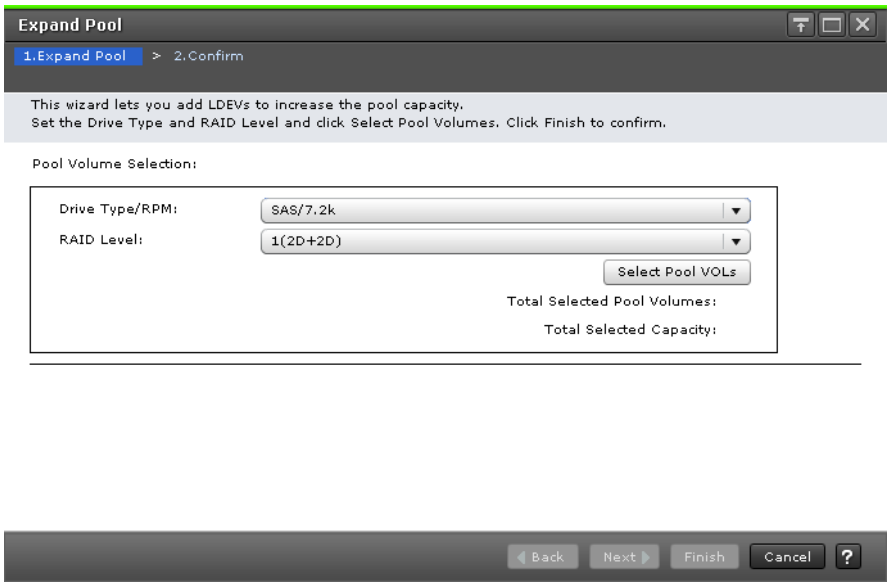
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

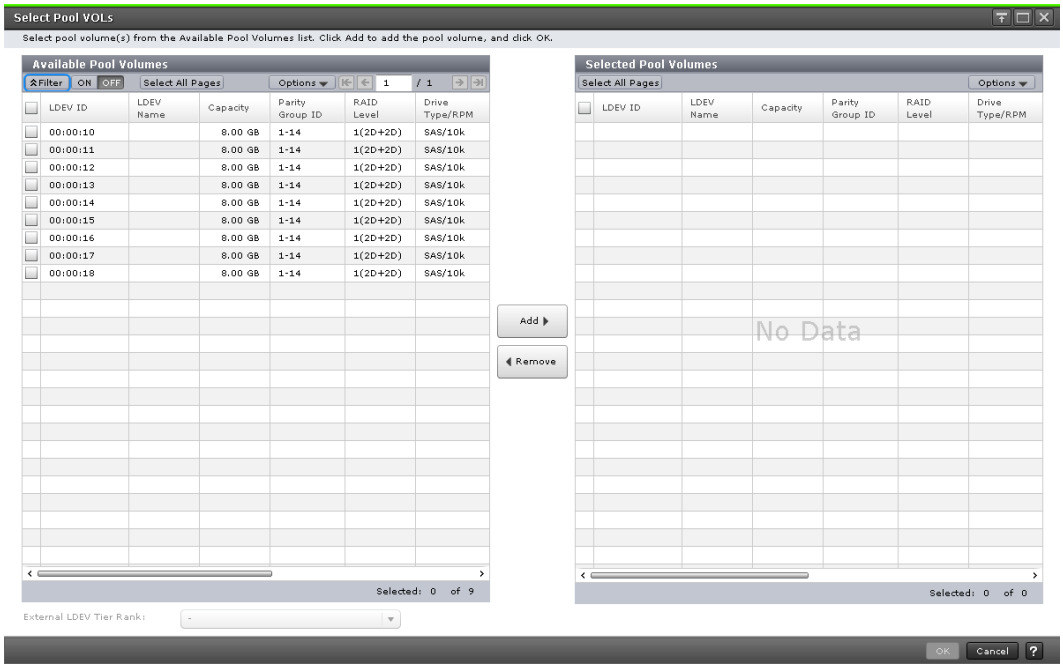
   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** tab, select the check box for the pool to which you want to add a pool-VOL from the list, and then click **Expand Pool**.

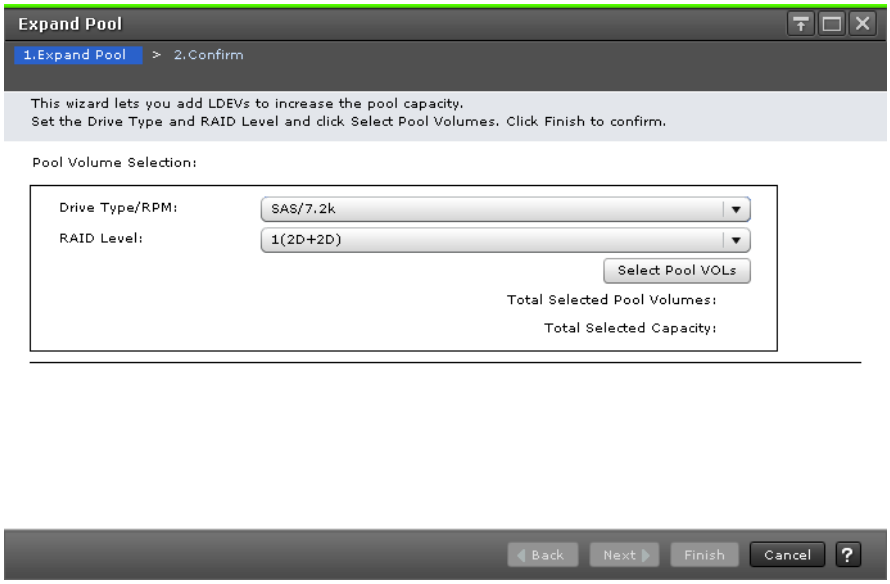


3. In the **Expand Pool** window of the **Expand Pool** wizard, click **Select Pool VOLs**.

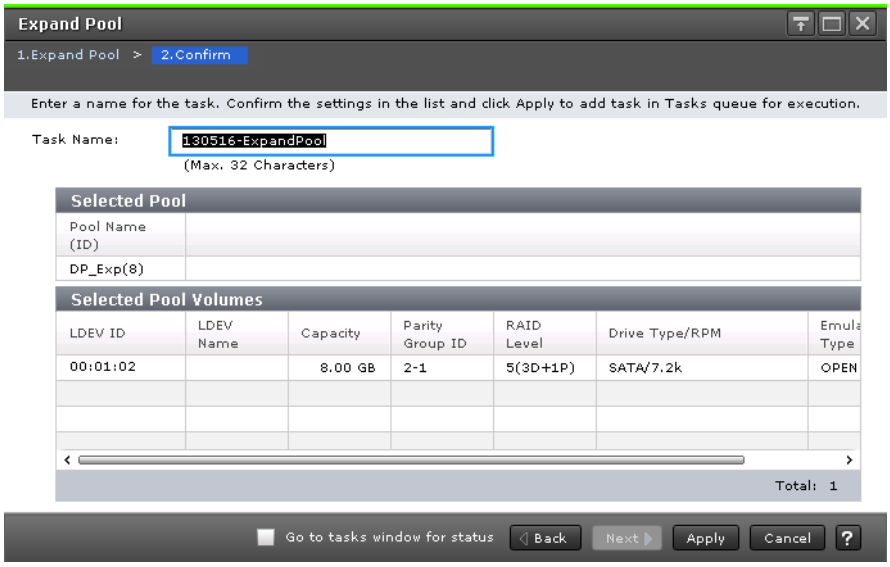


4. In the **Select Pool VOLs** window, complete the following, and then click **OK**:
   a. (Optional) To filter rows, in the **Available Pool Volumes** table, select **ON** in the **Filter** component.
   b. (Optional) To select all of the pool-VOLs in the list, in the **Available Pool Volumes** table, click **Select All Pages**.
   c. (Optional) To specify the capacity unit and the number of rows to display, in the **Available Pool Volumes** table, click **Options**.
   d. In the **Available Pool Volumes** table, select the LDEV you want, and then click **Add**.
   The LDEV is moved to the **Selected Pool Volumes** table.

Note: If you are adding an LDEV belonging to a parity group for which accelerated compression is enabled, see the related section in Provisioning Guide for your storage system.



5. In the **Expand Pool** window of the **Expand Pool** wizard, click **Finish**, and then confirm the settings.



6. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
7. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
8. Click **Apply** to submit the task.

Failure of available pool capacity formatting and pool capacity increase

Pool capacity formatting and increase can fail in some circumstances.

The following are the circumstances under which the available pool capacity is not formatted and the available pool capacity is not increased:

- You are formatting a pool-VOL other than the one that you have selected to format.
  For more information about formatting LDEVs, see the *Provisioning Guide* for your storage system.
- The pool usage rate has reached the warning threshold (see Editing the data pool warning threshold on page 183).
- The I/O loads on the storage system are high.
- One of the following is blocked:
  - The selected pool.
  - The cache memory.
  - The pool-VOLs in the selected pool.
  - The external pool-VOLs in the selected pool.
- The access attribute on the pool-VOL in the selected pool has been corrected.
- You are not operating the format function for available pool capacity.

The following are circumstances under which the formatted pool capacity might decrease:

- New pages are being allocated.
- Correction copy is being executed.

Decreasing pool capacity

You can decrease the pool capacity for up to eight tasks at the same time.

For more information about decreasing pool capacity, formatting LDEVs, and the **Shrink Pool** window, see the *Provisioning Guide* for your storage system.

If processing ends abnormally, check the Tasks window.

Before you begin

- The used capacity of the pool-VOL must be below the pool threshold.
- If you are deleting pool-VOLs with system area, there must be more than 4.2 GB of available capacity.
- You must not be currently performing any of the following tasks:
  - Creating a pool.
  - Deleting a pool.
  - Increasing a pool.
  - Deleting a pool-VOL to decrease the pool capacity.
  - Recovering a pool.
  - Stopping the process of decreasing pool capacity.
  - Editing a data pool warning threshold.

- Simultaneously running CCI commands to decrease the pool capacity.

- You must not be maintaining the cache memory.
- The cache memory must be up and running.
- The I/O load to the V-VOL related to the pool must be low.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

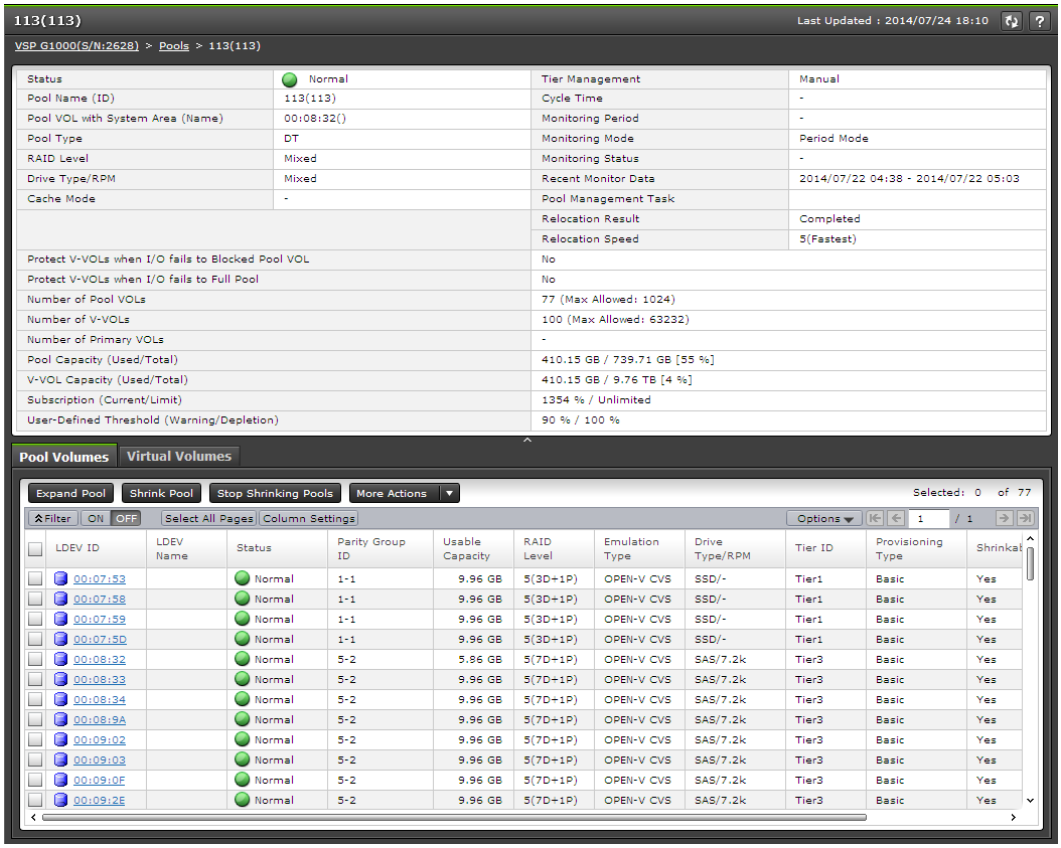
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

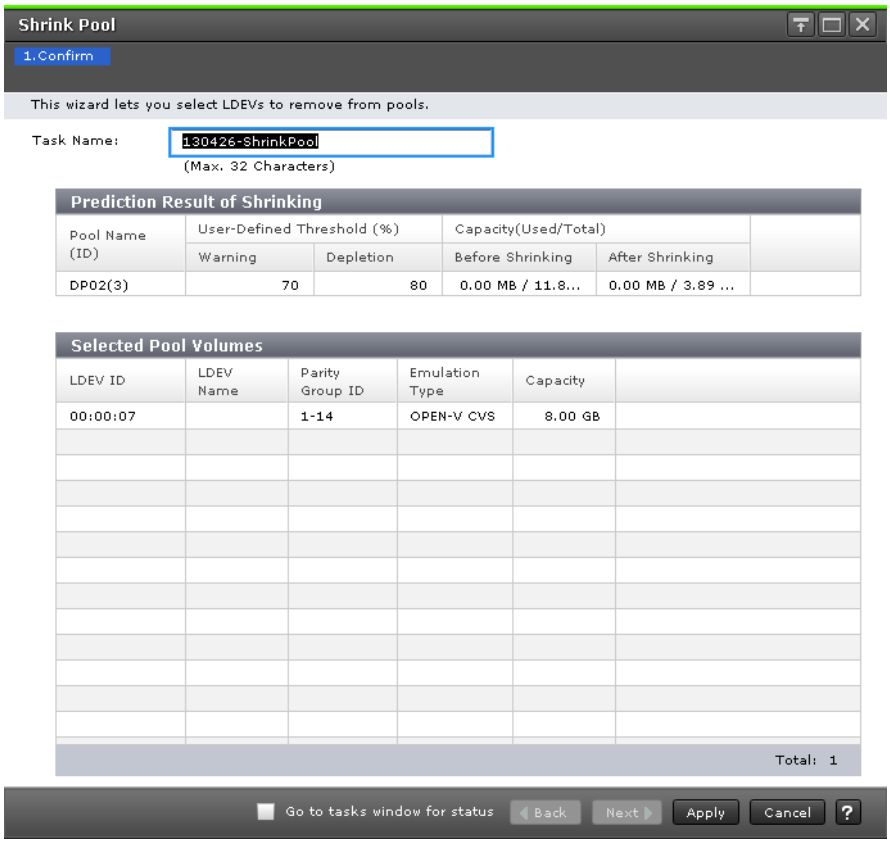
2. In the **Pools** tab, click the name of the pool for which you want to decrease capacity.



3. In the ***Pool Name*** window, in the **Pool Volumes** tab, from the list of volumes, select the check box for the pool that contains the pool-VOLs

you want to delete to decrease pool capacity, and then click **Shrink Pool**.

Note: You can select one or more pool volumes.



4. In the **Prediction Result of Shrinking** table, confirm the pool capacity, the used pool capacity, and the free pool capacity, before and after shrinking.
5. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
6. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
7. Click **Apply** to submit the task.

Result

The tiers in pools are deleted and the pool capacity is decreased.

Stopping the process of decreasing pool capacity

You can stop the process of decreasing pool capacity.

For more information about the **Stop Shrinking Pools** window, see the *Provisioning Guide* for your storage system.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

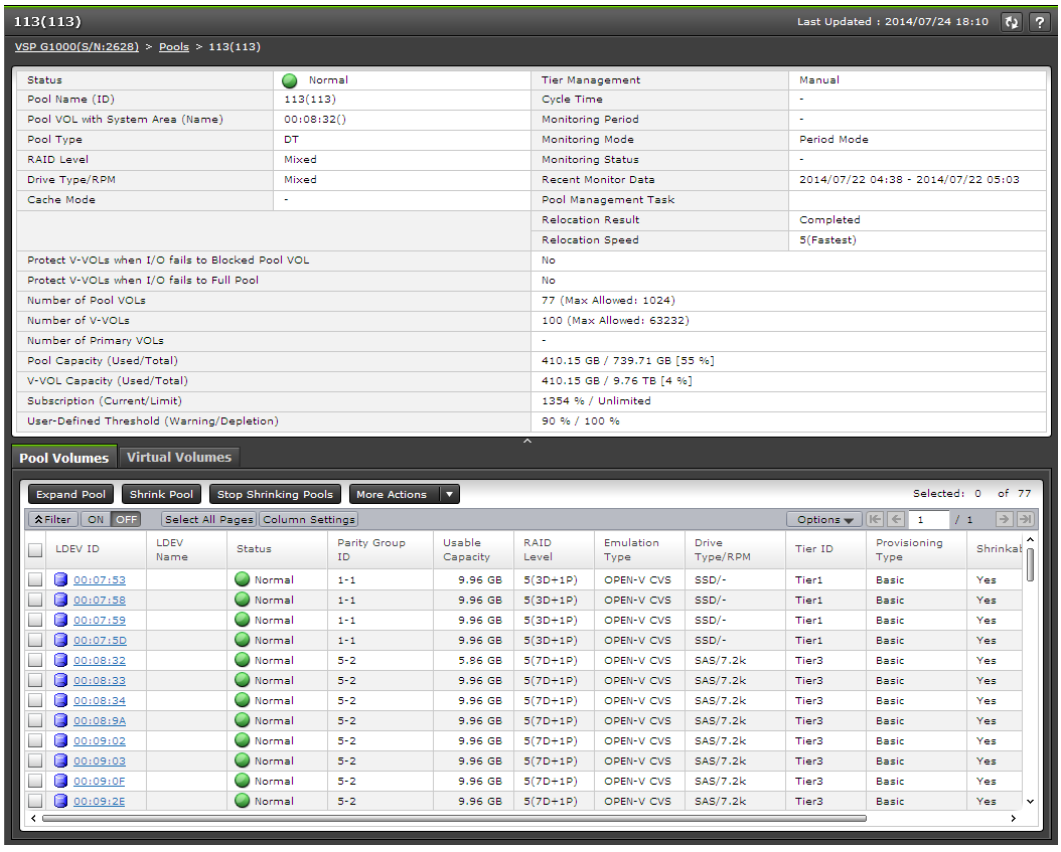
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

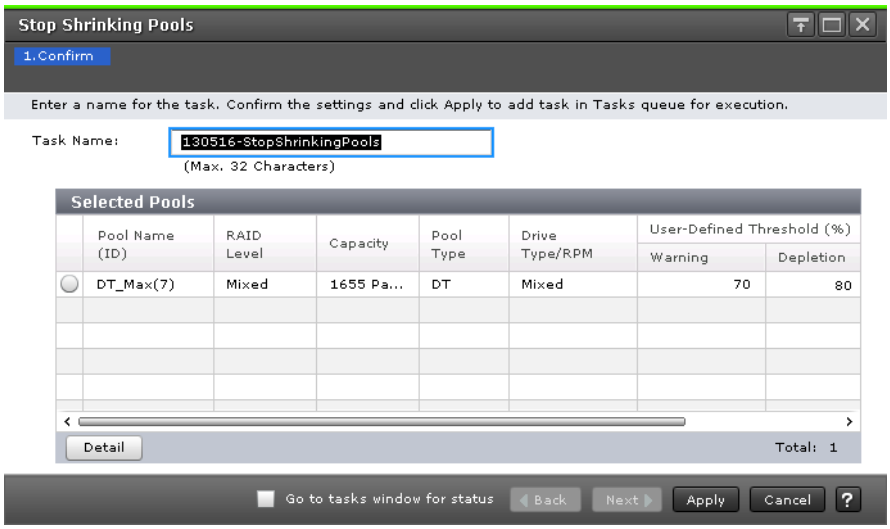
2. In the **Pools** tab, click the name of the pool for which you want to stop decreasing capacity.



3. In the ***Pool Name*** window, in the **Pool Volumes** tab, from the list of volumes, select the check box for the pool that contains the pool-VOLs

for which you want to stop decreasing pool capacity, and then click **Stop Shrinking Pool**.

Note: You can select one or more pool volumes.



4. In the **Stop Shrinking Pools** window, confirm the settings.
   If you select a row and click **Detail**, the **Pool Properties** window will be displayed.
5. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
6. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
7. Click **Apply** to submit the task.

Editing the data pool warning threshold

You can prevent the pool from reaching full capacity by monitoring the pool usage rate.

For more information about checking alerts and checking the details of a SIM, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system.

For more information about SNMP, see the *Hitachi SNMP Agent User Guide*.

Before you begin

You must not be decreasing the pool capacity.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

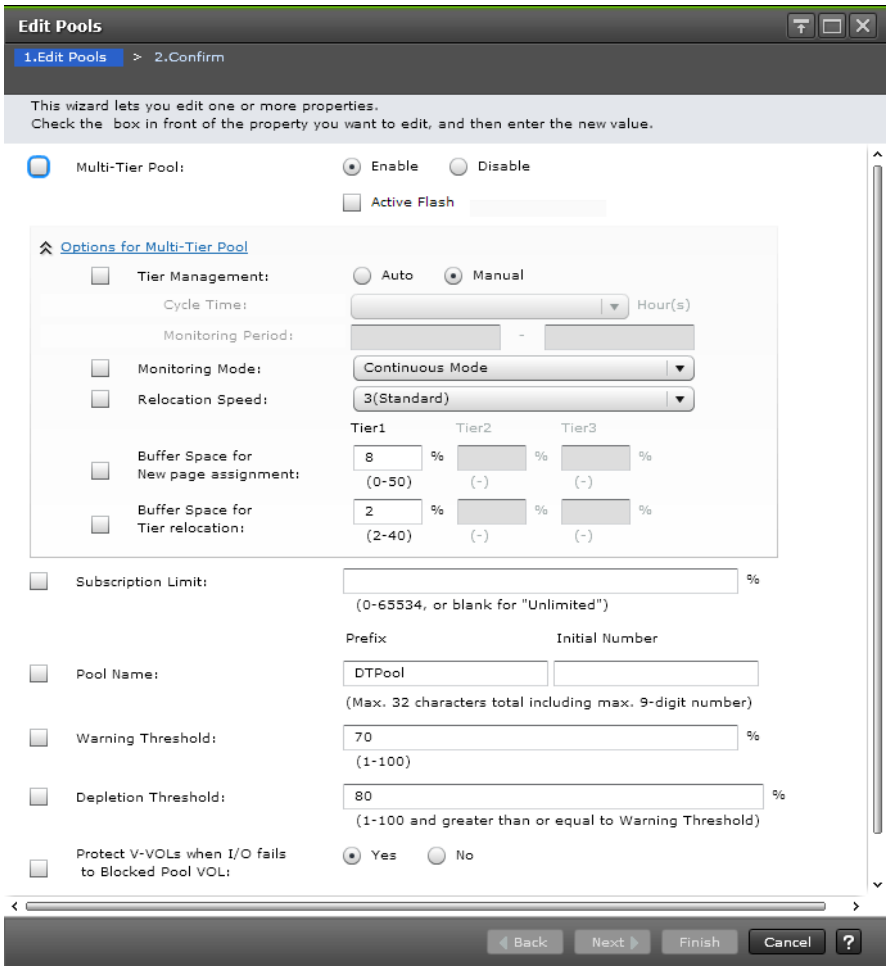
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** tab, from the list of pools, select the check box for the pool with the warning threshold that you want to change, and then click **More Actions > Edit Pools**.



3. In the **Edit Pools** window of the **Edit Pools** wizard, complete the following:

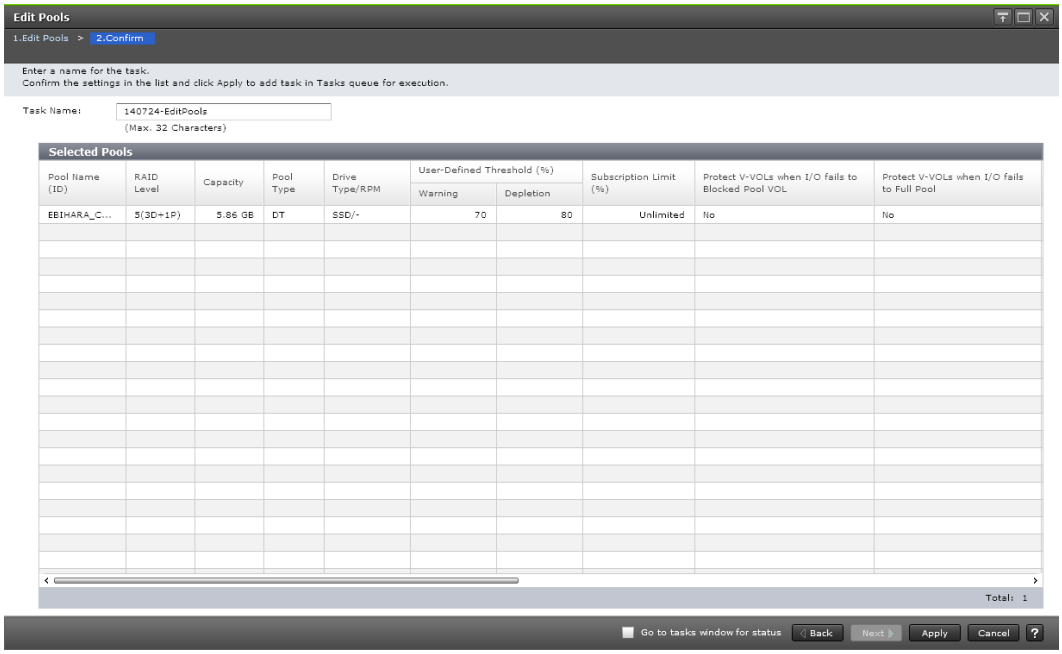
   Warning Threshold

   - Enter the data pool warning threshold.

- Range: 20% - 95%, in 1% increments.
- Default: 80%

Caution: Excessive pool usage rates (rates over 50%) are rounded down to the closest integer. Therefore, excessive pool usage in SIM and SNMP might be reported when the actual pool usage rate exceeds the threshold, even though the value shown is only 50%.

4. Click **Finish**, and then confirm the settings.



5. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

6. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
7. Click **Apply** to submit the task.

Related references

- Thin Image data pool requirements on page 72

Editing pool names

You can edit pool names.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

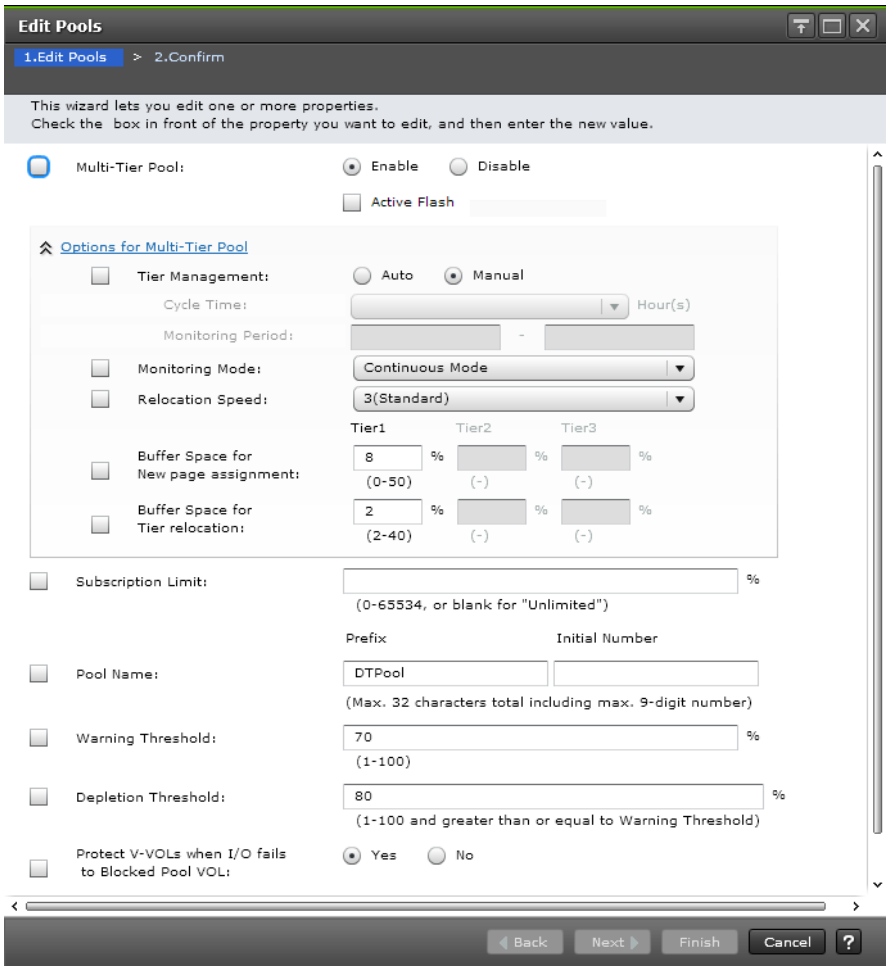
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** tab, from the list of pools, select the check box for the pool whose name you want to change, and then click **More Actions > Edit Pools**.



3. In the **Edit Pools** window of the **Edit Pools** wizard, complete the following items for **Pool Name**:

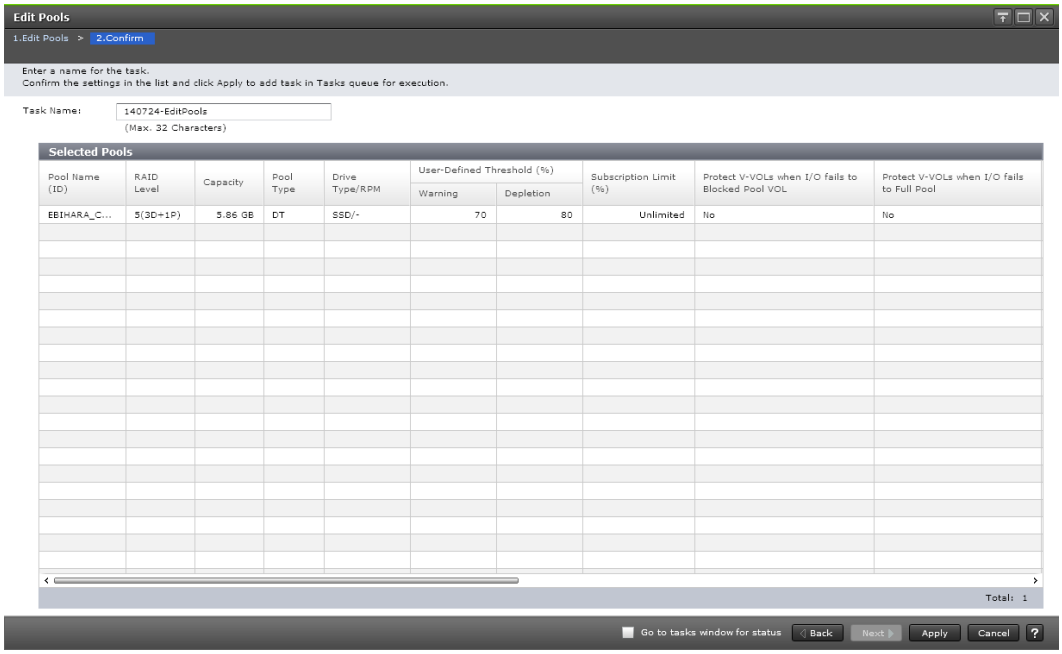
   - **Prefix**

Enter the new alphanumeric characters that precede the pool number. This field is case sensitive.

- **Initial Number**
  Enter the pool's new initial number, using 9 digits or fewer.

The character limit for both fields together is 32 alphanumeric characters.

4. Click **Finish**, and then confirm the settings.



5. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

6. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
7. Click **Apply** to submit the task.

Workflow for recovering blocked pools

When a pool is blocked, you must recover the pool volume, pool, Thin Image pairs, and then V-VOL in that order. This section describes how to recover a blocked pool.

Recovering blocked pool volumes

When a pool volume is blocked, contact customer support.

Recovering the pools

Recover the pool by using one or both of the following methods:

- Add additional pool-VOLs.
- Decrease the pool usage rate by deleting the P-VOL's snapshot data.

Recovering Thin Image pairs

When a pool is blocked, all Thin Image pairs that contain snapshot data of the blocked pool switch to the PSUE status. To recover these pairs, delete and then re-create them.

Related tasks

- Resynchronizing Thin Image pairs on page 143
- Deleting Thin Image pairs on page 145
- Increasing pool capacity on page 175
- Recovering blocked pools on page 188

Recovering blocked pools

You can recover blocked pools using the **Restore Pools** window.

The pool recovery time depends on pool or V-VOL usage and system workload. Calculate roughly 20 minutes of recovery time for every 100 TB of pool or V-VOL usage.

Caution: Recover blocked pools for disaster recovery purpose only.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

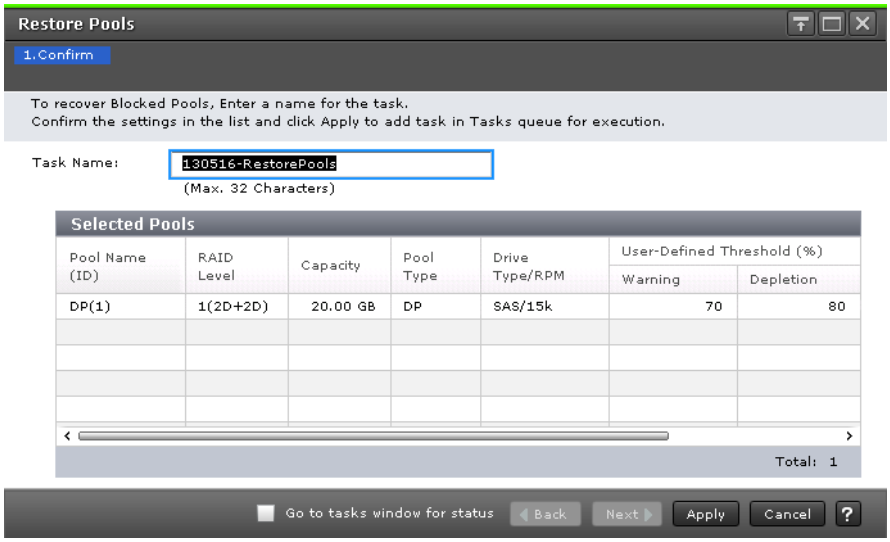
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** tab, from the list of pools, select the check box for the pool that you want to recover, click **More Actions > Restore Pools**, and then confirm the settings.



3. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
4. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
5. Click **Apply** to submit the task.

Workflow for deleting pools

Use this process to delete pools.

1. Delete all of the Thin Image pairs.
2. Delete the pools.
3. (Optional) Erase data from the volume (volume shredding).
   For more information about volume shredding, see the *Hitachi Volume Shredder User Guide*.

Related tasks

- Deleting Thin Image pairs on page 145
- Deleting pools on page 189

Deleting pools

You can delete pools that have a 0% usage rate and that are not assigned for DP-VOLs.

Deleting a pool blocks its pool-VOLs (LDEVs). To use blocked pool-VOLs, format the volumes.

Note: If the blocked pool-VOL is an external volume, select Normal Format when formatting the volume.

For more information about DP-VOL requirements, see the *Provisioning Guide* for your storage system.

Procedure

1. Navigate to the **Pools** window.

   In Hitachi Command Suite:

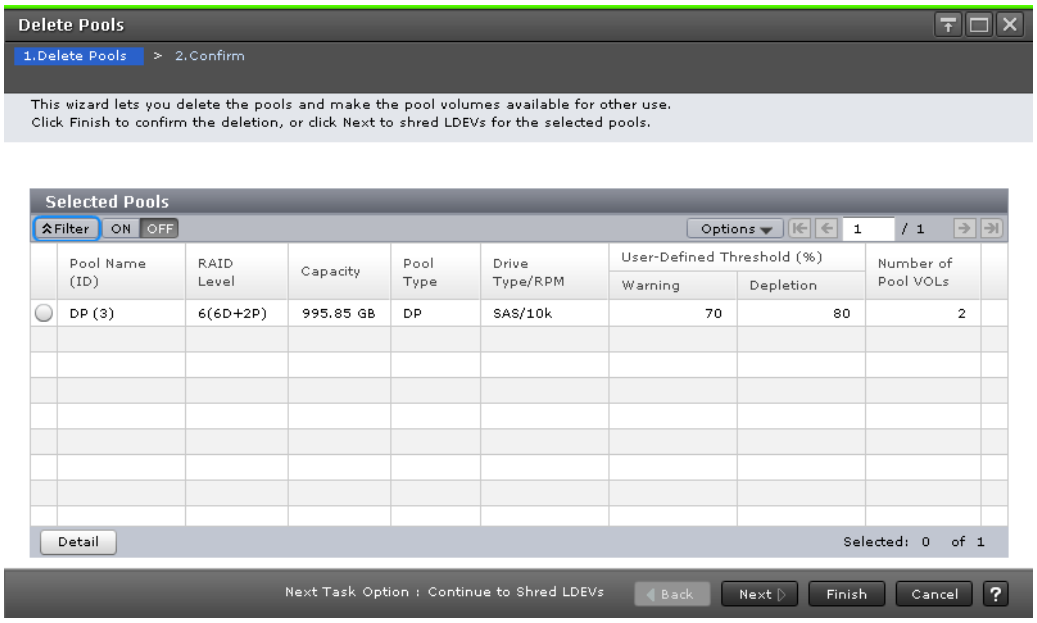
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** tab, from the list of pools, select the check box for the pool that you want to delete, and then click **More Actions > Delete Pools**.



3. In the **Delete Pools** window of the **Delete Pools** wizard, click **Finish**, and then confirm the settings.

   Click **Next** if you want to perform volume shredding to erase data from the volume.

   For details on volume shredding operations, see the *Hitachi Volume Shredder User Guide*.

4. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

5. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
6. Click **Apply** to submit the task.

Managing virtual volumes

Editing virtual volume names

You can edit a virtual volume's name as well as view information about LDEVs from the **Pools** window.

Procedure

1. Navigate to the **Pools** window.

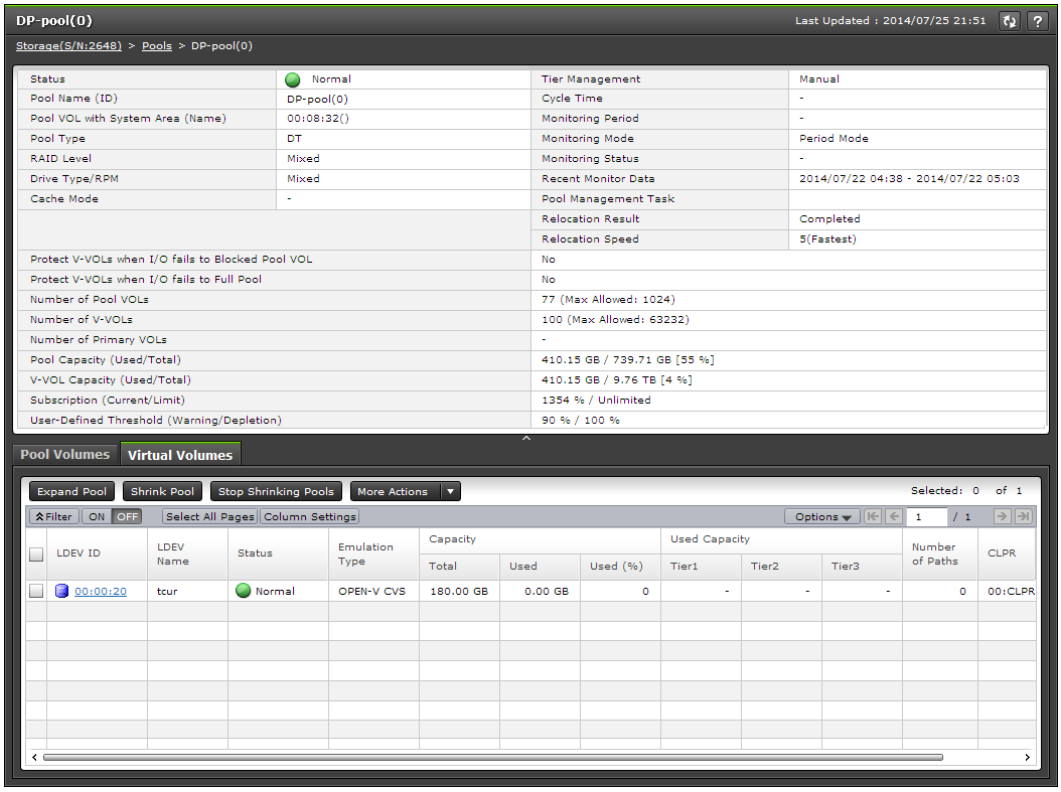
   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

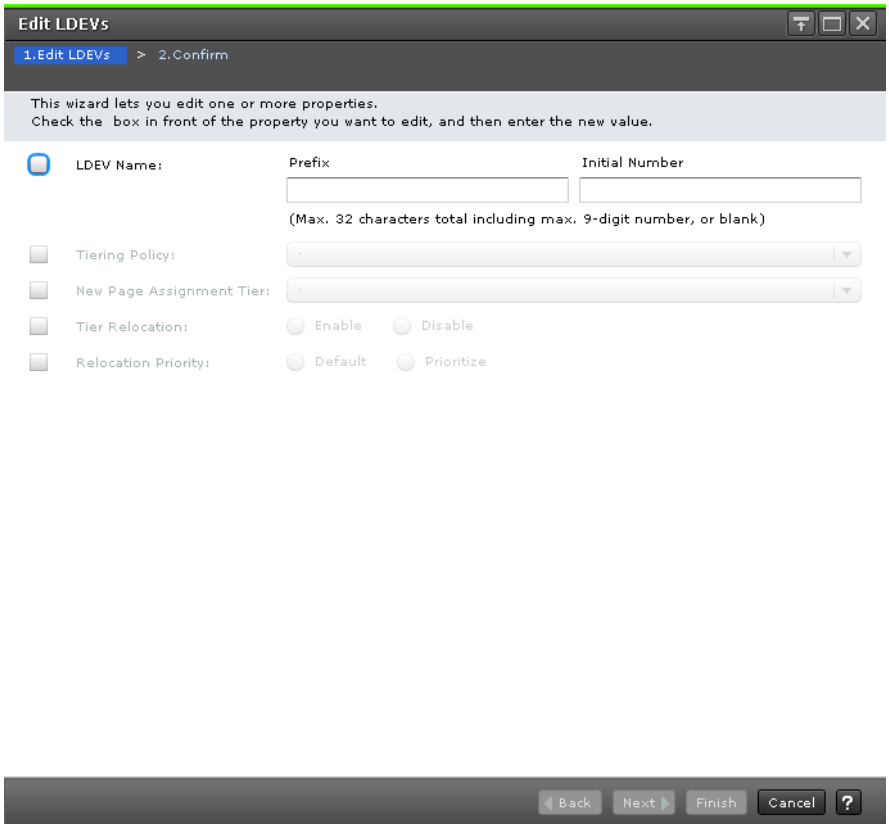
   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

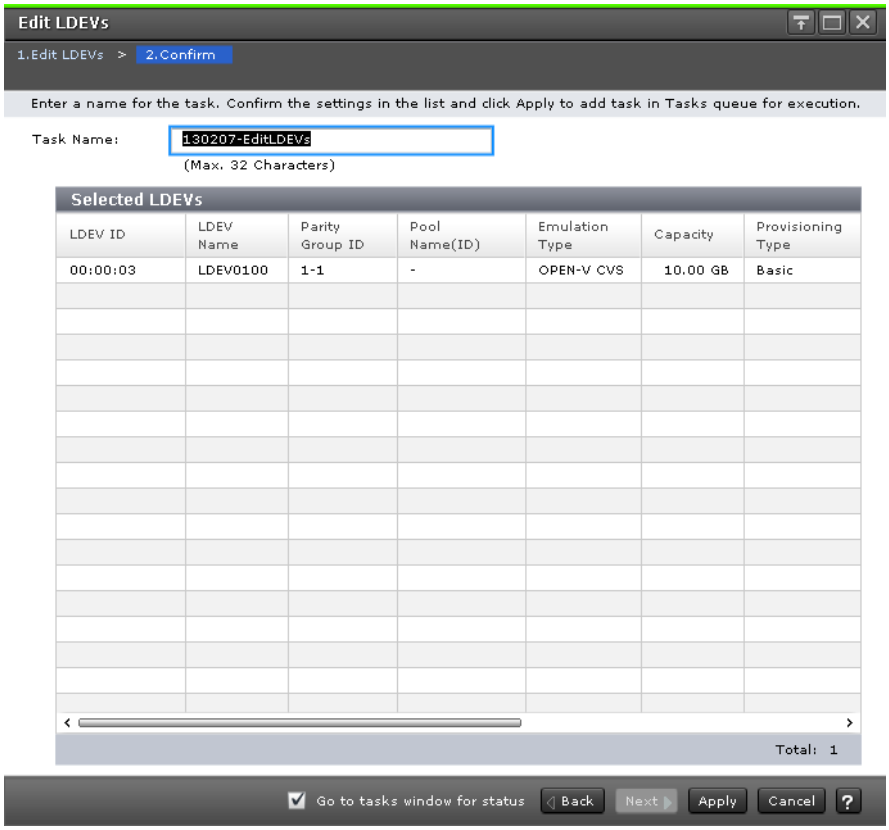
   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.
2. In the **Pools** tab, click the name of the pool for which you want to edit virtual volumes.
3. In the ***Pool Name*** window, select the **Virtual Volumes** tab.



4. In the **Virtual Volumes** tab, from the list of volumes, select the check boxes for the V-VOLs you want to change, and then click **More Actions > Edit LDEVs**.



5. In the **Edit LDEVs** window of the **Edit LDEVs** wizard, for **LDEV Name**, enter the prefix and the initial number.



6. Click **Finish**, and then confirm the settings.
7. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
8. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
9. Click **Apply** to submit the task.

Workflow for deleting V-VOLs specified for Thin Image S-VOLs

Typically, you cannot delete V-VOLs and V-VOL groups that are specified for Thin Image S-VOLs. If the groups are specified for S-VOLs, complete this workflow.

1. Delete the Thin Image pairs.
2. Delete the V-VOL.

Related tasks

- Deleting Thin Image pairs on page 145

Deleting virtual volumes

You can delete virtual volumes.

For more information about the **Delete LDEVs** window, see the *Provisioning Guide* for your storage system.

Procedure

1. Navigate to the **Logical Devices** window.

   In Hitachi Command Suite:

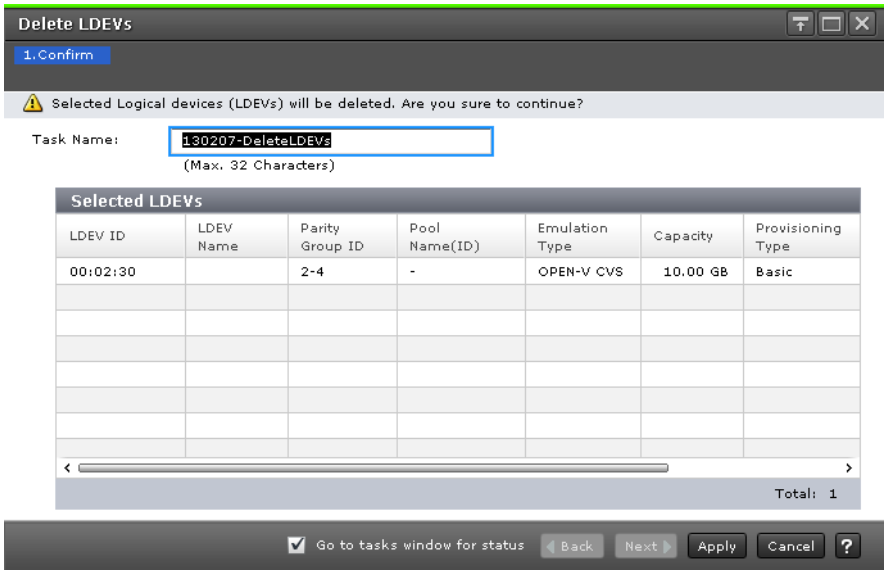
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.

   b. Expand the target storage system, right-click **Volumes**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Logical Devices**.

2. In the **Logical Devices** window, from the list of volumes, select the check boxes for the V-VOLs that you want to delete, click **More Actions > Delete LDEVs**, and then confirm the settings.



3. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |

4. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
5. Click **Apply** to submit the task.

Related tasks

- Deleting Thin Image pairs on page 145

Viewing snapshot data capacity (VSP G1000, G1500, and VSP F1500)

You can use the **raidcom** command to view the snapshot data capacity for each P-VOL.

This capacity indicates the pool capacity which is used as snapshot data stored from the P-VOL, but it does not include all of the information required to manage snapshot data. Although snapshot data is assigned from the pool in 42 MB blocks, Thin Image stores snapshot data from a P-VOL in 256 KB blocks. Therefore, the snapshot data capacity is not always consistent with each pool's used capacity.

The following example shows how to use the **raidcom** command to view snapshot data capacity.

```
#raidcom get ldev -ldev_id 640
Serial# : 63502
LDEV : 640
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 2181120
VOL_Capacity(cyl) : 22720
NUM_LDEV : 1
LDEVs : 640
NUM_PORT : 1


PORTs : CL2-E-0 14 Linux_X86
F_POOLID : NONE
VOL_ATTR : CVS : VVOL : QS
:
TIER_Alloc_level : H
TIER#1_Alloc_rate : MAX : 50 : MIN : 30
TIER#3_Alloc_rate : MAX : 50 : MIN : 30
Snap_Used_Pool(MB) : 2181
```

For more information about the **raidcom** command, see the *Command Control Interface Command Reference*.

Maintaining pairs during storage system maintenance

You can maintain pairs when you switch off the storage system power and when you replace the microcode.

Switching off the power supply

Use this workflow to switch off the power supply.

1. Stop the host I/O.
2. Switch off the power supply.

When power is restored, the behavior of Thin Image depends on the following:

- The power supply and having data in shared memory.
- The power supply and losing data in shared memory.

Related tasks

- Creating Thin Image data pools on page 98
- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128

Power supply and existing shared memory

After you switch off the power supply, you can use the pools and pairs if data in the shared memory exists and the data is not blocked.

The storage system checks the status of the pool and pool-VOLs. If the pool-VOLs are blocked at the time you switch off the power supply, the pool is blocked and the pairs are suspended ("PSUE" status).

If you interrupt the workflow of storing snapshot data or cloning pairs by consistency groups by switching off the power supply and the status of all the pairs in a consistency group has not completely changed, the workflow does not resume when you switch the power supply on again. The status of some pairs may remain unchanged.

If the pool is blocked and the pairs are suspended, complete the following:

1. Restore the power.
2. Recover the pools.

Related tasks

- Recovering blocked pools on page 188

Power supply and losing data in shared memory

If you lose power and the data in shared memory is lost, the VSP G1000 storage system saves the data to SSD at the time the power supply is switched off, but for VSP G200, G400, G600, G800, you must recreate the pools and pairs.

You can still use the pool and Thin Image pairs with a VSP G1000 storage system, because the data is restored to shared memory from SSD after switching the power supply back on.

For a VSP G200, G400, G600, G800 storage system, first restore the power, then recreate the pools and pairs.

Replacing the microcode (or firmware) offline

Microcode, also known as firmware, is usually replaced online to prevent the loss of pool and pair data in shared memory.

If it is needed to be replaced offline (for example, when changing the configuration of shared memory), pool and pair information in shared memory is lost, and pools and pairs must be recreated.

Note: There are some terminology differences among VSP storage systems.

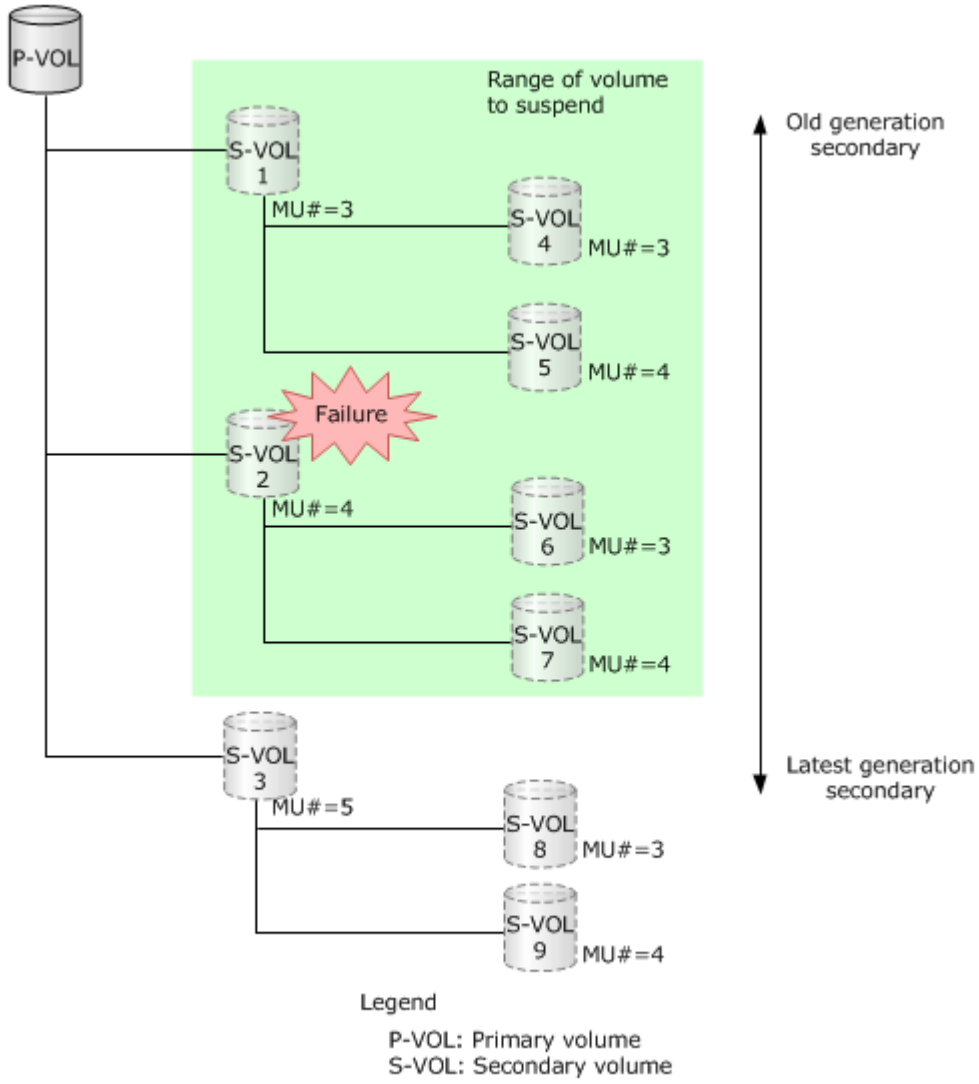
The terms "microcode" and "firmware" refer to the same thing. The term "microcode" is used for VSP G1000, G1500, and VSP F1500, and the term "firmware" is used for VSP G200, G400, G600, G800.

Definition of failure

When a failure occurs in a cascade configuration, in addition to the volume in which the failure occurs, the following volumes are also suspended:

- Cascaded volumes under the volume in which the failure occurred.
- Volumes (including their cascade volumes) older generationally than the volume in which the failure occurred.

The following figure illustrates the volumes to be suspended when a failure occurs.


P-VOL
Range of volume to suspend
S-VOL 1
MU#=3
S-VOL 4
MU#=3
S-VOL 5
MU#=4
Failure
S-VOL 2
MU#=4
S-VOL 6
MU#=3
S-VOL 7
MU#=4
S-VOL 3
MU#=5
S-VOL 8
MU#=3
S-VOL 9
MU#=4
Old generation secondary
Latest generation secondary
Legend
P-VOL: Primary volume
S-VOL: Secondary volume

6

Troubleshooting Thin Image

This chapter provides information on troubleshooting Thin Image.

- General troubleshooting
- Workflow for correcting SIMs related to cache management devices
- Workflow for correcting pool-related SIMs
- Completing SIMs (VSP G1000, G1500, and VSP F1500)
- Contacting customer support

General troubleshooting

This table lists problems related to Thin Image that can occur, along with their causes and solutions.

Problem	Causes and solutions
Pool information is not displayed.	Cause: The pool is blocked. Solution: Recover the blocked pool (see Workflow for recovering blocked pools on page 187).
A pool is blocked.	Solution: Perform Workflow for correcting pool-related SIMs on page 211.
The pool usage rate of capacity ensured for writing exceeds the threshold.	Solution: Perform Workflow for correcting pool-related SIMs on page 211. For more information on the pool capacity and the capacity ensured for writing, see the *Provisioning Guide* for your storage system.
You cannot add pool-VOLs.	Causes: • You have reached the maximum amount of pool-VOLs that can be added to a pool (see Increasing pool capacity on page 175). • Available pool management block in the V-VOL management area in the SM is insufficient. • Pool-VOL requirements were not followed. Solutions: • Add pool-VOLs to another pool. • Initialize the V-VOL management area. • Check pool-VOL requirements.

You cannot create HTI pairs.	Causes:
	• You have reached the maximum amount of cache management devices.
	• You have not met the prerequisites to create the pair.
	• The status of the specified volume is not displayed because you are deleting the HTI pair.
	
	Solutions:
	• Make sure that you have enough cache management devices to create the pairs (see Thin Image cache management device requirements on page 77).
	• If cache management devices are running out, complete one of the following:
	  ○ Delete unnecessary external volumes.
	  ○ Delete unnecessary V-VOLs.
	  ○ Delete the HTI pairs related to the P-VOL.
	• Complete the following:
	  1. Fulfill the conditions to create the pair.
	  2. Create the pair.
	• Execute the **`inqraid`** CCI command and verify that the volume is not used by HTI, and then try the pair creation again.

A timeout occurs and the CCI command ends abnormally (error code `EX_EWSTOT`).	Cause: The consistency group contains an HTI pair whose status cannot be changed. Solution: Resolve the error condition and perform pair tasks (see Notes on using Thin Image primary volumes as TrueCopy, ShadowImage, or Universal Replicator pair volumes on page 226 and Notes on storing snapshot data, and on cloning pairs (VSP G1000, G1500, and VSP F1500) on page 226).
HTI pairs are not displayed in the volume list.	Causes: • You have not created the HTI pairs.

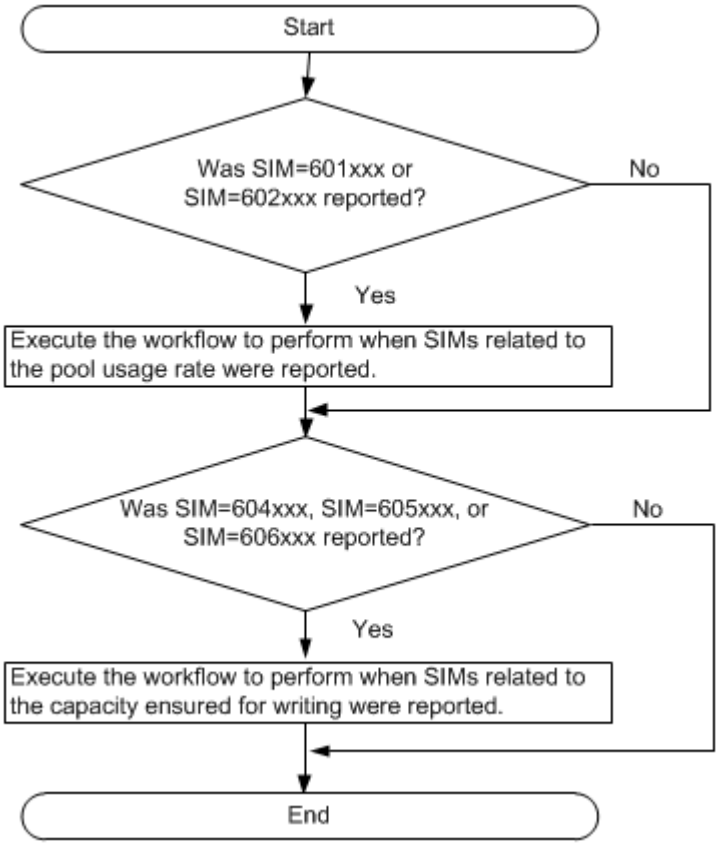
Problem	Causes and solutions
	• The filtering function is prohibiting the displaying of the pairs. Solutions: • Create the HTI pairs. • Change the settings in the **Display Filter** dialog box.
An error occurred while restoring the pair.	Cause: A volume is blocked because a failure occurred in the data drive. Solution: **1.** Delete the blocked HTI pair (see Deleting Thin Image pairs on page 145). **2.** Contact customer support.
A volume is blocked.	Causes: • A failure occurred in at least two data drives. • The breaker was turned off once and then the power supply switched on. Solution: Contact customer support.
A problem occurred in the host application for monitoring the volumes.	Cause: Access to the volume is rejected. Solution: **1.** Stop the host application monitoring the volumes. **2.** Split all of the pairs ("PSUS" status or an unpaired volume) (see Splitting Thin Image pairs to store snapshot data on page 135). **3.** Start the monitoring application on the host and check whether the host has access to pair volumes (see How Thin Image pair status changes on page 37).
A virtual volume cannot be recognized correctly after the host server is booted/ rebooted or the command for recognizing a device is performed.	Cause: Access to the volume is rejected. Solution: **1.** Stop the host application monitoring the volumes. **2.** Split all of the pairs ("PSUS" status or an unpaired volume) (see Splitting Thin Image pairs to store snapshot data on page 135). **3.** Reboot the host server or run a command that causes the system to recognize the device. **4.** Start the monitoring application on the host and check whether the host has access to pair volumes (see How Thin Image pair status changes on page 37).
The host computer attempts to access the port and an error occurs.	Cause: A port may go offline because access to a volume on another port has been rejected. Solutions: • Wait until the process has completed, and then retry the task. • If a host application is installed to monitor the volume, stop the application.
HDvM - SN times out frequently.	Causes: • HDvM - SN cannot respond to the SVP because the load is too heavy. • The time-out period is not an adequate length. Solutions: • Wait until the process has completed and then retry the task. • Verify the values for the HDvM - SN RMI time-out period. For more information about how to set RMI time-out period, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system.
The pair information in the **Local Replication** window is not updated. The date and time in Last Updated is not updated.	Cause: HTI processing may be in progress. Solution: The update will complete sometime after the HTI processing finishes.

Problem	Causes and solutions
After a host completes a write operation, the used pool capacity shown in the Summary section of the **Pools** window and in the list in the Primary Volumes tab of the selected pool do not match.	Cause: The copy processing is running. Solution: Wait until the copy processing is completed. The used pool capacity shown in the Summary section of the **Pools** window and in the list in the Primary Volumes tab of the selected pool match. For more information about viewing the used pool capacity in this section and on this tab, see Monitoring pool information on page 171.
You cannot resynchronize a suspended HTI pair ("PSUE" status).	Cause: You are attempting to create a blocked and suspended ("PSUE" status) pair. Solution: **1.** Delete the HTI pairs related to the P-VOL (see Deleting Thin Image pairs on page 145). **2.** Create the HTI pair (see Creating Thin Image pairs using Device Manager - Storage Navigator on page 128).

If the solutions in this table do not work, or if your problem is not included in this table, contact customer support.

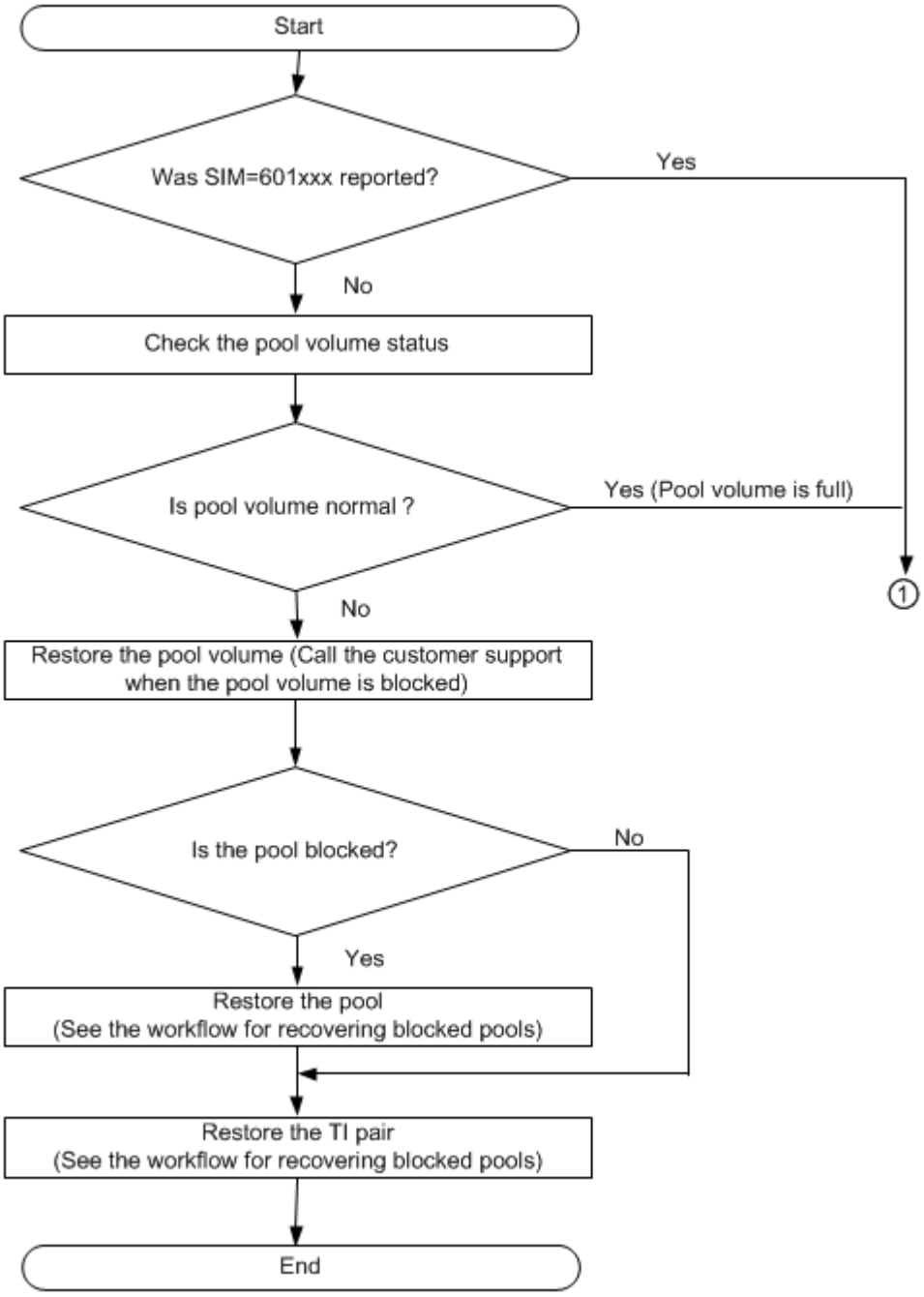
Workflow for correcting pool-related failures (SIM = 601xxx, 602xxx, 604xxx, 605xxx, and 606xxx)

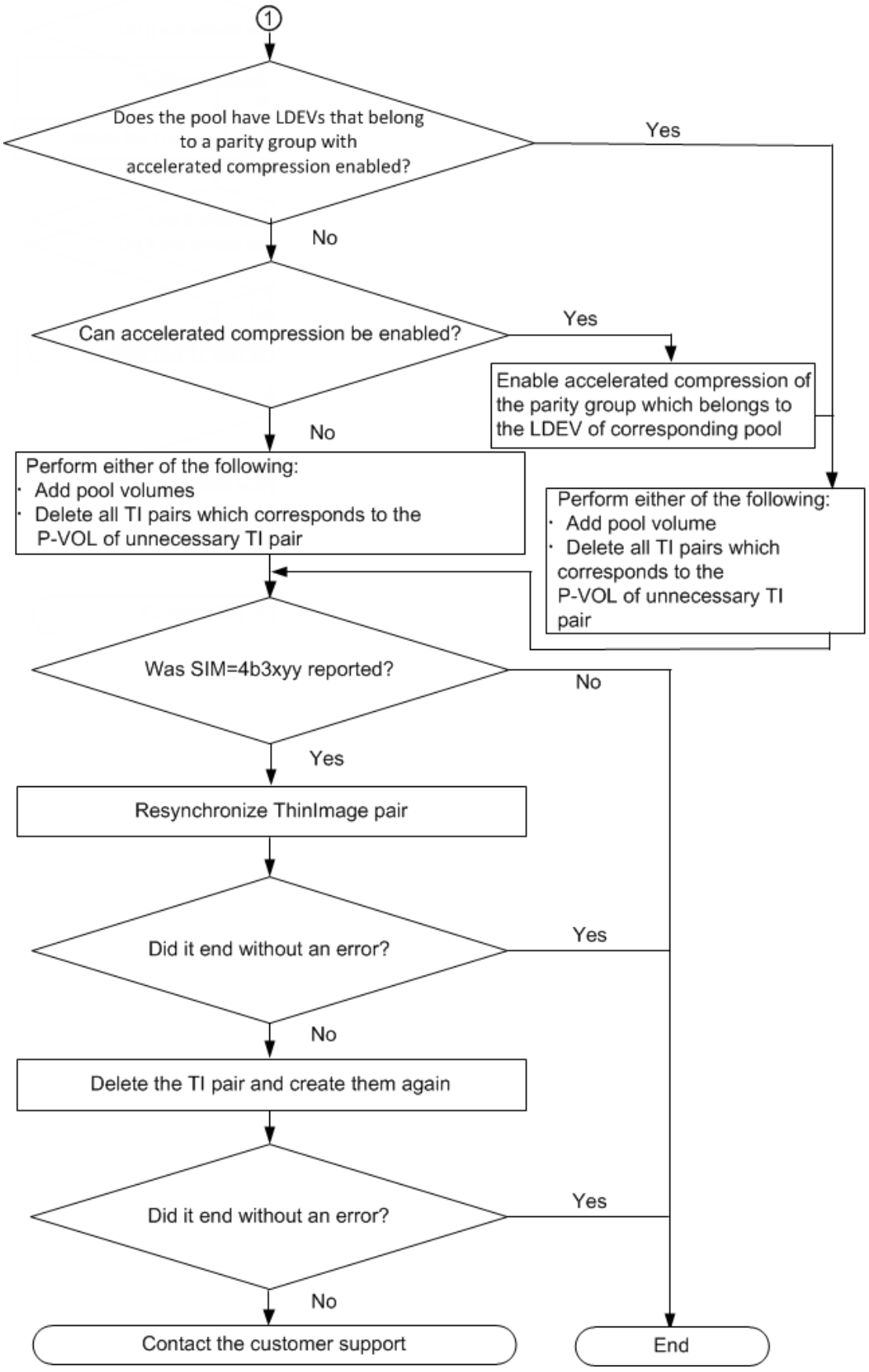
The following figure explains how to correct pool-related failures for Thin Image.



Workflow to perform when SIMs related to the pool usage rate were reported

The following figure explains how to take action when 601*xxx* or 602*xxx* has occurred.


Start
Was SIM=601xxx reported?
Yes
No
Check the pool volume status
Is pool volume normal ?
Yes (Pool volume is full)
No
①
Restore the pool volume (Call the customer support when the pool volume is blocked)
Is the pool blocked?
No
Yes
Restore the pool (See the workflow for recovering blocked pools)
Restore the TI pair (See the workflow for recovering blocked pools)
End


1
Does the pool have LDEVs that belong to a parity group with accelerated compression enabled?
Yes
No
Can accelerated compression be enabled?
Yes
Enable accelerated compression of the parity group which belongs to the LDEV of corresponding pool
No
Perform either of the following:
· Add pool volumes
· Delete all TI pairs which corresponds to the P-VOL of unnecessary TI pair
Perform either of the following:
· Add pool volume
· Delete all TI pairs which corresponds to the P-VOL of unnecessary TI pair
Was SIM=4b3xyy reported?
No
Yes
Resynchronize ThinImage pair
Did it end without an error?
Yes
No
Delete the TI pair and create them again
Did it end without an error?
Yes
No
Contact the customer support
End

The pool capacity required for resolving SIMs is calculated as follows:

```
required-capacity = (capacity-used-by-pool / pool-threshold) -
pool-capacity-before-expansion
```

When you expand a pool using LDEVs created from parity groups of which accelerated compression is enabled, the total amount of the LDEVs should meet the following conditions:

```
total-capacity-of-LDEVs-to-be-created ≤ (physical-amount-of-
parity-group / (1 –deletion-rate)) –

- capacity-of-pool-volumes-belonging-to-applicable-parity-group-
of-pool-before-expansion
```

Determine whether to expand a pool by comparing the results calculated by using the above formulas.

When

```
required-capacity ≤ total-capacity-of-LDEVs-to-be-created
```

The insufficient capacity can be reserved by using the available capacity in a parity group of which accelerated compression is enabled.

When

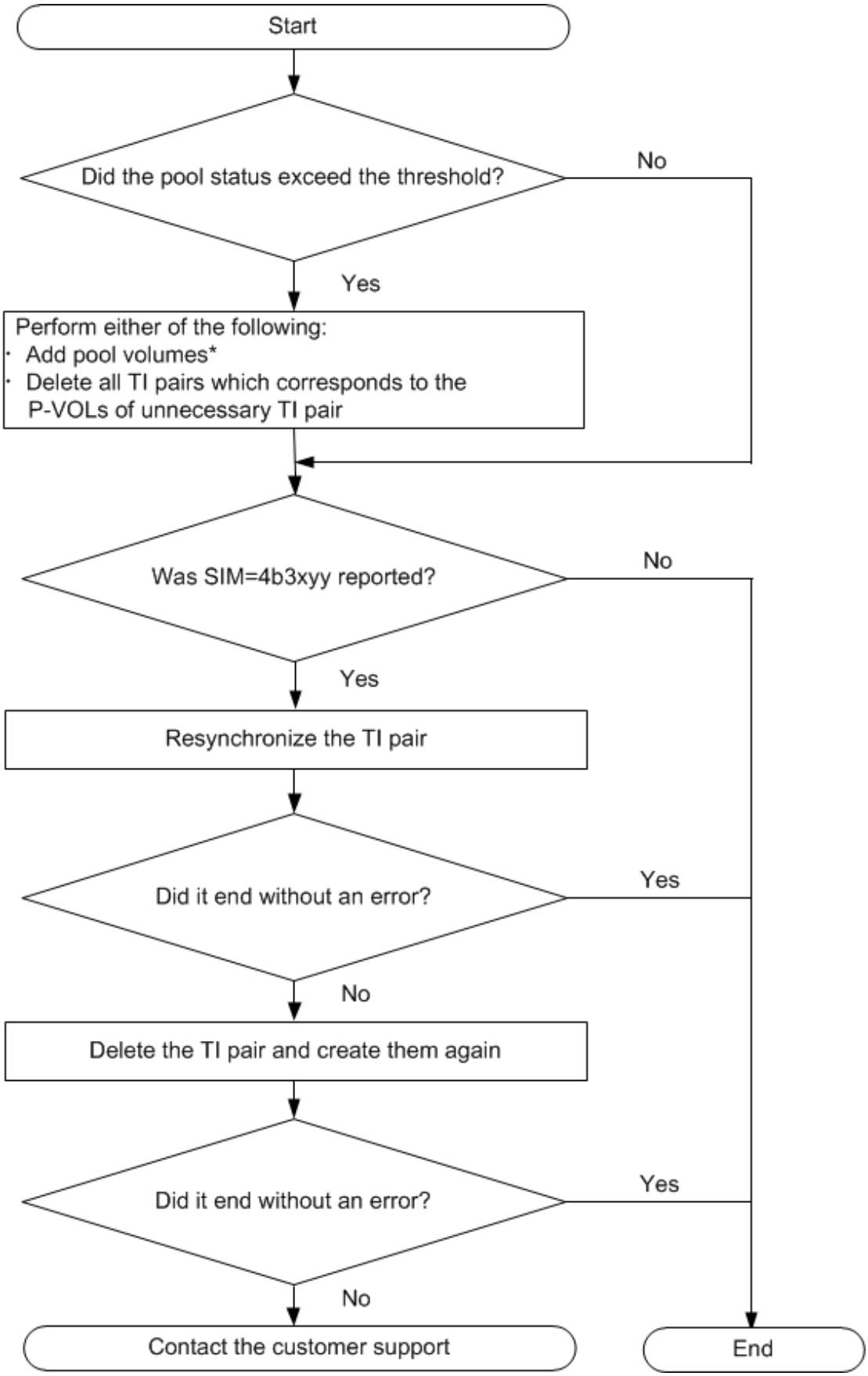
```
required-capacity > total-capacity-of-LDEVs-to-be-created
```

To reserve the insufficient capacity, add a parity group to create an LDEV, and then expand the pool.

Note that the threshold and the deletion rate used for the calculation are expressed as a fraction converted from a percent. For example, if the threshold is 80%, enter 80/100 as the pool threshold for the calculation.

Workflow to perform when SIMs related to the capacity ensured for writing were reported

The following figures explain how to take action when 604xxx, 605xxx, or 606xxx has occurred.


Start
Did the pool status exceed the threshold?
No
Yes
Perform either of the following:
· Add pool volumes*
· Delete all TI pairs which corresponds to the P-VOLs of unnecessary TI pair
Was SIM=4b3xyy reported?
No
Yes
Resynchronize the TI pair
Did it end without an error?
Yes
No
Delete the TI pair and create them again
Did it end without an error?
Yes
No
Contact the customer support
End

*To resolve SIMs, add parity groups to create LDEVs, and then expand the pool. The required physical capacity can be calculated by using the following formula:

```
required-physical-capacity = (physical-capacity-of-pool / pool-threshold) – physical-capacity-of-pool-before-expansion
```

Note the threshold and the deletion rate used for the calculation are expressed as a fraction converted from a percent. For example, if the threshold is 80%, enter 80/100 as the pool threshold for the calculation.

Workflow for correcting SIMs related to cache management devices

The `Reference code 670000` SIM (service information message) is issued if the number of the remaining cache management devices falls below a threshold number.

The cache management device threshold that triggers the warning SIM depends on the storage system:

- VSP G200: 256
- VSP G400, G600 or VSP F400, F600: 512
- VSP G800 or VSP F800: 2,048
- VSP G1000, G1500, and VSP F1500: 4,096

For more information about SIM reference codes, contact customer support.

(VSP G1000, G1500, and VSP F1500) You can view SIMs that occur in the storage system in an HDvM - SN window.

For more information about checking alerts and the details of a SIM, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide* for your storage system.

You must reserve enough cache management devices. If a warning SIM is issued before you deplete cache management devices, a problem has not necessarily occurred. Using the storage system and depleting the cache management devices blocks the Thin Image pair and suspends the pair ("PSUE" status) and snapshot data cannot be stored or pairs cannot be cloned. In addition, you cannot create a new Thin Image pair using another P-VOL.

Note: You cannot store snapshot data or create additional Thin Image pairs using other P-VOLs while the pair is suspended.

Use the following workflow to correct the warning SIMs related to cache management devices:

1. Confirm that the number of remaining cache management devices meets the threshold for your storage system.
2. Remove unneeded V-VOLs.
3. Remove all of the snapshots in the unneeded P-VOLs by resynchronizing the pairs.
4. (VSP G1000, G1500, and VSP F1500)Manually complete the SIMs related to cache management devices.

Related concepts

- Workflow for correcting pool-related SIMs on page 211

Related tasks

- Resynchronizing Thin Image pairs on page 143
- Manually completing SIMs on page 213

Calculating the number of remaining cache management devices

Use this formula to calculate the number of remaining cache management devices.

remaining-cache-management-devices = available-cache-management-devices - cache-management-devices-being-used

The number of available cache management devices depends on the storage system:

- VSP G200: 3,840
- VSP G400, G600 or VSP F400, F600: 7,936
- VSP G800 or VSP F800: 32,512
- VSP G1000, G1500, and VSP F1500: 65,280

Related tasks

- Viewing the number of cache management devices on page 171

Workflow for correcting pool-related SIMs

If the pool capacity ensured for writing exceeded the threshold, a pool was blocked, or there is no free space in shared memory, Service Information Messages (SIMs) below are issued. For details about the pool usage capacity and the capacity ensured for writing, see the Provisioning Guide for your storage system.

Correct pool-related Service Information Messages (SIMs) for the following, if they occur.

- Reference code 601*xxx*, 604*xxx*, or 606*xxx*: The pool usage rate of capacity ensured for writing exceeds the threshold.
- Reference code 602*xxx* or 605*xxx*: The pool is blocked.
- Reference code 602ffe: Multiple pools are blocked.

- Reference code 603000: The Snapshot Estimated Manageable Capacity is less than the following values, depending on the storage system model:
  - VSP G200: 12 TB
  - VSP G400, G600, G800 or VSP F400, F600, F800: 20 TB
  - VSP G1000, G1500, and VSP F1500: 128 TB
- Reference code 624000: You have reached capacity in the shared memory.

xxx indicates the pool ID. For details about reference codes of SIMs, contact customer support.

For VSP G1000 and G1500, and VSP F1500, you can check the SIMs occurring in storage systems from a Device Manager - Storage Navigator window. For information on Device Manager - Storage Navigator windows you can use for checking SIMS, see the *Provisioning Guide* for your storage system.

Use the following workflow to correct pool-related SIMs:

1. Complete one of the following:
   - **For reference code 601xxx, 602xxx, 604xxx, 605xxx, 606xxx, or 602ffe:** Recover the pool ("Normal" status).
     For more information about the countermeasures to take when the pool capacity ensured for writing exceeds the threshold and when a pool was blocked, see Workflow for correcting pool-related failures (SIM = 601xxx, 602xxx, 604xxx, 605xxx, and 606xxx) on page 204.
   - **For reference code 624000:** Complete one of the following:
     - Delete unused pools.
     - Delete unused Thin Image pairs.
     - Delete unused DP-VOLs.
     - Shrink the capacity of the HDP, HDT, or active flash pool.
   - **For reference code 603000:** If a long time has passed since you performed the tasks listed for reference code 624000 (above), reference code 624000 is reported.
   - Perform one of the procedure listed above for reference code 624000 again.
2. (VSP G1000, G1500, and VSP F1500) Clear the SIM from the storage system. Depending on the SIM's reference code, one of the following occurs:
   - The SIM is automatically completed.
   - You manually complete the SIM.
3. (Optional) Use HDvM - SN to confirm that the SIM completed normally.

For more information about the **Pools** window and the **Complete SIMs** window, see the *Provisioning Guide* for your storage system.

For more information about completing SIMs automatically and manually, see the *System Administrator Guide* for your storage system.

Related concepts

- Automatic completion of SIMs on page 213

Related tasks

- Manually completing SIMs on page 213

Completing SIMs (VSP G1000, G1500, and VSP F1500)

Completing SIMs means changing the SIM status to "Completed". When the cause of a SIM occurrence is solved, change the SIM status to Completed. If you complete a SIM without solving the cause, the SIM might occur again when another operation is performed.

Automatic completion of SIMs

SIMs are automatically completed in these cases.

- **For reference code 620xxx:** The usage level of HDP pool number *xxx* falls below the warning threshold.
  For more information about setting the data pool's warning threshold, see Creating Thin Image data pools on page 98.
- **For reference code 625000:** The usage level of each HDP pool in all of the pools in the storage system falls below the depletion threshold.
- **For reference code 626xxx:** The usage level of each HDP pool number *xxx* falls below the depletion threshold.

Note: The data pool's depletion threshold is not a value you can set using Thin Image.

SIM reference codes 620*xxx*, 625000, and 626*xxx* are automatically completed if you increase the pool capacity by adding pool-VOLs. Increasing the pool capacity removes the condition that causes these SIMs.

Manually completing SIMs

You can manually complete the SIMs related to cache management devices to clear them from the storage system and process pool-related SIMs.

For more information about completing SIMs automatically and manually, see the *System Administrator Guide*.

Procedure

1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand the storage system tree.
   b. Expand the target storage system, right-click **DP Pools**, and then select **System GUI**.

In Device Manager - Storage Navigator:

a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Pools**.

2. In the **Pools** window, click **More Actions > Complete SIMs**.
3. Accept the default task name or enter a unique name.

   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
4. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
5. Click **Apply** to submit the task.

Result

The SIMs are completed ("Completed" status).

You can confirm whether a SIM has been completed normally by checking the system information and status in HDvM - SN.

For more information about checking alerts for SIMs, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide*.

Contacting customer support

If you need to contact customer support, you should provide as much information about the problem as possible.

Please include the following:

- The circumstances surrounding the error or failure.
- The content of any messages displayed on HDvM - SN.
- The HDvM - SN configuration information (use the Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by HDvM - SN.

HDS customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to Hitachi Data Systems Support Connect for contact information: https://support.hds.com/en_us/contact-us.html.

A

CCI command reference for Thin Image

This appendix describes CCI commands corresponding to actions in the HDvM - SN GUI. Use CCI to perform Thin Image tasks by entering commands from a host.

- Pair tasks using CCI or Device Manager - Storage Navigator
- CCI pair command results
- Troubleshooting with Command Control Interface

Pair tasks using CCI or Device Manager - Storage Navigator

You can use CCI as well as Device Manager - Storage Navigator (HDvM - SN) to perform pair tasks. When you use CCI, perform tasks by running an existing command for pair tasks or a CCI command.

Use CCI commands to store a minimum of 65 snapshots, perform a minimum of 65 clones, or use a minimum of 64 MU numbers.

The following table shows the pair tasks you can perform, the CCI commands you can use to perform the task, and the HDvM - SN wizard and windows from which to start the task.

Pair task	CCI command	HDvM - SN
Create pair	`paircreate`	Create TI Pairs wizard
	`raidcom add snapshot`	
Create and split pair	`paircreate -split`	**Split Pairs** wizard
Split pair	`pairsplit`	**Split Pairs** wizard

	`raidcom modify snapshot -snapshot_data create`
	
	`raidcom modify snapshot -snapshot_data clone` (VSP G1000, G1500, and VSP F1500)
	
	`raidcom modify snapshot -snapshot_data split`	

Normal Copy	`pairresync`	**Resync Pairs** wizard
	`raidcom modify snapshot -snapshot_data resync`	
Reverse Copy	`pairresync -restore`	**Resync Pairs** wizard
	`raidcom modify snapshot -snapshot_data restore`	
Delete pair	`pairsplit -S`	**Delete Pairs** window
	`raidcom delete snapshot`	
Assign an S-VOL to snapshot data	`raidcom map snapshot` (VSP G200, G400, G600, G800) `raidcom mount snapshot` (VSP G1000, G1500, and VSP F1500)	Create TI Pairs wizard **Assign Secondary Volumes** wizard
Release the assignment of an S-VOL to snapshot data	`raidcom unmap snapshot` (VSP G200, G400, G600, G800) `raidcom unmount snapshot` (VSP G1000, G1500, and VSP F1500)	**Remove Secondary Volumes** window
Change the assignment of an S-VOL to snapshot data	`raidcom replace snapshot`	**Assign Secondary Volumes** wizard

For more information about using the CCI, see the *Command Control Interface Command Reference*.

CCI pair command results

To avoid getting mixed results, run CCI commands on pairs that are in the required status.

The following table shows the results of running commands on pairs depending on their status.

Status	CCI command						
	paircreate	**paircreate -split**	**pairsplit**	**pairresync**	**pairresync -restore**	**pairsplit -S***	**pairsplit -E**
SMPL	Ok	Ab	Ab	Ab	Ab	Np	Ab
COPY	Np	Ab	Ab	Np	Np	Ab	Ab
PAIR/PFUL	Np	Ok	Ok	Np	Np	Ok	Ab
PSUS/ PFUS	Ab	Np	Np	Ok	Ok	Ok	Ab
RCPY	Np	Ab	Ab	Np	Np	Ab	Ab
PSUE	Ab	Ab	Ab	Ok	Ab	Ok	Ab

* (VSP G1000, G1500, and VSP F1500) Terminates normally, regardless of the pair status, when the snapshot tree is specified as the range to be deleted.

Legend:

Ok: The command ends normally and the task is performed.
Np: The command is not rejected and ends normally but the task is not performed.
Ab: The command is rejected and ends abnormally.

Do not specify noread mode (-m noread) for S-VOLs using CCI. If you do, the command ends normally but the noread mode does not take effect.

If a CCI command is rejected and ends abnormally and the host is running the HP-UX operating system, sense bytes (SSB) are output to the CCI error log file. Sense bytes indicate the cause of the error.

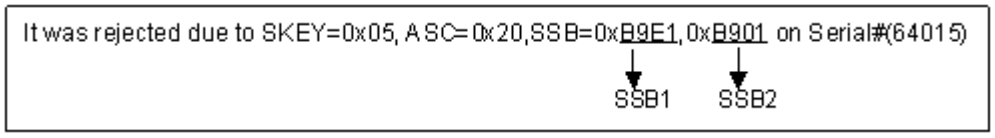
For more information about SSB and error causes, see Troubleshooting with Command Control Interface on page 217.

Troubleshooting with Command Control Interface

To identify the cause of errors that occur when you run CCI commands, refer to the log displayed in the CCI window or the CCI operation log file.

Procedure

1. Find the error code in the log displayed in the CCI window or the CCI operation log file. The CCI log file's default location is `/HORCM/log*/curlog/horcmlog_HOST/horcm.log`, where the asterisk (*) is the instance number and *HOST* is the host name.
   The following figure shows an example of a log displayed in the CCI window.



   An error code string in the CCI operation log file looks like the following example:

```
11:06:03-37897-10413- SSB = 0xB901,4A96
```

2. Locate the SSB1 and SSB2 codes. In the examples above, the error codes appear to the right of "SSB =".
   - The last four digits to the left of the comma (,) are the SSB1 code (B9E1).
   - The last four digits to the right of the comma (,) are the SSB2 code (B901).
3. Locate the description of the SSB1/SSB2 error code combination in the table in Command Control Interface SSB2 codes on page 218. For error codes not described in this table, call customer support.

Command Control Interface SSB2 codes

This table lists the SSB2 codes when SSB1 is 2E31, B901, B9A8, B9A9, B9AD, or B9AE, the related CCI command, and the cause of the error.

SSB2	CCI command	Cause of error
9100	All commands	You cannot run the command because the user authentication is not performed.
9685	paircreate	You cannot create the HTI pair because of a shortage of pair tables.
9700	paircreate	You cannot create the HTI pair because the pool is not available.
9702	paircreate	You cannot create the HTI pair because you specified a pool ID different from the pool ID used by existing pairs with the specified P-VOL.
9703	paircreate	You cannot create the HTI pair because the volume you specified as the P-VOL is already used by another HTI S-VOL.
9704	paircreate	You cannot create the HTI pair because the volume you specified as the S-VOL is already used by another HTI P-VOL.

SSB2	CCI command	Cause of error
9705	paircreate	You cannot create the HTI pair because the volume you specified as the S-VOL is already used by another HTI S-VOL.
9706	paircreate	You cannot create the HTI pair because another HTI pair is using the snapshot ID you specified.
9707	paircreate	You cannot create the HTI pair because the capacity of the pair that you are trying to create exceeds the amount of licensed capacity you have reserved.
9718	All commands	The command ended abnormally. You tried to use a command other than **paircreate** for the volume in the pair other than the HTI pair. This error can also occur if you run the command with an unsupported parameter specified.
9719	All commands	The command ended abnormally because the pair is in a status that the command does not accept. This error can also be reported if you run the command with an unsupported parameter specified.
971A	paircreate	You cannot create the HTI pair because you do not have sufficient SM capacity.
971F	pairresync -restore	You cannot restore the HTI pair because the volume you specified as the P-VOL has an S-VOL Disable attribute.
9722	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified either of the following for the HTI P-VOL. • External volume for which the Data Direct Mapping attribute is enabled. • Volume belongs to a parity group for which accelerated compression is enabled These volumes can only be used as the pool volume.
9723	All commands	VSP G200: The command ended abnormally because shared memory (Base) is not added. VSP G400, G600, G800 and VSP F400, F600, F800: The command ended abnormally because shared memory (Extension1) is not added. VSP G1000, G1500, and VSP F1500: The command ended abnormally because shared memory (64KLDEV Extension) is not added.
9724	All commands	VSP G200: The command ended abnormally because shared memory (Base or greater) is not added. VSP G400, G600, G800 and VSP F400, F600, F800: The command ended abnormally because shared memory Base (Extension1 or greater) is not added. VSP G1000, G1500, and VSP F1500: The command ended abnormally because shared memory Base (16KLDEV, SI, VM, DP, TI, FC or greater) is not added.
9725	All commands	The command ended abnormally because the LDEV number of the volume you specified as the HTI P-VOL is beyond the specified range.

SSB2	CCI command	Cause of error
9726	All commands	The command ended abnormally because you specified an unmounted volume as the HTI P-VOL.
9727	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a blocked volume as the HTI P-VOL.
9728	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume that is in the process of being shredded or formatted as the HTI P-VOL.
9729	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume as the HTI P-VOL, and that volume has an emulation type other than OPEN-V.
972A	paircreate	You cannot create the HTI pair because the volume you specified as the HTI P-VOL has the command device setting.
972C	paircreate	You cannot create the HTI pair because the capacity of the volume you specified as the HTI P-VOL exceeds the supported size.
972E	paircreate	You cannot create the HTI pair because the capacity of the volume you specified as the HTI S-VOL exceeds the supported size.
972F	paircreate	You cannot create the HTI pair because you specified a V-VOL as the HTI P-VOL.
9730	paircreate	You cannot create the HTI pair because you specified a pool-VOL as the HTI P-VOL.
9731	pairresync -restore	You cannot restore the HTI pair because the HTI P-VOL and TC P-VOL share a volume, and the TC pair is not split ("PSUS" status) or is suspended and blocked (“PSUE” status).
9732	pairresync -restore	You cannot restore the HTI pair because the HTI P-VOL and UR P-VOL share a volume, and the UR pair is not split ("PSUS" status) or is suspended and blocked (“PSUE” status).
9733	pairresync -restore	You cannot restore the HTI pair because the HTI P-VOL and TC S-VOL share a volume.
9734	pairresync -restore	You cannot restore the HTI pair because the HTI P-VOL and UR S-VOL share a volume.
9735	paircreate	You cannot create the HTI pair because you specified a UR journal volume as the HTI P-VOL.
973B	All commands	The command ended abnormally because the LDEV number of the volume you specified as the HTI S-VOL is beyond the specified range.
973C	All commands	The command ended abnormally because you specified an unmounted volume as the HTI S-VOL.
973D	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a blocked volume as the HTI S-VOL.
973E	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume that is in process of being shredded or formatted as the HTI S-VOL.
973F	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume whose emulation type is other than OPEN-V as the HTI S-VOL.

SSB2	CCI command	Cause of error
9740	paircreate	You cannot create the HTI pair because the volume you specified as the HTI S-VOL has the command device setting.
9742	paircreate	You cannot create the HTI pair because you specified an external volume as the HTI S-VOL.
9744	pairsplit -S, unmap snapshot, replace snapshot	The command ended abnormally because the volume you specified as the S-VOL was grouped with a datastore of Hitachi Storage Provider for VMware vCenter.
9745	paircreate	You cannot create the HTI pair because you specified a volume other than a V-VOL as the HTI S-VOL.
9746	paircreate	You cannot create the HTI pair because you specified a pool-VOL as the HTI S-VOL.
9747	paircreate	You cannot create the HTI pair because you specified a TC P-VOL as the HTI S-VOL.
9748	paircreate	You cannot create the HTI pair because you specified a TC S-VOL as the HTI S-VOL.
9749	paircreate	You cannot create the HTI pair because you specified a UR data volume or journal volume in the intermediate site of 3DC cascading configuration as the HTI S-VOL.
974A	paircreate	You cannot create the HTI pair because you specified a UR P-VOL as the HTI S-VOL.
974B	paircreate	You cannot create the HTI pair because you specified a UR S-VOL as the HTI S-VOL.
974C	paircreate	You cannot create the HTI pair because you specified a UR journal volume as the HTI S-VOL.
974F	All commands	The command ended abnormally because the volume you specified as the HTI S-VOL has an S-VOL Disable attribute.
9752	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because the Max LBA size of the volumes you specified as the HTI P-VOL and S-VOL is different.
9753	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because the number of slots of the volumes you specified as the HTI P-VOL and S-VOL is different.
9754	paircreate	You cannot create the HTI pair because you specified a DP-VOL as the HTI S-VOL.
9756	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified either of the following for the HTI S-VOL. • External volume for which the Data Direct Mapping attribute is enabled. • Volume belongs to a parity group for which accelerated compression is enabled
9757	All commands	The command ended abnormally because you specified a Volume Migration V2 source volume as the HTI P-VOL. For more information about using Volume Migration V2, contact customer support.
9758	All commands	The command ended abnormally because you specified a Volume Migration V2 target volume as the HTI P-VOL. For more information about using Volume Migration V2, contact customer support.

SSB2	CCI command	Cause of error
975A	All commands	The command ended abnormally because you specified an SI P-VOL as the HTI S-VOL.
975B	All commands	The command ended abnormally because you specified an SI S-VOL as the HTI S-VOL.
975C	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a DP-VOL for which the Data Direct Mapping attribute is enabled as the HTI S-VOL.
975D	All commands	The command ended abnormally because you specified a Volume Migration V2 source volume as the HTI S-VOL. For more information about using Volume Migration V2, contact customer support.
975E	All commands	The command ended abnormally because you specified a Volume Migration V2 target volume as the HTI S-VOL. For more information about using Volume Migration V2, contact customer support.
976A	paircreate	An unavailable parameter (unsupported parameter) is specified in the command.
976C	pairsplit	You cannot store the snapshot data because you have run the command when the pair is suspended and blocked ("PSUE" status).
976E	pairsplit	The snapshot data cannot be stored because the HTI P-VOL and a TC S-VOL share the volume, and the status of the TC pair is "COPY".
976F	pairsplit	Snapshot data cannot be stored because the HTI P-VOL and a UR S-VOL share the volume, and the status of the UR pair is "COPY".
9772	paircreate	The HTI pair cannot be created because you specified a UR delta resync pair volume as the HTI S-VOL.
9774	paircreate	The HTI pair cannot be created because the HTI P-VOL and an SI P-VOL share the volume, and the MU number you specified for the HTI pair is already used by the SI pair.
9777	paircreate	The HTI pair cannot be created because the HTI P-VOL and an SI S-VOL share the volume, and you specified MU number zero (0) for the HTI P-VOL.
977A	paircreate, pairsplit	The command ended abnormally because the HTI P-VOL and an SI P-VOL share the volume, and the SI pair was in the process of resynchronization.
977B	paircreate, pairsplit	The command ended abnormally because the HTI P-VOL and an SI S-VOL share the volume, and the SI pair status is not "PSUS".
977C	pairresync -restore	You cannot restore the HTI pair because the HTI P-VOL and an SI P-VOL share the volume, and the SI pair is not split ("PSUS" status) or is suspended and blocked ("PSUE" status).
977D	pairresync -restore	The HTI pair cannot be restored because the HTI P-VOL and an SI S-VOL share the volume, and the SI pair is not split ("PSUS" status).
977E	pairsplit	Snapshot data cannot be stored because the pool or the pool-VOL is blocked.
9783	pairresync -restore	You cannot restore the HTI pair because of one of the following reasons:

SSB2	CCI command	Cause of error
		• You are storing snapshot data for the HTI pair that you want to restore using the consistency group to which the pair is assigned. • You are using the P-VOL of the HTI pair you want to restore as the P-VOL for another HTI pair, and you are storing the snapshot data of the latter pair using the consistency group in which the pair is defined.
9786	All commands	The command ended abnormally because you specified a global-active device volume for quorum disk as the HTI P-VOL.
9787	All commands	The command ended abnormally because you specified a global-active device volume for quorum disk as the HTI S-VOL.
978A	paircreate	You cannot create the HTI pair using the consistency group ID because of one of the following reasons: • SI is using the specified consistency group ID. • You have reached the maximum number of pairs that can be created for a consistency group. • A pair that uses the same P-VOL is assigned to the specified consistency group.
978B	paircreate	You cannot create the HTI pair because the consistency group ID you specified is not within range.
9790	paircreate	You cannot create the HTI pair because you have specified a DP-VOL that is undergoing accelerated compression as the HTI P-VOL.
9793	paircreate	You cannot create the HTI pair because a DP-VOL that is processing the Unmap command issued with system option mode 905 ON has been specified as the HTI P-VOL.
9796	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume that does not have a path definition as the HTI P-VOL.
9797	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because you specified a volume that does not have a path definition as the HTI S-VOL.
97A1	paircreate	If you have reached the maximum number of HTI pairs, you cannot create new pairs.
97A2	paircreate, pairsplit, pairresync, pairresync-restore	The command ended abnormally because you specified a volume that uses two mirrors in a three UR data center configuration as the P-VOL.
97A3	paircreate, pairsplit, pairresync, pairresync-restore	The command ended abnormally because the volume specified as the S-VOL uses two mirrors in a three UR data center configuration.
97A4	paircreate	You cannot create the HTI pair because you have specified a DP-VOL in the initialization process as the HTI P-VOL.
97A5	All commands	The command ended abnormally because you specified a volume that was undergoing online data migration as the HTI P-VOL.
97A6	All commands	The command ended abnormally because you specified a volume that was undergoing online data migration as the HTI S-VOL.
97B4	paircreate	You cannot create the pair and use the specified consistency group because you have you have reached the maximum number of consistency groups that can be created.
97B5	paircreate	You cannot create the HTI pair for the specified P-VOL because the maximum number of snapshot ID (MU number) was used.

SSB2	CCI command	Cause of error
97B6	paircreate	You cannot create the HTI pair because of one of the following reasons: • You were in the process of creating a new snapshot group but you reached the maximum number of snapshot groups that can be created. • You have specified a snapshot group which has reached the maximum number of pairs allowed in a group.
97B7	paircreate	You cannot create the HTI pair because the HDP pool is being initialized.
97B9	paircreate, pairsplit, pairresync, pairresync -restore	The command ended abnormally because the status of the pairs using the P-VOL you specified is suspended ("PSUE" status).
97BD	map snapshot/ unmap snapshot	The command ended abnormally because you specified a P-VOL that is not an HTI P-VOL.
97BE	map snapshot/ unmap snapshot/ replace snapshot replace snapshot is for VSP G1000, G1500, and VSP F1500	The command ended abnormally because you specified a volume that does not exist.
97BF	paircreate	You cannot create the HTI pair from the consistency group to which the specified snapshot group belongs because of one of the following reasons: • SI is using the specified consistency group. • You have reached the maximum number of pairs that can be created for a consistency group. • A pair that uses the same P-VOL exists already in the specified snapshot group.
97C2	All commands	The command ended abnormally because you specified an MU number outside the allowable range.
97C4	All commands	The command ended abnormally because of one of the following reasons: • You have specified a pool that is not an HTI pool. • You have specified a pool that does not exist.
97C6	paircreate, pairsplit, pairresync, or pairresync -restore	The command ended abnormally because HTI is not installed.
97C7	paircreate	You cannot create the HTI pair because the capacity of cache management devices is insufficient.
97C8	paircreate	You cannot create the HTI pair because the capacity of the volume you specified as the P-VOL or the S-VOL of the HTI pair is more than the supported size.
97CB	All commands	The command ended abnormally because you specified a pool that is not an HTI pool.
97CD	paircreate/map snapshot	The command ended abnormally because you specified a deduplication system data volume as the P-VOL of a Thin Image pair.

SSB2	CCI command	Cause of error
97CE	paircreate/map snapshot	The command ended abnormally because you specified a deduplication system data volume as the S-VOL of a Thin Image pair.
97CF	paircreate	You cannot create the HTI pair because an HTI group is already using the CG number you specified.
97D4	All commands	The command ended abnormally because you are in the process of turning off the power.
97D5	All commands	You cannot run the command because even though the specified serial number matches the virtual storage machine, the physical storage system's serial number that corresponds with the virtual storage machine's serial number does not match when the virtual storage machine's serial number is specified for P-VOL and S-VOL.
97D6	All commands	You cannot run the command because the model, serial number, or virtual LDEV ID of the volume specified as P-VOL is being changed.
97D7	All commands	You cannot run the command because the model, serial number, or virtual LDEV ID of the volume specified as S-VOL is being changed.
97D8	All commands	The pair operation was rejected because one of the following conditions holds for the volume that is specified as the HTI P-VOL: • The volume is used as a global-active device pair volume and does not accept pair operations. • The volume is specified reservation attribute of a global-active device.
97D9	All commands	The pair operation was rejected because one of the following conditions holds for the volume that is specified as the HTI S-VOL: • The volume is used as a global-active device pair volume. • The volume is specified reservation attribute of a global-active device.
97DA	paircreate, map snapshot	The command ended abnormally because the T10 PI settings for the P-VOL and S-VOL did not match.
97DD	unmap snapshot/ replace snapshot	The command ended abnormally because you specified a pair to which an S-VOL is not assigned.
97DE	map snapshot/ unmap snapshot/ replace snapshot	The operation failed because different DKCMAIN microcode versions are mixed. Confirm DKCMAIN microcode version.
97DF	map snapshot	The command ended abnormally because you specified an S-VOL that is assigned to a pair.
97F1	replace snapshot	The command ended abnormally because the pair cannot be identified from snapshot data and the P-VOL that you specified.
97F1	map snapshot/ replace snapshot	The command ended abnormally because you specified a pair to which an S-VOL is assigned.
97FA	unmap snapshot/ replace snapshot	The command ended abnormally because you specified an S-VOL that is not assigned to a pair.
B912	paircreate, pairsplit, pairresync	The HTI pair task failed because you specified the incorrect S-VOL.
B9A7	All commands	You cannot retrieve the consistency group information because HTI is not installed.
FF58	pairsplit, pairresync, pairresync -restore	The pair is cascaded.

SSB2	CCI command	Cause of error
FF59	paircreate	The primary volume is used by a cascaded pair.
FF6D	paircreate	The primary volume is used by a cascaded pair.
FF72	paircreate, pairsplit, pairresync, pairresync -restore	A snapshot tree is being deleted.

This table lists the SSB2 codes when SSB1 is B980, the related CCI command, and the cause of the error.

SSB2	CCI command	Cause of error
B901	paircreate, pairresync, pairsplit, pairsplit -S	The specified port is for NAS Platform (system LU).
B903	paircreate, pairresync	The selected resource belongs to NAS_Platform_System_RSG.

Notes on using Thin Image primary volumes as TrueCopy, ShadowImage, or Universal Replicator pair volumes

The **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** CCI command might return the error code EX_EWSTOT (timeout) and terminate abnormally when the status of a pair in a Thin Image consistency group cannot be changed.

Following are possible reasons why the pair status cannot be changed:

- The Thin Image primary volume is used as a Universal Replicator S-VOL, and you are reaching the UR journal volume capacity limit.
- The Thin Image license is invalid.
- The Thin Image pair volumes are blocked.
- The current status of the Thin Image, ShadowImage, TrueCopy, or Universal Replicator pair does not allow the **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** command to run on the pair.

After resolving these error conditions, make sure that all pairs in the consistency group are in "PAIR" status before running the **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** command again. For details about Thin Image pairs, see How Thin Image works on page 27.

Notes on storing snapshot data, and on cloning pairs (VSP G1000, G1500, and VSP F1500)

There are some situations in which storing snapshot data or cloning pairs might end abnormally.

The **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** CCI command might terminate abnormally, as shown below, if the consistency group includes a pair in a status other than "PAIR."

- The command is rejected.
- Timeout occurs with the error code EX_EWSTOT.
- The pair is suspended with the error code EX_EWSUSE.

If you perform an operation other than pairsplit (for example, deletion of snapshot data or a Thin Image pair) on a pair in the consistency group while the **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** command is running, consistency of snapshot data to be stored or the S-VOL in which pairs are cloned cannot be maintained. Therefore, the **raidcom modify snapshot -snapshot_data create** or **raidcom modify snapshot -snapshot_data clone** command might end abnormally as shown below.

- Timeout might occur with the error code EX_EWSTOT.
- The pair might be suspended with the error code EX_EWSUSE.

Restoring a Thin Image pair might end abnormally in either of the following conditions.

- Snapshot data for a consistency group including the pair is being acquired.
- The primary volume of the pair is also used as the primary volume of another Thin Image pair. In addition, snapshot data for a consistency group including the latter pair is being acquired.

B

Thin Image GUI reference

This appendix describes Thin Image (HTI) windows and dialog boxes.

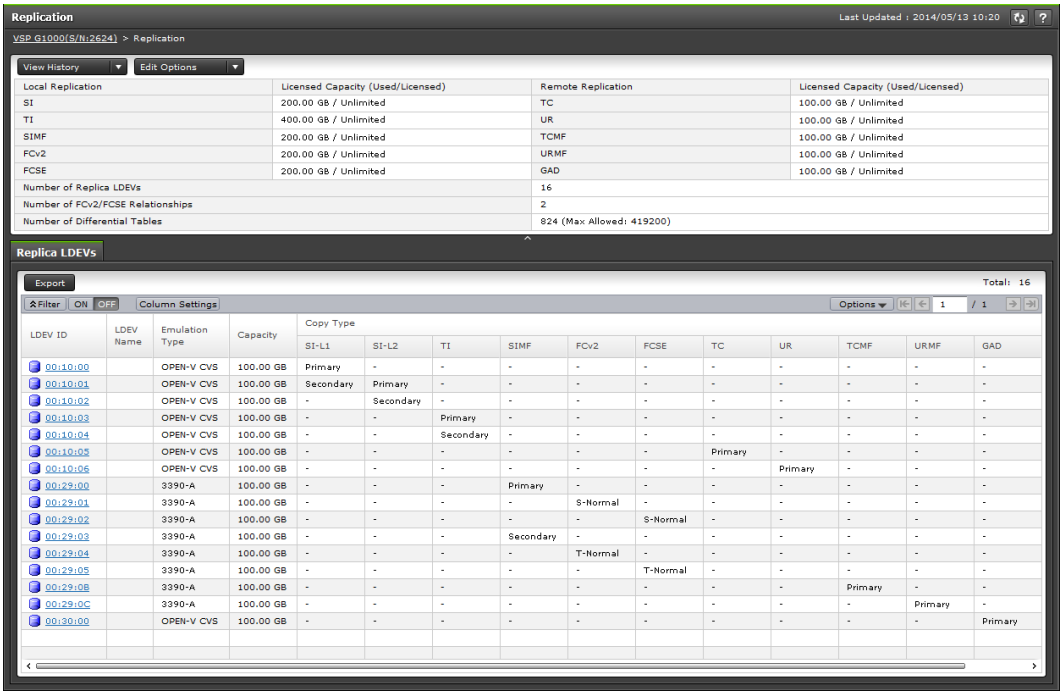
- Replication window
- Local Replication window
- View Pair Synchronization Rate window
- View Pair Properties window
- History window
- Consistency Group Properties window
- Create TI Pairs wizard
- Select Pool window
- Split Pairs wizard
- Resync Pairs wizard
- Delete Pairs window
- Edit Local Replica Options wizard
- TI Pairs window
- Assign Secondary Volumes wizard
- Remove Secondary Volumes window

Replication window

Use this window to perform the following tasks:

- Viewing replication summary information (see Viewing summary replication information on page 156).
- Opening the window from which you can view local replication summary information (see Viewing local replication summary information on page 157).
- Opening the window from which you can set the system options that affect performance in Thin Image (see Changing system options that affect Thin Image performance on page 119).
- Opening the window from which you can review the tasks that have been performed on a pair (see Viewing Thin Image pair task history on page 168).

The following image shows the **Replication** window with the summary section at the top of the window and the Replica LDEVs tab at the bottom.



Summary

This section is the table at the top of the **Replication** window that shows summary information about replication.

The following table lists the items in this section of the **Replication** window.

Item	Description
Licensed Capacity	The used and licensed capacity of each software application.
Number of Replica LDEVs	The number of LDEVs used for replication.
Number of FCv2/FCSE Relationships (VSP G1000, G1500, and VSP F1500)	The number of FCv2 and FCSE relationships that are in use.
Number of Differential Tables	The number of differential tables in use and the differential table limit, for local replication. Differential tables in use for remote replication are not included. Because differential tables are not used for all operations, the number of differential tables does not change when you execute the following operations: • Thin Image pair operations. • SIz pair operations for a DP-VOL that exceeds 262,668 cylinders. • SI pair operations for a DP-VOL that exceeds 4 TB. • Compatible FlashCopy® V2 or Hitachi Compatible FlashCopy® relationship operations.
View History > Local Replication	Click to open the **View History** window for local replication.
View History > Remote Replication	Click to open the **View History** window for remote replication.
Edit Options > Local Replication	Click to open the **Edit Local Replica Options** wizard.
Edit Options > Remote Replication	Click to open the **Edit Remote Replica Options** wizard. For more information about using this wizard to set the number of volumes, path blockade, and other options, see the *Hitachi TrueCopy® User Guide*.
Edit Options > SCP Time (VSP G1000, G1500, and VSP F1500)	Click to open the **Edit SCP Time** wizard. For more information about the tasks you can perform using this wizard, see the *Hitachi TrueCopy® User Guide*.

Replica LDEVs tab

This tab shows only pairs that consist of the P-VOL and S-VOLs (the source and target volumes for FCv2 or FCSE) allocated to each user.

The following table lists the items on the Replica LDEVs tab.

Item	Description
LDEV ID	The selected LDEV's identification number, which is a combination of the LDKC, CU and LDEV. Click the ID to open the **LDEV Properties** window, from which you can view the properties assigned to the selected LDEV.

Item	Description
	For more information about this window, see the *Provisioning Guide* for your storage system.
LDEV Name	The selected LDEV's name.
Emulation Type (VSP G1000, G1500, and VSP F1500)	The selected LDEV's emulation type.
Capacity	The selected LDEV's capacity.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair HTI volume status: • **Primary:** P-VOL • **Secondary:** S-VOL If you have not configured a pair, a hyphen (-) is displayed.
Virtual Storage Machine*	Information about the virtual storage machine to which the LDEV belongs. Values: • **Model/Serial Number:** The model type and serial number of the volume's virtual storage machine. • **LDEV ID:** The identification number of the volume's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Device Name:** The name of the volume's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **SSID:** The virtual SSID of the volume. If no virtual SSID is specified, a blank is displayed.
Export button	Click to open a dialog from which you can download table information to a file.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide*.	

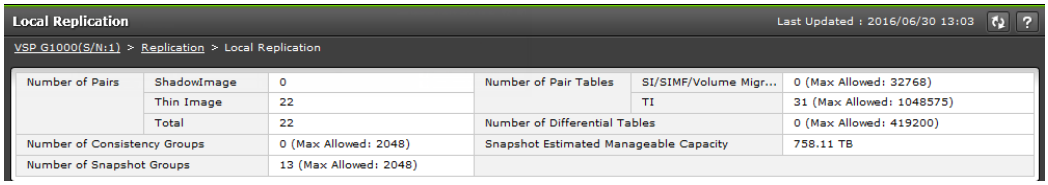
Local Replication window

Summary information about local replication.

Summary

This section is the table at the top of the **Local Replication** window that shows summary information about local replication.

The following image shows the summary section of the **Local Replication** window.



The following table lists the items in this section of the **Local Replication** window.

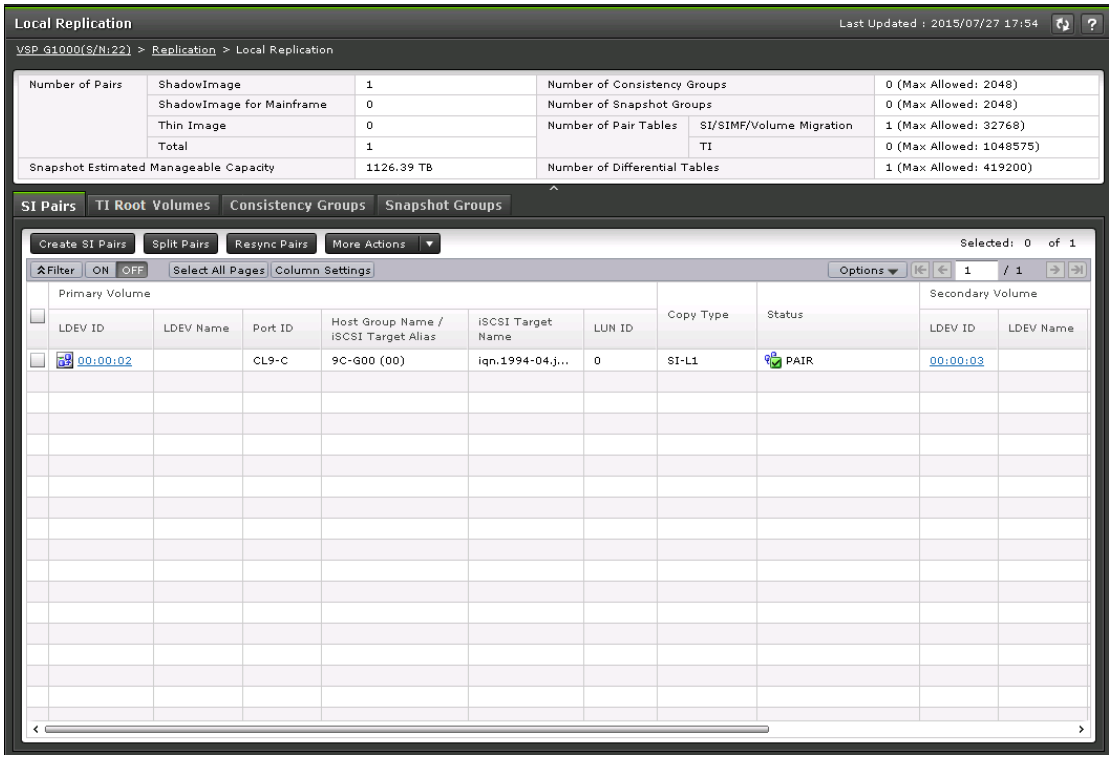
Item	Description
Number of Pairs	The number of pairs for each local replication software application type. The total number of pairs is shown on the Total line.
Number of Consistency Groups	The number of consistency groups that have a status other than "Free", and the consistency group limit in your storage system.
Number of Snapshot Groups	The number of snapshot groups that are in use and the snapshot group limit in your storage system.
Number of Pair Tables	The number of pair tables. This number varies depending on the combinations of software applications you are using. Values: • **SI/Volume Migration:** (VSP G200, G400, G600, G800) The number of SI and Volume Migration pair tables in use, and the SI and Volume Migration pair table limit in your storage system. • **SI/MF/Volume Migration V2:** (VSP G1000, G1500, and VSP F1500) The number of SI, SIz, and Volume Migration V2 pair tables in use and the SI, SIz, and Volume Migration V2 pair table limit in your storage system. • **TI:** The number of HTI pair tables in use and the HTI pair table limit in your storage system.
Number of Differential Tables	The number of differential tables that are in use and the differential table limit in your storage system. Because differential tables are not used for all operations, the number of differential tables does not change when you execute the following operations: • Thin Image pair operations. • SIz pair operations for a DP-VOL that exceeds 262,668 cylinders. • SI pair operations for a DP-VOL that exceeds 4 TB.
Snapshot Estimated Manageable Capacity	The HTI pair's estimated manageable capacity, which is the estimated HTI pair capacity that

Item	Description
	you can create using the remaining shared memory capacity. This value varies depending on the amount of HTI P-VOLs you add or delete and the number or HTI pairs you create. The  icon is displayed if this item is less than the following values, depending on the storage system model: • VSP G200: 12 TB • VSP G400, G600, G800: 20 TB • VSP G1000, G1500, and VSP F1500 :128 TB **Note:** This value does not guarantee that the HTI pairs of the indicated capacity have been successfully created.

SI Pairs tab

This tab only shows SI pairs to which you are allocated the P-VOL or the S-VOLs.

The following image shows this tab on the **Local Replication** window.



The following table lists the items on this tab.

Item	Description
Primary Volume	The SI P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. Click to open the **LDEV Properties** window. Use this window to search for P-VOL information. • **LDEV Name:** The P-VOL's LDEV name. • **Port ID:** The port name of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **iSCSI Target Name:** The P-VOL's iSCSI target name. If the LUN path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500)SI only. For SIz, a hyphen (-) is displayed. • **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **Provisioning Type*:** The P-VOL's provisioning type. ○ **Basic:** Internal volume ○ **DP:** DP-VOL ○ **External:** External volume ○ **External MF:** (VSP G1000, G1500, and VSP F1500) Migration volume • **Emulation Type*:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute*:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity*:** The P-VOL's capacity. • **CLPR*:** The P-VOL's CLPR ID. • **Encryption*:** The P-VOL's encryption information. ○ **Enabled:** Encryption is enabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ **Disabled:** Encryption is disabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. • **T10 PI*:** The P-VOL's T10 PI attribute information. ○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. (VSP G1000, G1500, and VSP F1500) If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **Virtual Storage Machine*:** The model type and serial number of the virtual storage machine to which the P-VOL belongs. • **Virtual LDEV ID*:** The identification number of the P-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name*:** The name of the P-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed.

Item	Description
	• **Virtual SSID*:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	The SI volume's copy type. Values: • **SI-L1:** SI L1 pair • **SI-L2:** SI L2 pair • **SIMF:** SIz pair
Status	The SI pair status. The following icons and pair statuses are shown: •  The SI pair is in the process of being deleted. Status: ○ **SI:** SMPL(PD) ○ **SIz:** Deleting/TRANS •  This icon is used for the following: You are copying the pair. Status: ○ **SI:** COPY(PD)/COPY ○ **SIz:** PENDING You are resynchronizing the pair. Status: ○ **SI:** COPY(RS)/COPY ○ **SIz:** Resync/PENDING You are restoring the pair. Status: ○ **SI:** COPY(RS-R)/RCPY ○ **SIz:** Resync-R/REVRSY You are in the process of Steady Split. Status: ○ **SI:** COPY(SP)/COPY ○ **SIz:** SP-Pend/TRANS •  The volumes are paired. Status: ○ **SI:** PAIR ○ **SIz:** DUPLEX •  This icon is used for the following: The pair is split. Status: ○ **SI:** PSUS ○ **SIz:** Split/SUSPOP You are splitting the pair in Quick Split mode. Status: ○ **SI:** PSUS(SP)/PSUS ○ **SIz:** V-Split/SUSPVS •  The pair is suspended. Status: ○ **SI:** PSUE ○ **SIz:** Suspend/SUSPER

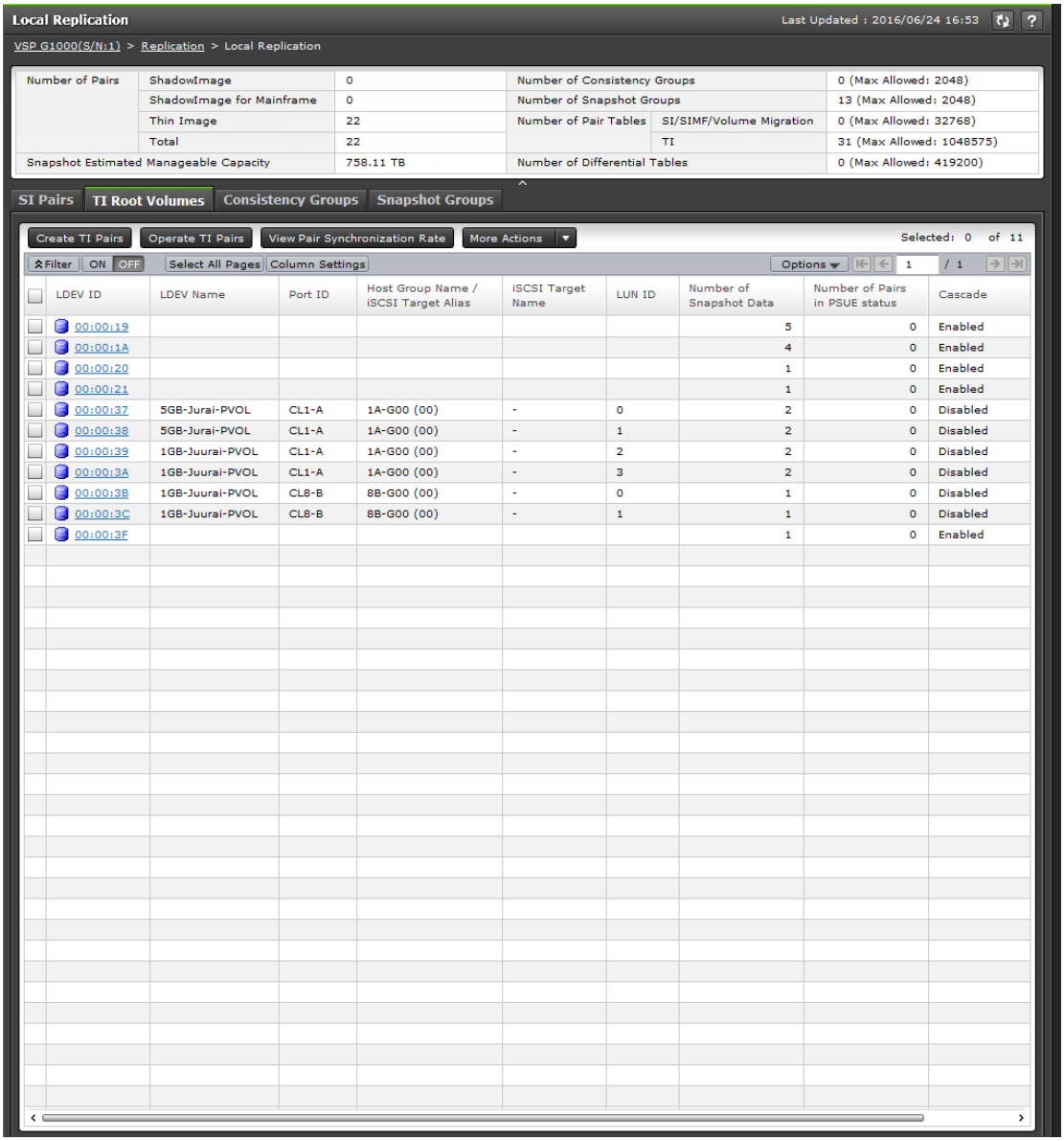
Item	Description
	For more information about SI or SIz pair status, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide*.
Secondary Volume	SI S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. Click to open the **LDEV Properties** window. • **LDEV Name:** The S-VOL's LDEV name. • **Port ID:** The port name of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500)SI only. For SIz, a hyphen (-) is displayed. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **iSCSI Target Name:** The S-VOL's iSCSI target name. If the LUN path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. (VSP G1000, G1500, and VSP F1500) SI only. For SIz, a hyphen (-) is displayed. • **Provisioning Type*:** The S-VOL's provisioning type. ○ **Basic:** Internal volume ○ **DP:** DP-VOL ○ **External:** External volume • **Emulation Type*:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Attribute*:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity*:** The S-VOL's capacity. • **CLPR*:** The S-VOL's CLPR ID. • **T10 PI*:** The S-VOL's T10 PI attribute information. ○ **Enabled:** The S-VOL's T10 PI attribute is enabled. ○ **Disabled:** The S-VOL's T10 PI attribute is disabled. • **Encryption*:** The S-VOL's encryption information. ○ **Enabled:** Encryption is enabled for the parity group to which the S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ **Disabled:** Encryption is disabled for the parity group to which the S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which the S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **Virtual Storage Machine*:** The model type and serial number of the virtual storage machine to which the S-VOL belongs. • **Virtual LDEV ID*:** The identification number of the S-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name*:** The name of the S-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed.

Item	Description
	• **Virtual SSID*:** The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Pace*	The speed at which the SI S-VOL is copied. Values: Faster, Medium, or Slower
CTG ID*	The identifier of the consistency group to which the SI pair is assigned.
Mirror Unit*	The SI pair's mirror unit number.
Topology ID	The SI LDEV's topology identification number, which consists of the LDEV ID and the mirror unit number. The ID indicates the pair's tier, or location, when the mirror unit locates it. Example: 00:00:00 (MU0-MU1)
Create SI Pairs button	Click to open the Create SI Pairs window.
Split Pairs button	Click to open the **Split Pairs** window.
Resync Pairs button	Click to open the **Resync Pairs** window.
More Actions	Click to view a list of tasks you can perform. Options: • **View Pair Synchronization Rate:** Click to open the **View Pair Synchronization Rate** window. • **View Pair Properties:** Click to open the **View Pair Properties** window. • **Suspend Pairs:** Click to open the **Suspend Pairs** window. • **Delete Pairs:** Click to open the **Delete Pairs** window. • **Export:** Click to open the dialog from which you can download table information to a file.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide*.	

TI Root Volumes or TI Primary Volumes tab

This tab shows only Thin Image pairs that have P-VOLs to which you are allocated.

The following image shows this tab in the **Local Replication** window.



The following table lists the items on this tab.

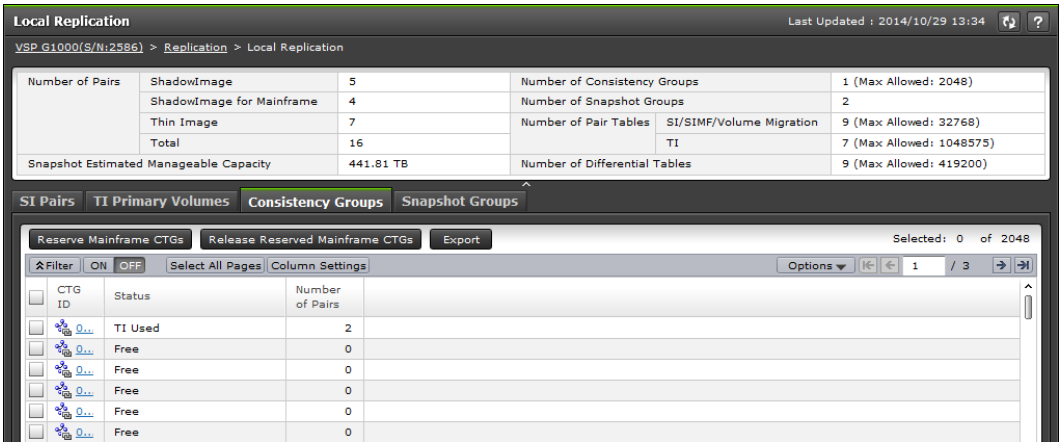
Item	Description
LDEV ID	The P-VOL's LDEV identification number. (VSP G1000, G1500, and VSP F1500) Click to open the TI Pairs window. (VSP Gx00 models and VSP Fx00 models) Click to open the **LDEV Properties** window.
LDEV Name	The P-VOL's LDEV name.
Port ID	The port identification number of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.

Item	Description
Host Group Name / iSCSI Target Alias	The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.
iSCSI Target Name	The P-VOL's iSCSI target name. If the LUN path is not defined, a blank is displayed.
LUN ID	The LUN identification number of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.
Attribute* VSP Gx00 models and VSP Fx00 models only.	The P-VOL's attribute.
Capacity*	The P-VOL's capacity.
CLPR*	The P-VOL's CLPR ID.
Encryption*	The P-VOL's encryption information. • **Enabled:** Encryption is enabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. • **Disabled:** Encryption is disabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. • **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. (VSP G1000, G1500, and VSP F1500) If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
Pool Name (ID)*	The pool name and identification number.
Number of Snapshot Data	The number of snapshot data to which the P-VOL belongs.
Number of Pairs in PSUE status	The number of pairs that are in PSUE status.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
T10 PI*	The P-VOL's T10 PI attribute information. • **Enabled:** The P-VOL's T10 PI attribute is enabled. • **Disabled:** The P-VOL's T10 PI attribute is disabled.
Virtual Storage Machine*	Information about the virtual storage machine to which the P-VOL belongs. Values: • **Model/Serial Number:** The model type and serial number of the P-VOL’s virtual storage machine. • **LDEV ID:** The identification number of the P-VOL’s virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Device Name:** The name of the P-VOL’s virtual device, in a combined format of "virtual emulation type", "number of virtual

Item	Description
	LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **SSID:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Create TI Pairs button	Click to open the Create TI Pairs window.
Operate TI Pairs button	Click to open the Operate TI Pairs window.
View Pair Synchronization Rate button	Click to open the **View Pair Synchronization Rate** window.
More Actions	Click to view a list of tasks you can perform. Options: • **View Pair Properties:** Click to open the **View Pair Properties** window. • **View LDEV Properties:** Click to open the **View LDEV Properties** window. • **Split Pairs:** Click to open the **Split Pairs** window. • **Resync Pairs:** Click to open the **Resync Pairs** window. • **Assign Secondary Volumes:** Click to open the **Assign Secondary Volumes** window. • **Remove Secondary Volumes:** Click to open the **Remove Secondary Volumes** window. • **Delete Pairs:** Click to open the **Delete Pairs** window. • **Export:** Click to open the dialog from which you can download table information to a file.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide* or the *System Administrator Guide*.	

Consistency Groups tab

The following image shows this tab of the **Local Replication** window.

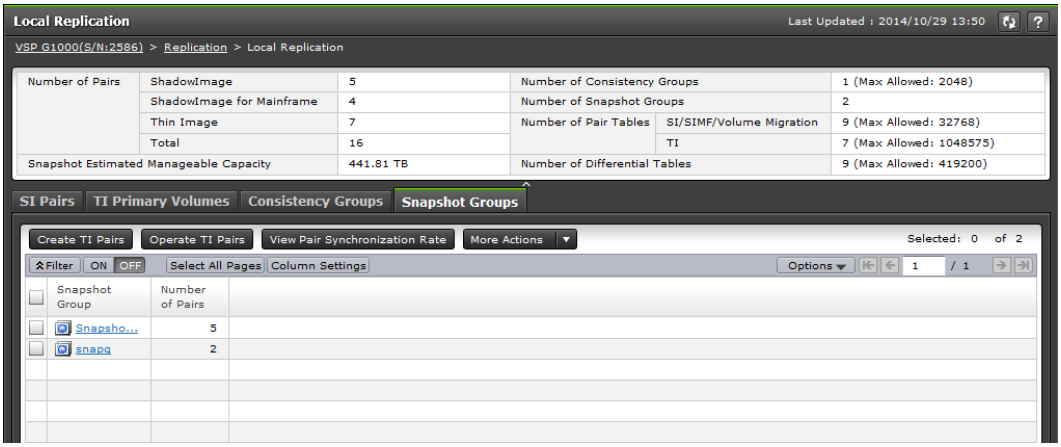


The following table lists the items on this tab.

Item	Description
CTG ID	The consistency group identification number. Click the identification number to open the **Consistency Group Properties** window.
Status	The consistency group status. Values: • **SI Used:** SI is using the consistency group. • **SIMF Used (RAID Manager):** (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group, and you are managing the group with CCI. • **SIMF Used (PPRC/BCM):** (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group, and you are managing the group with PPRC or Business Continuity Manager. • **TI Used:** HTI is using the consistency group. • **Mainframe Reserved:** (VSP G1000, G1500, and VSP F1500) The consistency group is reserved for PPRC or Business Continuity Manager. • **Free:** The consistency group is not being used and is not reserved. • **(Changing...):** The status is in the process of changing.
Number of Pairs	The number of pairs assigned to the consistency group for each local replication software application type.
Reserve Mainframe CTGs (VSP G1000, G1500, and VSP F1500)	Click to open the **Reserved Mainframe CTGs** window.
Release Reserved Mainframe CTGs (VSP G1000, G1500, and VSP F1500)	Click to open the **Release Reserved Mainframe CTGs** window.
Export button	Click to open a dialog from which you can download table information to a file.

Snapshot Groups tab

The following image shows this tab of the **Local Replication** window.



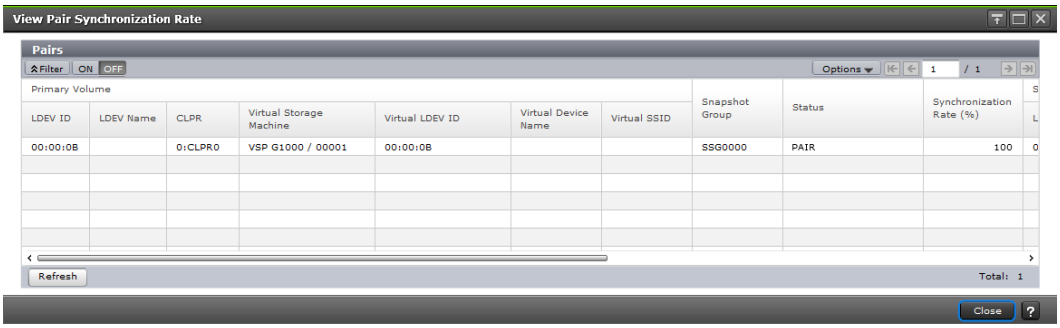
The following table lists the items on this tab.

Item	Description
Snapshot Group	The snapshot group name. Click the snapshot group name to open the TI Pairs window.
Number of Pairs	The number of pairs assigned to the snapshot group.
Create TI Pairs button	Click to open the Create TI Pairs window.
Operate TI Pairs button	Click to open the TI Pairs window.
View Pair Synchronization Rate button	Click to open the **View Pair Synchronization Rate** window.
More Actions	Click to view a list of tasks you can perform. Options: • **Split Pairs:** Click to open the **Split Pairs** window. • **Resync Pairs:** Click to open the **Resync Pairs** window. • **Assign Secondary Volumes:** Click to open the **Assign Secondary Volumes** window. • **Remove Secondary Volumes:** Click to open the **Remove Secondary Volumes** window. • **Delete Pairs:** Click to open the **Delete Pairs** window. • **Export:** Click to open the dialog from which you can download table information to a file.

View Pair Synchronization Rate window

This window includes the Pairs table.

The following image shows this window.



Pairs table

The following table lists the items in this table on the **View Pair Synchronization Rate** window.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. Click to open the **LDEV Properties** window. Use this window to search for P-VOL information. • **LDEV Name:** The P-VOL's LDEV name. • **CLPR:** The P-VOL's CLPR ID. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the P-VOL belongs. • **Virtual LDEV ID:** The identification number of the P-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name:** The name of the P-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	The SI volume's copy type. Values: • **SI-L1:** SI L1 pair • **SI-L2:** SI L2 pair • **SIMF:** SIz pair
Snapshot Group	The HTI snapshot group name. If you have not configured a snapshot group for the HTI pair, this item is blank.
Status	The pair status. For more information about HTI pair status, see Thin Image pair status definitions on page 161.
Synchronization Rate (%)	For SI • If the pair status is COPY(PD)/COPY, COPY(SP)/COPY, or PSUS (SP)/PSUS, the copy progress rate is displayed. • If the pair status is PAIR, PSUS, COPY(RS-R)/RCPY, or PSUE, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is COPY(RS)/COPY changed from PSUE, the copy progress rate is displayed. • If the pair status is COPY(RS)/COPY changed from other than PSUE, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is SMPL(PD), a hyphen is displayed. SIz: • If the pair status is PENDING, SP-Pend/TRANS, or V-Split/SUSPVS, the copy progress rate is displayed.

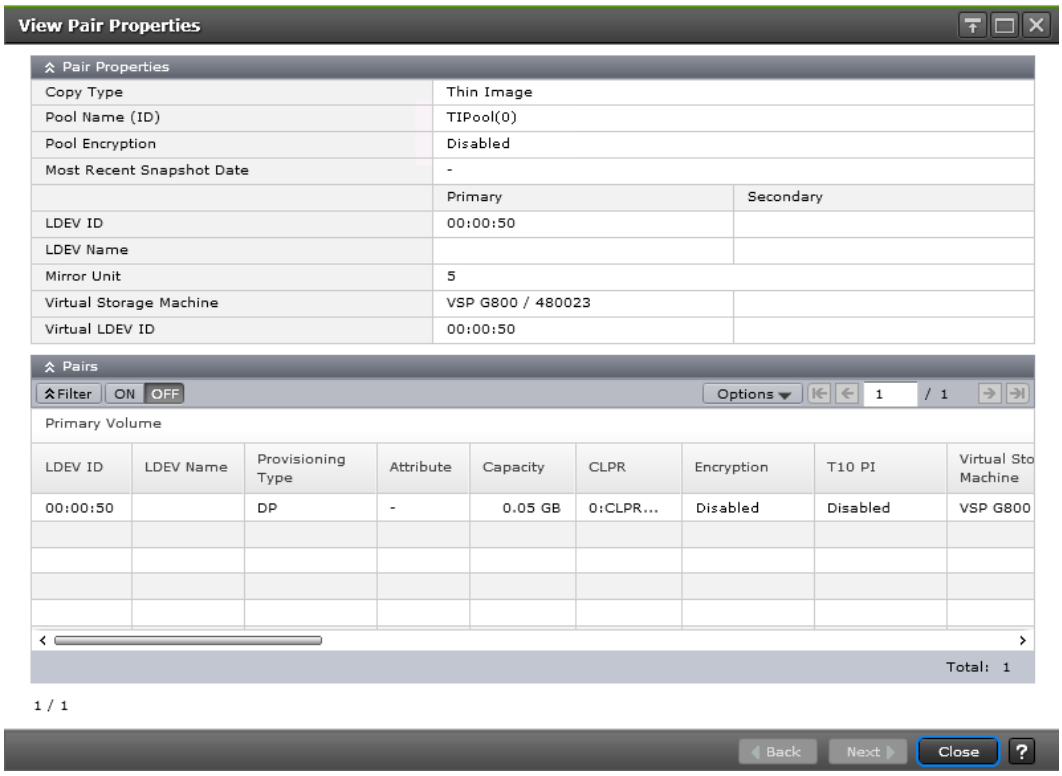
Item	Description
	• If the pair status is DUPLEX, Split/SUSPOP, Resync-R/REVRSY, or Suspend/SUSPER, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is Resync/PENDING, changed from Suspend/SUSPER, the copy progress rate is displayed. • If the pair status is Resync/PENDING, changed from other than Suspend/SUSPER, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is Deleting/TRANS, a hyphen is displayed. For Thin Image pairs where the cascade attribute is disabled, the rate at which the Thin Image S-VOL matches the next new generation of the S-VOL. If the S-VOL is the latest one, the storage system computes the synchronization rate by comparing the S-VOL with the P-VOL. For Thin Image pairs where the cascade attribute is enabled, the following information is displayed depending on the pair status: • The pair status is PAIR, PSUS, or PSUE. The pair synchronization rate shows the rate that current S-VOL data matches that of the next generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL with the P-VOL. • The pair status is COPY, PSUS(SP), RCPY, or SMPL(PD). The progress rate of each process is displayed.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. Click to open the **LDEV Properties** window. • **LDEV Name:** The S-VOL's LDEV name. • **CLPR:** The S-VOL's CLPR ID. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the S-VOL belongs. • **Virtual LDEV ID:** The identification number of the S-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name:** The name of the S-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) is displayed for non-HTI pairs.
Type	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.

Item	Description
(VSP G1000, G1500, and VSP F1500)	A hyphen (-) is displayed for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs) and the mirror unit number.
Refresh button	Click to update the information in this table.

View Pair Properties window

Use this window to monitor pair properties and to confirm the status of a volume.

The following image shows this window.



Pair Properties table

The following table lists the items in this table.

Item	Description
Copy Type	The volume's copy type.

Item	Description
	Values: • **ShadowImage:** SI pair • **Thin Image:** HTI pair • **ShadowImage for Mainframe:** SIz pair.
Pool Name (ID)	The pool name and identification number. For non-HTI pairs, a hyphen (-) is displayed.
Pool Encryption	The pool's encryption information. • **Enabled:** Encryption is enabled for a pool created by the pool volume. • **Disabled:** Encryption is disabled for a pool created by the pool volume. • **Mixed:** A pool contains both pool volumes for which encryption is enabled and ones for which encryption is disabled, or volumes for which encryption is specified and an external volume. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For pools created in external volumes, blocked pools, and non-HTI pairs, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
Most Recent Snapshot Date	The most recent date and time you created the pair to store snapshot data. For non-HTI pairs, a hyphen (-) is displayed.
LDEV ID	The identification number of the LDEV for the P-VOL and S-VOLs.
LDEV Name	The name of the LDEV for the P-VOL and S-VOLs.
Mirror Unit	The mirror unit number.
Virtual Storage Machine	The model type and serial number of the virtual storage machine to which the P-VOL and S-VOL belong.
Virtual LDEV ID	The identification number of the virtual LDEV for the P-VOL and S-VOLs. If no virtual LDEV ID is assigned, a blank is displayed.

Pairs table

This table shows a list of all pairs related to a pair shown in the Pair Properties table.

The following table lists the items in this table.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number.

Item	Description

	• **LDEV Name:** The P-VOL's LDEV name.
	• **Provisioning Type:** The P-VOL's provisioning type.
	  ○ **Basic:** Internal volume
	  ○ **DP:** DP-VOL
	  ○ **External:** External volume
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute.
	• **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type.
	• **Capacity:** The P-VOL's capacity.
	• **CLPR:** The P-VOL's CLPR ID.
	• **Encryption:** The P-VOL's encryption information.
	  ○ **Enabled:** Encryption is enabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.
	  ○ **Disabled:** Encryption is disabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.
	  ○ **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.
	
	Note: Data encryption is not ensured in an LDEV with Mixed encryption status.
	(VSP G1000, G1500, and VSP F1500) If the LDEV is an external volume or migration volume, a hyphen (-) is displayed.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	• **T10 PI:** The P-VOL's T10 PI attribute information.
	  ○ **Enabled:** The P-VOL's T10 PI attribute is enabled.
	  ○ **Disabled:** The P-VOL's T10 PI attribute is disabled.
	• **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the P-VOL belongs.
	• **Virtual LDEV ID:** The identification number of the P-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed.
	• **Virtual Device Name:** The name of the P-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed.
	• **Virtual SSID:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.

Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about HTI pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values:

Item	Description

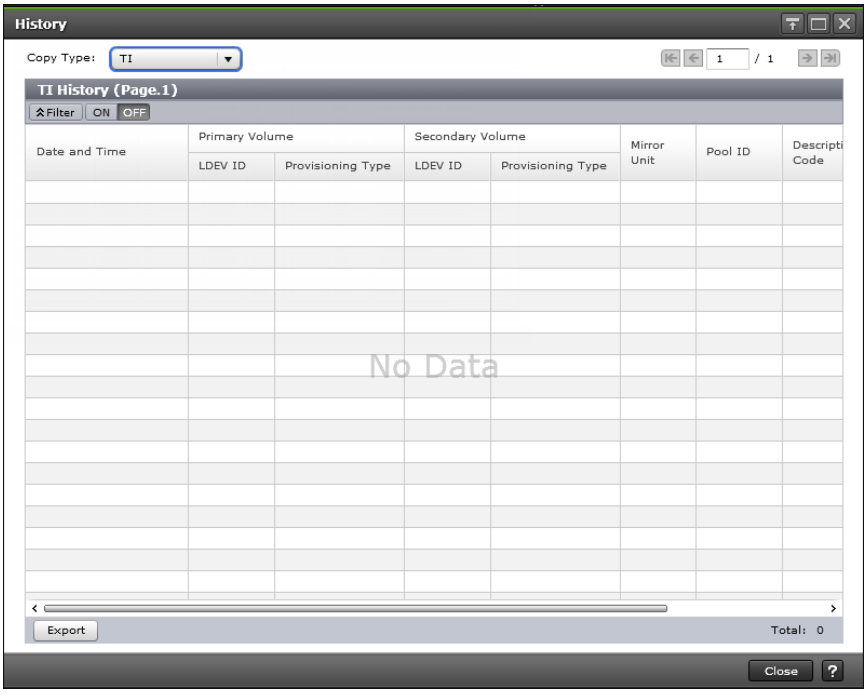
	• **LDEV ID:** The S-VOL's LDEV identification number. Click to open the **LDEV Properties** window.
	• **LDEV Name:** The S-VOL's LDEV name.
	• **Provisioning Type:** The S-VOL's provisioning type.
	  ○ **Basic:** Internal volume
	  ○ **DP:** DP-VOL
	  ○ **External:** External volume
	  ○ **Snapshot:** HTI volume
	• **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type.
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute.
	• **Capacity:** The S-VOL's capacity.
	• **CLPR:** The S-VOL's CLPR ID.
	• **Encryption:** The S-VOL's encryption information.
	  ○ **Enabled:** Encryption is enabled for the parity group to which the S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.
	  ○ **Disabled:** Encryption is disabled for the parity group to which the S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.
	  ○ **Mixed:** The pool to which the S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.
	
	Note: Data encryption is not ensured in an LDEV with Mixed encryption status.
	If the LDEV is an external volume or migration volume, a hyphen (-) is displayed.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	• **Mode:** Indicates whether the S-VOL has been written to.
	  ○ **For SI:** W is displayed if the S-VOL has been written to, but it cannot be read when its pair status is PSUS(SP)/PSUS or PSUS.
	  ○ N is displayed when the S-VOL cannot be read because "-m noread" is specified using CCI.
	  ○ A hyphen (-) is displayed if the S-VOL has not been written to, and it can be read.
	
	  ○ **For HTI:** W is displayed if the S-VOL has been written to when its pair status is PSUS.
	  ○ A hyphen (-) is displayed if the S-VOL has not been written to.
	
	  ○ **For SIz:** W is displayed if the S-VOL has been written to when its pair status is V-Split/SUSPVS or Split/SUSPOP.
	  ○ Protect is displayed if Protect is set from Business Continuity Manager when S-VOL's pair status is Split/SUSPOP, SP-Pend/TRANS, or V-Split/SUSPVS.
	  ○ A hyphen (-) is displayed when the S-VOL has not been written to, and Protect is not set.
	• **T10 PI:** The S-VOL's T10 PI attribute information.
	  ○ **Enabled:** The S-VOL's T10 PI attribute is enabled.
	  ○ **Disabled:** The S-VOL's T10 PI attribute is disabled.
	• **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the S-VOL belongs.

Item	Description
	• **Virtual LDEV ID:** The identification number of the S-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name:** The name of the S-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
CTG ID	The consistency group identification number.
Copy Pace	The speed at which the S-VOL is copied. A hyphen (-) is displayed.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) is displayed for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • Clone A pair with the clone attribute. A hyphen (-) is displayed for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs) and the mirror unit number.

History window

Use this window to view Thin Image pair task history.

The following image shows this window.



Setting fields

The following table lists the items on the **History** window.

Item	Description
Copy Type list	The volume's copy type. Values: • **SI:** SI • **TI:** HTI • **SIMF:** (VSP G1000, G1500, and VSP F1500) SIz • **FCv2/FCSE:** (VSP G1000, G1500, and VSP F1500) FCv2 and FCSE

TI History table

Only tasks that you have performed on the pairs that consist of the P-VOL and/or S-VOLs to which you are allocated are shown on this table.

The following table lists the items in this table on the **History** window.

Item	Description
Date and Time	The date and time you performed the task.
Primary Volume	The P-VOL information. Values:

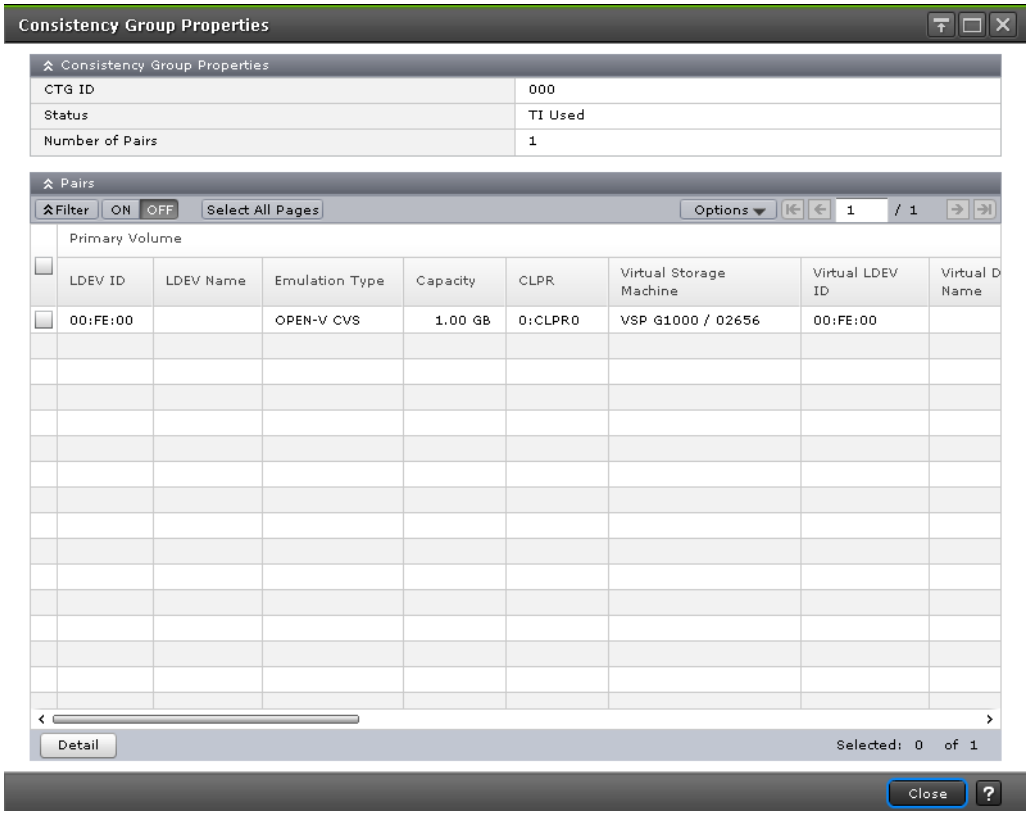
Item	Description

	• **LDEV ID:** The primary, or source, volume's LDEV identification number.
	• **Provisioning Type:** The P-VOL's provisioning type.
	  ○ **Basic:** Internal volume
	  ○ **DP:** DP-VOL
	  ○ **External:** External volume

Secondary Volume	The S-VOL information. (VSP G1000, G1500, and VSP F1500) LDEV ID: The S-VOL's LDEV identification number. (VSP G1000, G1500, and VSP F1500) Provisioning Type: The S-VOL's provisioning type. • Basic: Internal volume • DP: DP-VOL • External: External volume
Mirror Unit	The mirror unit number.
Pool ID	The pool identification number.
Description Code	The code for the type of task you performed.
Description	The description of the task you performed. For more information about HTI pair tasks, see Viewing Thin Image pair task history on page 168.
Export button	Click to open a dialog from which you can download table information to a file.

Consistency Group Properties window

The following image shows this window.



Consistency Group Properties table

The following table lists the items in this table on the **Consistency Group Properties** window.

Item	Description
CTG ID	The consistency group identification number.
Status	The consistency group status. Values: • **SI Used:** SI is using the consistency group. • **SIMF Used (RAID Manager):** (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group, and you are managing the group with CCI. • **SIMF Used (PPRC/BCM):** (VSP G1000, G1500, and VSP F1500) SIz is using the consistency group, and you are managing the group with PPRC or Business Continuity Manager. • **TI Used:** HTI is using the consistency group. • **Mainframe Reserved:** (VSP G1000, G1500, and VSP F1500) The consistency group is reserved for PPRC or Business Continuity Manager. • **Free:** The consistency group is not being used and is not reserved. • **(Changing...):** The status is in the process of changing.

Item	Description
Number of Pairs	The number of pairs that are assigned to the consistency group.

Pairs table

This table shows a list of pairs with P-VOLs and S-VOLs to which you are allocated.

The following table lists the items in this table on the **Consistency Group Properties** window.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the P-VOL belongs. • **Virtual LDEV ID:** The identification number of the P-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name:** The name of the P-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Capacity:** The S-VOL's capacity.

Item	Description
	• **CLPR:** The S-VOL's CLPR ID. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the S-VOL belongs. • **Virtual LDEV ID:** The identification number of the S-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • **Virtual Device Name:** The name of the S-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Pool Name (ID)	The pool name and identification number.
Copy Pace	The speed at which the S-VOL is copied. A hyphen (-) is displayed.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute. A hyphen (-) displays for non-HTI pairs. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for HTI pairs), which is the base of the target pair, and the mirror unit number.
Detail button	Click to open the **View Pair Properties** window.

Create TI Pairs wizard

Use this wizard to create Thin Image pairs.

Related tasks

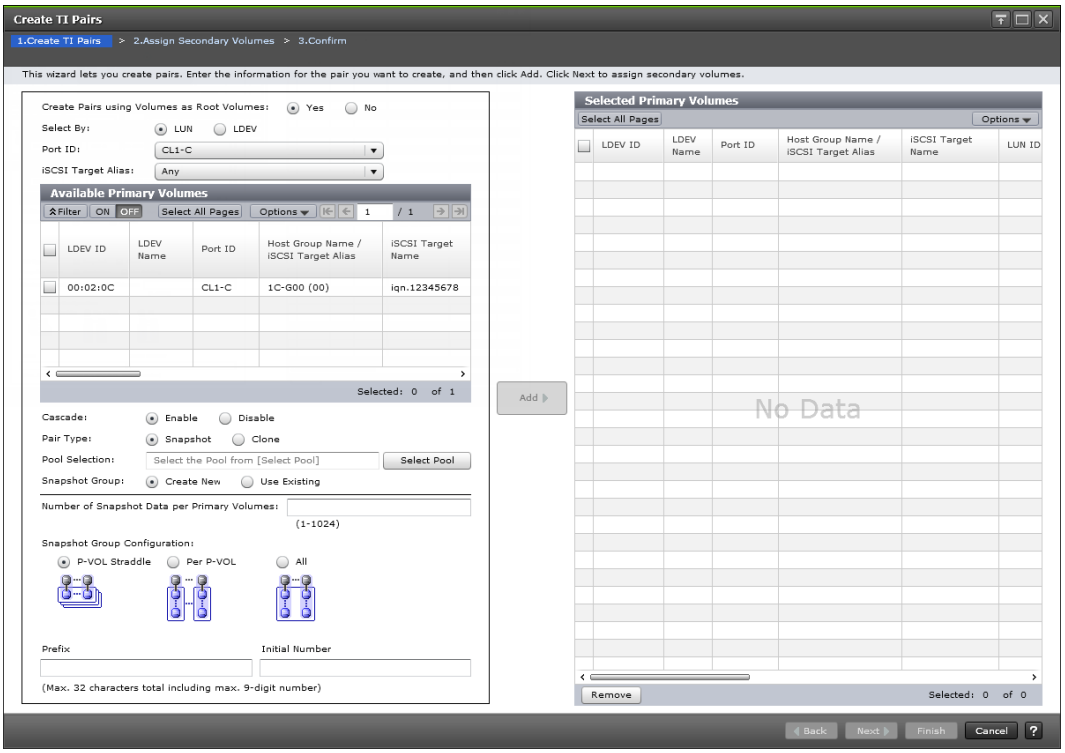
- Creating Thin Image pairs using Device Manager - Storage Navigator on page 128
- Assigning secondary volumes to snapshot data after creating new Thin Image pairs on page 148
- Changing assignment of secondary volumes to Thin Image pair snapshot data on page 153

Create TI Pairs window

Use this window of the Create TI Pairs wizard to select LDEVs that are P-VOLs.

This window is the first window of the Create TI Pairs wizard.

The following image shows this window.



Setting fields

The following table lists the items on this window of the Create TI Pairs wizard.

Item	Description
Use Primary Volumes of Thin Image Pairs (VSP Gx00 models and VSP Fx00 models)	Specifies whether you want to use the Thin Image pair's P-VOL. Values: • **Yes:** The storage system shows only P-VOLs of the pair that is already created in the Available Primary Volumes table. • **No:** The storage system shows only LDEV of the pair that is not created yet in the Available Primary Volumes table.

Item	Description
Create Pairs using Volumes as Root Volumes (VSP G1000, G1500, and VSP F1500)	Specify whether to create a new pair using the specified volume as the root volume. • **Yes**: Create a pair using the specified volume as the root volume. The **Available Primary Volumes** table lists LDEVs which are not paired, and S-VOLs of the cascade pairs with the clone attribute. • **No**: Create a pair using the P-VOL of a created pair. The **Available Primary Volumes** table lists P-VOLs of created pairs, and S-VOLs of created cascade pairs.
Selection Object (VSP Gx00 models and VSP Fx00 models)	Filters LDEVs in the Available LDEVs table according to port type. **NAS Platform (User LU)** is displayed for VSP Gx00 models, and VSP Fx00 models.
Select By (VSP G1000, G1500, and VSP F1500)	Specify whether to specify LUN to create a pair. • LUN: Specify LUN, and then select an LDEV to create a pair. • LDEV: Select an LDEV to create a pair without specifying LUN.
Port ID	The LDEV's LUN path port identification number for which you want to filter the Available LDEVs table. This item dispays if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Host Group Name	Used to filter LDEVs to display in the Available Primary Volumes table. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By, and a Fibre Channel port for Port ID. (VSP Gx00 models and VSP Fx00 models) This item is displayed if you select a Fibre Channel port or a NAS user data port for Port ID. Default: Any
iSCSI Target Alias	Used to filter LDEVs to display in the Available Primary Volumes table. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By, and an iSCSI port for Port ID. (VSP Gx00 models and VSP Fx00 models)This item is displayed if you select an iSCSI port for Port ID. Default: Any
Cascade (VSP G1000, G1500, and VSP F1500)	Select to enable or disable creation of cascaded pairs. • **Enable:** Cascaded pairs can be created. • **Disable:** Cascaded pairs cannot be created.
Pair Type	Select the pair type.

Item	Description
(VSP G1000, G1500, and VSP F1500)	• **Snapshot:** Creates a pair with the snapshot attribute. • **Clone:** Creates a pair with the clone attribute. This item is available when you select: • No for Create Pairs using Volumes as Root Volumes. • Yes for Create Pairs using Volumes as Root Volumes and Enable for Cascade.
Select Pool button	Click to open the **Select Pool** window. (VSP G1000, G1500, and VSP F1500) You cannot select this button if you select No for Create Pairs using Volumes as Root Volumes. (VSP Gx00 models and VSP Fx00 models) You cannot select this button if you select Yes for Use Existing Volumes of Thin Image Pairs.
Snapshot Group	Specifies whether to create a new snapshot group or to use an existing one. Values: • **Create New:** Enter the values of the snapshot group you want to create in Number of Snapshot Data per Primary Volume, Prefix, and Initial Number, and then select Snapshot Group Configuration. • **Use Existing:** Select Snapshot Group Configuration, and then select the snapshot group you want to use from the Available Snapshot Groups table. If you select All in Snapshot Group Configuration, enter a value for Number of Snapshot Data per Primary Volume.
Number of Snapshot Data per Primary Volume	The number of snapshot data per primary volume.
Snapshot Group Configuration	The configuration of the snapshot data. Values: • **P-VOL Straddle:** When you select Create New in Snapshot Group, creates a snapshot group that straddles multiple primary volumes. When you select Use Existing in Snapshot Group, adds snapshot data to an existing snapshot group that you select in the Available Snapshot Groups table as straddling multiple primary volumes. • **Per P-VOL:** Creates a snapshot group for each primary volume. You can select this option if you select Create New in Snapshot Group. • **All:** When you select Create New in Snapshot Group, creates a new snapshot group and adds all snapshot data to it. When you select

Item	Description
	Use Existing in Snapshot Group, adds all snapshot data to an existing snapshot group.
Prefix	The fixed character prefix of the snapshot group.
Initial number	The initial number of the snapshot group.
Add button	Click to move the selected volumes from the Available Primary Volumes table to the Selected Primary Volumes table.

Available Snapshot Groups table

The following table lists the items in the Available Snapshot Groups table on the Create TI Pairs window.

This table is displayed if you select Use Existing in Snapshot Group.

Item	Description
Snapshot Group	The snapshot group name.
Number of Pairs	The number of snapshot group pairs.
New Snapshot Group	Indicates whether the snapshot group is new or existing. Values: • **Yes:** Newly created snapshot group. • **No:** Already defined snapshot group.

Available Primary Volumes table

The following table lists the items in the Available Primary Volumes table on the Create TI Pairs window.

Item	Description
LDEV ID	The LDEV's identification number which can be specified as the P-VOL.
LDEV Name	The LDEV's name.
Port ID	The port name of the LDEV's LUN path. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Host Group Name / iSCSI Target Alias	The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
iSCSI Target Name	The iSCSI target name. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
LUN ID	The LUN identification number of the LDEV's LUN path.

Item	Description
	This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Provisioning Type	The LDEV's provisioning type. Values: • **Basic:** Internal volume. • **DP:** DP-VOL. • **External:** External volume. • **ALU:** ALU attribute volume.
Attribute	The LDEV's attribute. Values: • **ALU:** ALU attribute volume. • **SLU:** SLU attribute volume. • **Data Direct Mapping:** Data Direct Mapping attribute volume. • (VSP Gx00 models, VSP Fx00 models) **NAS Platform (User LU):** User LU of NAS. If the volume does not have any attribute specified, a hyphen (-) is displayed.
Capacity	The capacity of the LDEV.
CLPR	The LDEV's CLPR ID.
Encryption	The LDEV's encryption information. • **Enabled:** Encryption is enabled for the parity group to which the LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. • **Disabled:** Encryption is disabled for the parity group to which the LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. • **Mixed:** The pool to which the LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. (VSP G1000, G1500, and VSP F1500) For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
T10 PI	The LDEV's T10 PI attribute information. • **Enabled:** The LDEV's T10 PI attribute is enabled. • **Disabled:** The LDEV's T10 PI attribute is disabled.
Number of Snapshot Data	The number of snapshot data to which the LDEV belongs.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascade pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
TI Pair Position (VSP G1000, G1500, and VSP F1500)	Indicates that the volume is the P-VOL or S-VOL of the pair.

Item	Description
TI Pair Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.
Primary Volumes	If you use the LDEV as an S-VOL for an existing pair, information about the P-VOL is displayed. Values: • **LDEV ID:** The LDEV's identification number. • **LDEV Name:** The LDEV's name. • **Port ID:** The port name of the LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path. • **iSCSI Target Name:** The P-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the LDEV's LUN path. • **Capacity:** The LDEV's capacity. • **CLPR:** The LDEV's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.

Selected Primary Volumes table

The following table lists the items in the Selected LDEVs table on the **Select Primary Volumes** window.

Item	Description
LDEV ID	The selected P-VOL's LDEV identification number.
LDEV Name	The selected P-VOL's LDEV name.
Port ID	The port name of the LDEV's LUN path.
Host Group Name / iSCSI Target Alias	The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path.
iSCSI Target Name	The iSCSI target name.
LUN ID	The LUN identification number of the LDEV's LUN path.
Attribute	The LDEV's attribute. Values: • **ALU:** ALU attribute volume. • **SLU:** SLU attribute volume. • **Data Direct Mapping:** Data Direct Mapping attribute volume. • (VSP Gx00 models, VSP Fx00 models only) **NAS Platform (User LU)**: User LU of NAS. If the volume does not have any attribute specified, a hyphen (-) is displayed.
Capacity	The capacity of the LDEV.

Item	Description
Encryption	The LDEV's encryption information. • **Enabled:** Encryption is enabled for the parity group to which the LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. • **Disabled:** Encryption is disabled for the parity group to which the LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. • **Mixed:** The pool to which the LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. (VSP G1000, G1500, and VSP F1500) For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
T10 PI	The LDEV's T10 PI attribute information. • **Enabled:** The LDEV's T10 PI attribute is enabled. • **Disabled:** The LDEV's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name.
New Snapshot Group	Indicates whether the snapshot group is new or existing. Values: • **Yes:** Newly created snapshot group. • **No:** Already defined snapshot group.
Number of Snapshot Data	The number of snapshot data.
Pool Name (ID)	The pool name and identification number.
Pool Encryption	The pool's encryption information. • **Enabled:** Encryption is enabled for a pool created by the pool volume. • **Disabled:** Encryption is disabled for a pool created by the pool volume. • **Mixed:** A pool contains both pool volumes for which encryption is enabled and ones for which encryption is disabled, or volumes for which encryption is specified and an external volume. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For pools created in external volumes, or blocked pools, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascade pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Pair Type (VSP G1000, G1500, and VSP F1500)	Select the pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.

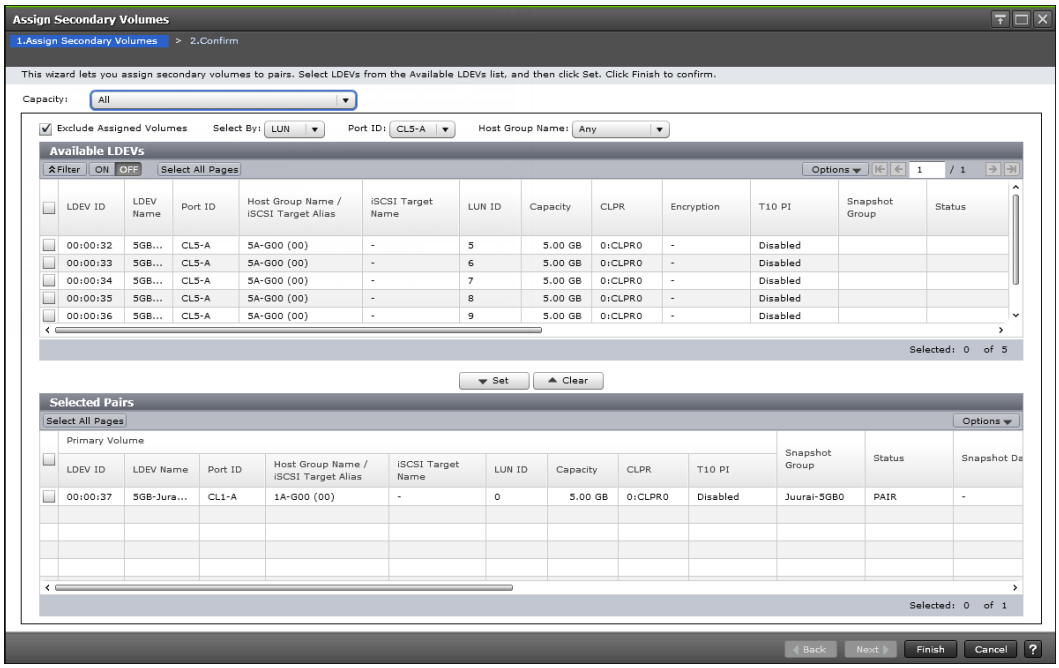
Item	Description
Remove button	Click to remove the selected row from the Selected Primary Volumes table.

Assign Secondary Volumes window

Use this window to select the LDEVs that are the S-VOL.

This window is the second window of the Create TI Pairs wizard.

The following image shows this window.



The following table shows the items in this window.

Item	Description
Capacity	Click to select the capacity for which to filter the available LDEVs.
Exclude Assigned Volumes	Hide volumes that are already paired from the Selected Pairs table.
Selection Object (VSP Gx00 models and VSP Fx00 models)	Filters LDEVs in the Available LDEVs table according to port type.
Select By (VSP G1000, G1500, and VSP F1500)	Filters LDEVs in the Available LDEVs table by the specified object.
Port ID	Filters LDEVs in the Available LDEVs table by the Port ID.

Item	Description
	(VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By.
Host Group Name	Used to filter LDEVs to display in the Available Primary Volumes table. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By, and a Fibre Channel port for Port ID. (VSP Gx00 models and VSP Fx00 models) This item is displayed if you select a Fibre Channel port or a NAS user data port for Port ID. Default: Any
iSCSI Target Alias	Used to filter LDEVs to display in the Available Primary Volumes table. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By, and an iSCSI port for Port ID. (VSP Gx00 models and VSP Fx00 models) This item is displayed if you select an iSCSI port for Port ID. Default: Any
Set button	Click to move an LDEV that you have selected in the Available LDEVs table to the Selected Pairs table. You can also click to configure a pair you have selected in the Available LDEVs table and a pair you have selected in the Selected Pairs table.
Clear button	Click to move the selected S-VOL from the Selected Pairs table back to the Available LDEVs table.

Available LDEVs table

The following table lists the items in the Available LDEVs table on the **Assign Secondary Volumes** window.

Item	Description
LDEV ID	The LDEV identification number, which you can specify as the S-VOL.
LDEV Name	The LDEV's name.
Port ID	The port name of the LDEV's LUN path. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By.
Host Group Name / iSCSI Target Alias	The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path.

Item	Description
	(VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By.
iSCSI Target Name	The iSCSI target name. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By.
LUN ID	The LUN identification number of the LDEV's LUN path. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select LUN for Select By.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Encryption (VSP G1000, G1500, and VSP F1500)	Encryption information. • **Enabled:** Encryption is enabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. • **Disabled:** Encryption is disabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. • **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. • If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
T10 PI	The LDEV's T10 PI attribute information. • **Enabled:** The LDEV's T10 PI attribute is enabled. • **Disabled:** The LDEV's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.

Item	Description
	• **Port ID:** The port name of the P-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. • **iSCSI Target Name:** The P-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.

Selected Pairs table

The following table lists the items in this table on the **Assign Secondary Volumes** window.

Item	Description

Primary Volume	The P-VOL information.
	
	Values:
	• **LDEV ID:** The P-VOL's LDEV identification number.
	• **LDEV Name:** The P-VOL's LDEV name.
	• **Port ID:** The port name of the P-VOL LDEV's LUN path.
	• **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path.
	• **iSCSI Target Name:** The P-VOL's iSCSI target name.
	• **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path.
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute.
	• **Capacity:** The P-VOL's capacity.
	• **CLPR:** The P-VOL's CLPR ID.
	• (VSP G1000, G1500, and VSP F1500) **Encryption** P-VOL's encryption information.
	  ○ **Enabled:** Encryption is enabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.
	  ○ **Disabled:** Encryption is disabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.
	  ○ **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.
	  Note: Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status.
	  ○ If the LDEV is an external volume or migration volume, a hyphen (-) is displayed.

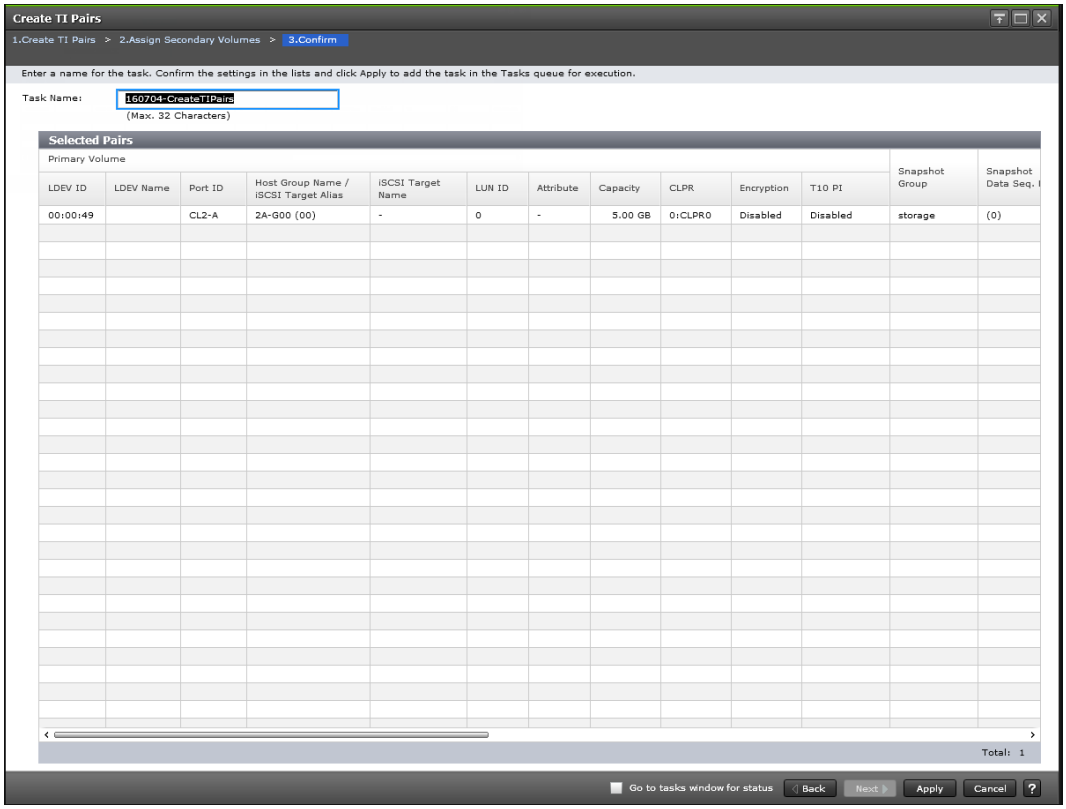
Item	Description
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The P-VOL's T10 PI attribute information. ○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name.
Snapshot Data Seq. No.	The sequence number of snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. If you have not allocated an LDEV to the S-VOL, this item is blank. • **LDEV Name:** The S-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Port ID:** The port name of the S-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. • **iSCSI Target Name:** The S-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID. • (VSP G1000, G1500, and VSP F1500)Encryption: S-VOL's encryption information. ○ **Enabled:** Encryption is enabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ **Disabled:** Encryption is disabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. ○ If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The S-VOL's T10 PI attribute information. ○ **Enabled:** The S-VOL's T10 PI attribute is enabled. ○ **Disabled:** The S-VOL's T10 PI attribute is disabled.
Pool Name (ID)	The pool name and identification number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • Enabled: Cascaded pairs can be created. • Disabled: Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • Snapshot: A pair with the snapshot attribute. • Clone: A pair with the clone attribute.

Item	Description
Pair Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The pair topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Create TI Pairs confirmation window

This window is the third and last window of the Create TI Pairs wizard.

The following image shows this window.



Selected Pairs table

The following table lists the items in this table on the **Confirm** window.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Port ID:** The port name of the P-VOL LDEV's LUN path.

Item	Description
	• **Host Group Name/iSCSI Target Alias:** The host group name of the P-VOL LDEV's LUN path. • **iSCSI Target Name:** The P-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID. • (VSP G1000, G1500, and VSP F1500) **Encryption** P-VOL's encryption information. ○ **Enabled:** Encryption is enabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ **Disabled:** Encryption is disabled for the parity group to which P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. ○ If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The P-VOL's T10 PI attribute information. ○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name.
Snapshot Data Seq. No.	The sequence number of snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. If you have not allocated an LDEV to the S-VOL, this item is blank. • **LDEV Name:** The S-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Port ID:** Port name of the S-VOL LDEV's LUN path. • **Host Group Name/iSCSI Target Alias:** The host group name of the S-VOL LDEV's LUN path. • **iSCSI Target Name:** The S-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID. • (VSP G1000, G1500, and VSP F1500) **Encryption** S-VOL's encryption information. ○ **Enabled:** Encryption is enabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.

Item	Description
	○ **Disabled:** Encryption is disabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. ○ If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The S-VOL's T10 PI attribute information. ○ **Enabled:** The S-VOL's T10 PI attribute is enabled. ○ **Disabled:** The S-VOL's T10 PI attribute is disabled.
Pool Name (ID)	The pool name and identification number.
Pool Encryption	The pool's encryption information. • **Enabled:** Encryption is enabled for a pool created by the pool volume. • **Disabled:** Encryption is disabled for a pool created by the pool volume. • **Mixed:** A pool contains both pool volumes for which encryption is enabled and ones for which encryption is disabled, or volumes for which encryption is specified and an external volume. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For pools created in external volumes, blocked pools, and non-HTI pairs, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Remove Secondary Volumes table

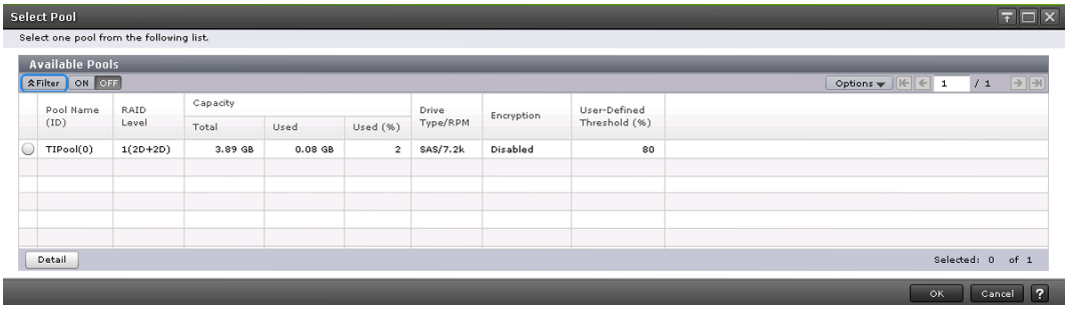
This table is displayed if a volume is selected that was already assigned to other snapshot data (by leaving the Exclude Assigned Volumes check box unselected in the **Assign Secondary Volumes** window).

The following table lists the items in this table on the **Confirm** window.

Item	Description
LDEV ID	The LDEV identification number, which you can specify as the S-VOL.
LDEV Name	The LDEV's name.
Attribute VSP Gx00 models and VSP Fx00 models only.	The LDEV's attribute.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Remount Device	Indicates whether remounting the device is required.
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Pair Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The pair topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Select Pool window

The following image shows the **Select Pool** window, which includes the Available Pools table.



Available Pools table

The following table lists the items in this table on the **Select Pool** window.

Item	Description
Pool Name (ID)	The pool name and identification number.
RAID Level	The RAID level of the pool.
Capacity	The pool capacity. If the pool-VOL belong to the parity group in which accelerated compression is enabled, is included in the pool, sometimes the capacity is displayed less than the possible capacity which can be written. Values: • **Total:** The total pool capacity. If the pool-VOL belonging to the parity group for which accelerated compression, is included in the pool, the capacity available for writing data might be less than the displayed capacity. • **Used:** The amount of pool capacity that is used. • **Used (%):** The percentage of pool capacity that is use. **Note:** This number is truncated to an integer.
Drive Type/RPM	The data drive type and RPM. For more information about data drive type, see Pool creation and data drive type priority on page 104.
Encryption	The pool's encryption information. • **Enabled:** Encryption is enabled for a pool created by the pool volume. • **Disabled:** Encryption is disabled for a pool created by the pool volume. • **Mixed:** A pool contains both pool volumes for which encryption is enabled and ones for which encryption is disabled, or volumes for which encryption is specified and an external volume. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For pools created in external volumes, or blocked pools, a hyphen (-) is displayed.
User-Defined Threshold (%)	The threshold you configure.
Detail button	Click to open the **Pool Property** window.

Item	Description
	For more information about this window, see the *Provisioning Guide* of your storage system.

Split Pairs wizard

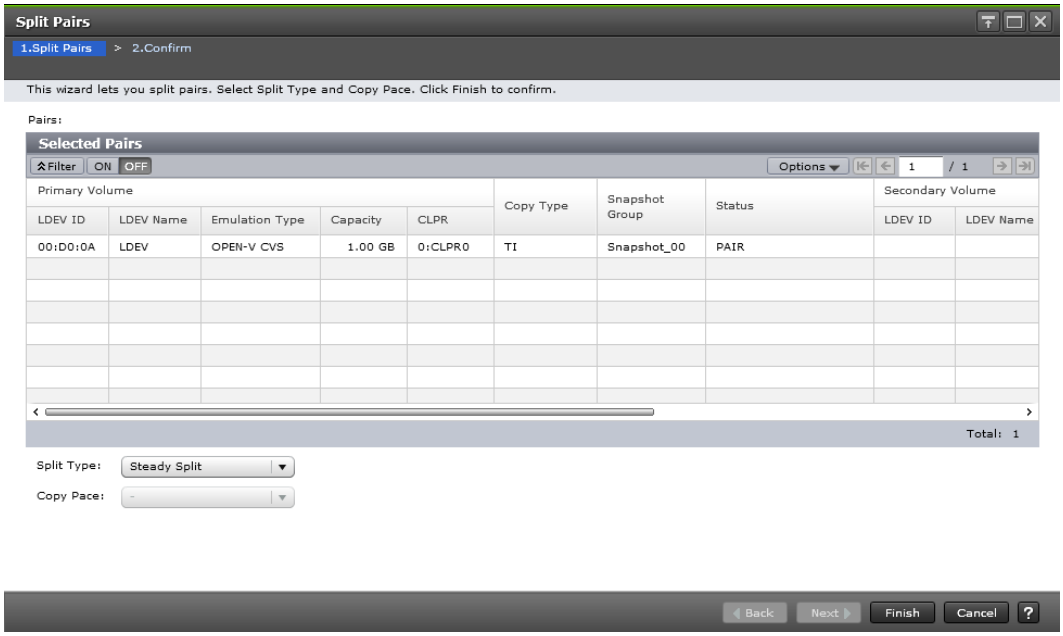
Use this wizard to split pairs.

Related tasks

- Splitting Thin Image pairs to store snapshot data on page 135

Split Pairs window

The following image shows this window, which is the first window of the **Split Pairs** wizard.



Selected Pairs table

The following table lists the items in this table on the **Split Pairs** window.

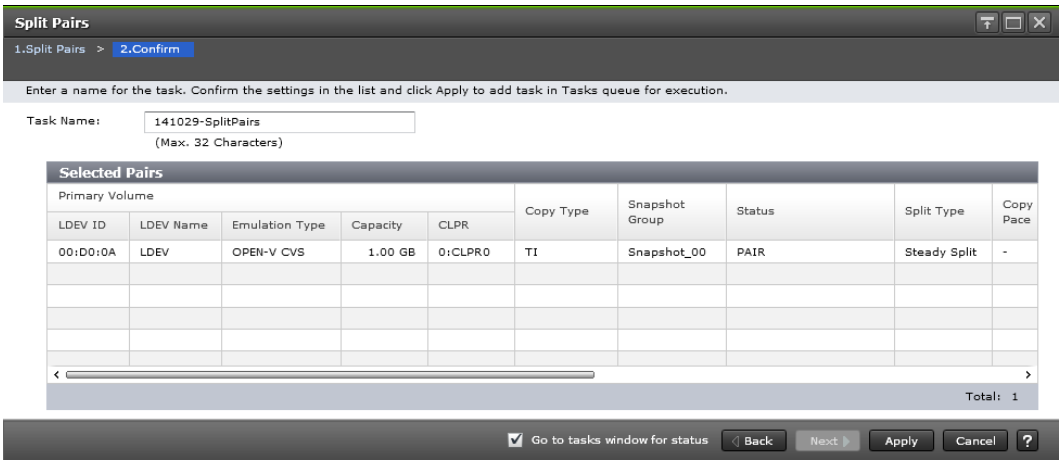
Item	Description
Primary Volume	P-VOL information for the pairs you have selected to split. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name.

Item	Description
	• **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information, see Thin Image pair status definitions on page 161.
Secondary Volume	The S-VOL information for the pairs you have selected to split. Values: • **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.
Split Type	The mode in which you want to split the selected pairs. Values: • **Quick Split:** The pair is split and then remaining differential data is copied to the S-VOL in the background. Specify this value when you want to write to or read from the S-VOL immediately after splitting a pair. • **Steady Split:** The differential data is copied to the S-VOL and then the pair is split.

Item	Description
	Note: This value is only available if you specify the copy type as TI. Default: Steady Split
Copy Pace	The speed at which the S-VOL is copied. For Thin Image pairs with the snapshot attribute, this item cannot be selected. A hyphen (-) is displayed.

Split Pairs confirmation window

The following image shows the **Confirm** window, which is the second and last window of the **Split Pairs** wizard.



Selected Pairs table

The following table lists the items in this table on the **Confirm** window.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The volume's copy type. Values:

Item	Description
	• **TI:** HTI pair
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information, see Thin Image pair status definitions on page 161.
Split Type	The split type. Values: • **Quick Split:** The pair is split and then remaining differential data is copied to the S-VOL in the background. Specify this value when you want to write to or read from the S-VOL immediately after splitting a pair. • **Steady Split:** The differential data is copied to the S-VOL and then the pair is split.
Copy Pace	The speed at which the S-VOL is copied. A hyphen (-) is displayed.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A snapshot pair. • **Clone:** A cloned pair. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Resync Pairs wizard

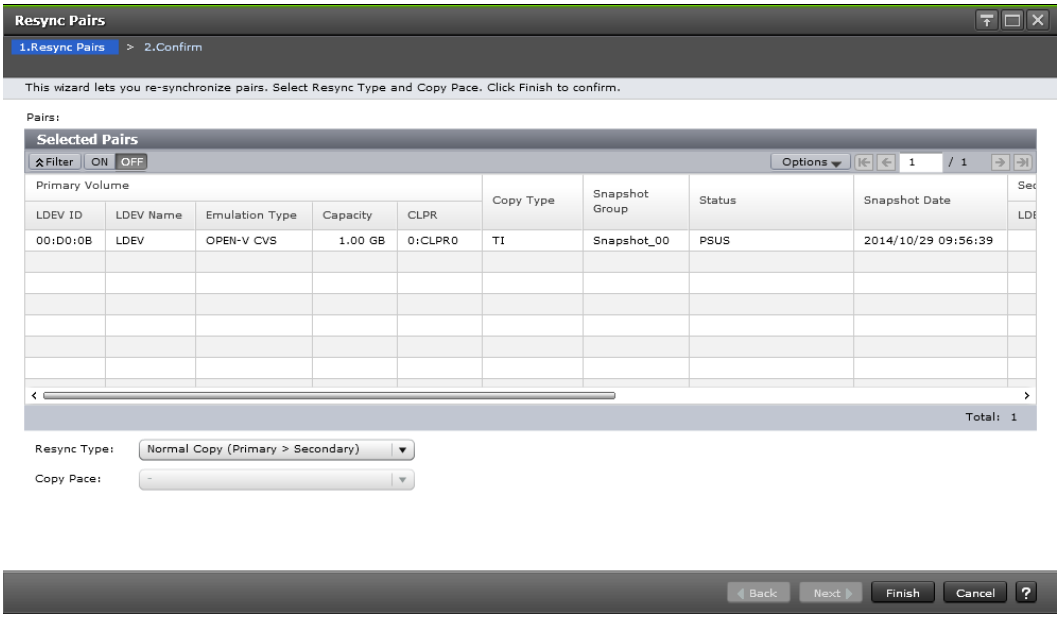
Use this wizard to resynchronize pairs.

Related concepts

- Thin Image pair resynchronization on page 142

Resync Pairs window

The following image shows this window, which is the first window of the **Resync Pairs** wizard.



Selected Pairs table

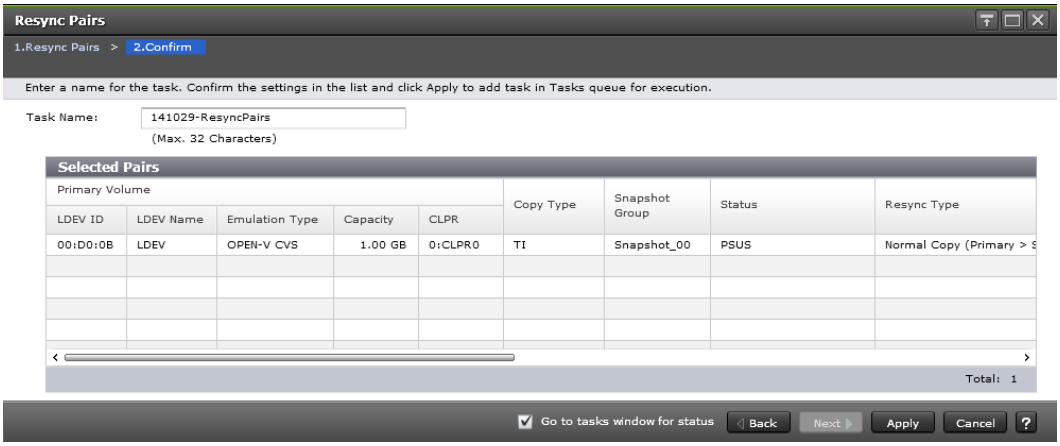
The following table lists the items in this table on the **Resync Pairs** window.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair
Snapshot Group	The snapshot group name.

Item	Description
	Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.
Resync Type	The type of resynchronization. Values: • **Normal Copy (Primary > Secondary):** A full forward resynchronization of data from the P-VOL to the S-VOL. • **Reverse Copy (Secondary > Primary):** A full restoration of P-VOL data from the S-VOL. The differential data is updated on the P-VOL. For more information about the types of pair resynchronization, see the *Hitachi ShadowImage® User Guide*.
Copy Pace	The speed at which the S-VOL is copied. A hyphen (-) is displayed.

Resync Pairs confirmation window

The following image shows the **Confirm** window, which is the second and last window of the **Resync Pairs** wizard.



Selected Pairs table

The following table lists the items in this table in the **Confirm** window of the **Resync Pairs** wizard.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information, see Thin Image pair status definitions on page 161.
Resync Type	The type of resynchronization. Values: • **Normal Copy (Primary > Secondary):** A full forward resynchronization of data from the P-VOL to the S-VOL. • **Reverse Copy (Secondary > Primary):** A full restoration of P-VOL data from the S-VOL. The differential data is updated on the P-VOL.

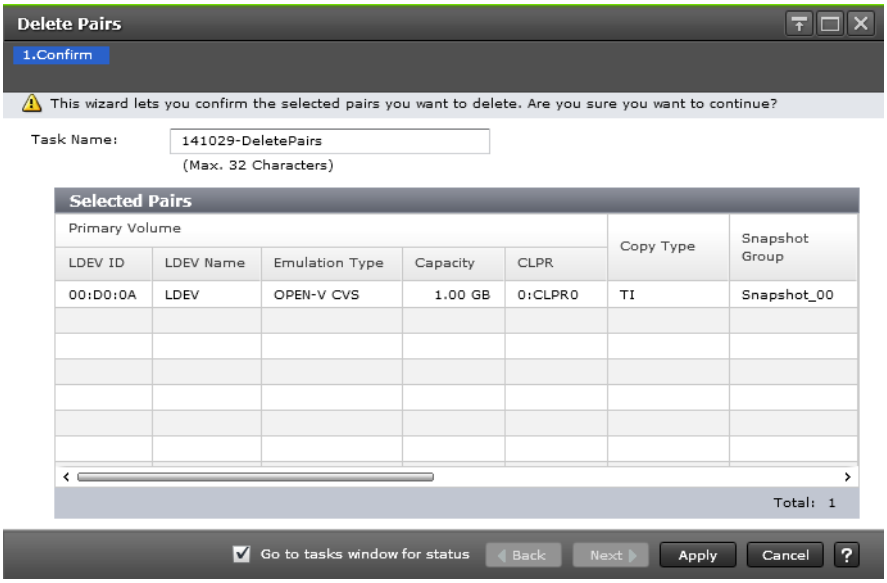
Item	Description
	For more information about the types of pair resynchronization, see the *Hitachi ShadowImage® User Guide*.
Copy Pace	The speed at which the S-VOL is copied. A hyphen (-) is displayed.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The S-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Delete Pairs window

Use this window to delete pairs and to restore pairs.

For more information about deleting pairs, see Deleting Thin Image pairs on page 145.

The following image shows this window.



Selected Pairs table

The following table lists the items in this table in the **Delete Pairs** wizard.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500) The P-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The volume's copy type. Values: • **TI:** HTI pair
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values:

Item	Description
	• **LDEV ID:** The S-VOL's LDEV identification number. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** (VSP G1000, G1500, and VSP F1500)The S-VOL's emulation type. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created. A hyphen (-) displays for non-HTI pairs.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute. A hyphen (-) displays for non-HTI pairs.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Related concepts

- Deleting Thin Image pairs on page 145

Edit Local Replica Options wizard

Use this wizard to set the system options that affect performance in HTI.

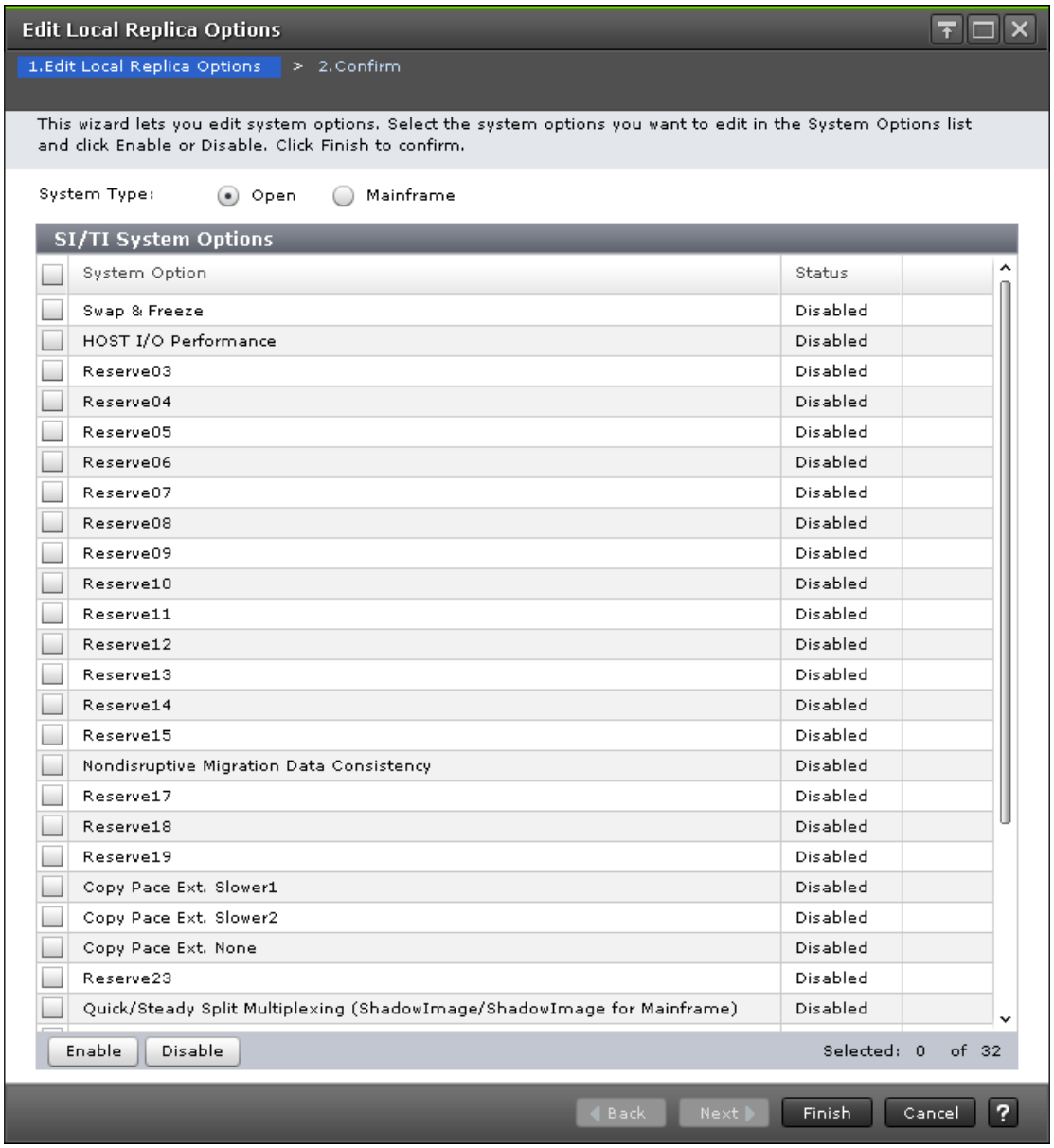
Related concepts

- Changing system options that affect Thin Image performance on page 119

Edit Local Replica Options window

This window is the first window of the **Edit Local Replica Options** wizard.

The following image shows this window.



Setting fields (VSP G1000, G1500, and VSP F1500)

The following table lists the items in the **Edit Local Replica Options** window of the **Edit Local Replica Options** wizard.

Item	Description
System Type	The storage system type. Values: • **Open:** Select when you want to change system options that affect SI and HTI performance.

Item	Description
	• **Mainframe:** Select when you want to change system options that affect SIz, FCv2, and FCSE performance. Default: Open

SI/TI System Options table

The following table lists the items in this table on the **Edit Local Replica Options** window.

Item	Description
System Option	Displays the system options. The number next to each item is the system option number. Values: • **Swap & Freeze (1):** Quick Restores and then saves the current data. Used with the Quick Restore, inhibits the Update Copy operation after performing Quick Restore, and the paired S-VOL in "PAIR" status is not updated. • **Host I/O Performance (2):** Use this option to give weight to I/O response rather than the copy time. This option controls copy operations and improves the host I/O response. • **Nondisruptive Migration Data Consistency (16):** Use this option to keep the latest data in the migration source storage system instead of distributing data in both the destination and source storage systems during data migration. • **Copy Pace Ext. Slower1 (20), Copy Pace Ext. Slower2 (21), Copy Pace Ext. None (22):** Reducing the copy volume in "PAIR" status curbs the influence to the I/O performance of the host server. This item is available to all pairs in "PAIR" status. The order of Copy Pace Ext. Slower1, Copy Pace Ext. Slower2, and Copy Pace Ext. None determines the host server's I/O performance. • **Quick/Steady Split Multiplexing (ShadowImage/ ShadowImage for Mainframe) (24):** Accelerates ShadowImage pair split. The multiplicity (the number of jobs for which copy processing can be executed concurrently) of copy processing for each pair is changed from 1 to 24. • **Reverse Copy Multiplexing (ShadowImage/ ShadowImage for Mainframe) (25):** Accelerates resynchronization of ShadowImage pairs. The multiplicity (the number of jobs for which copy processing can be executed concurrently) of copy processing for each pair is changed from 1 to 24.
Status	Shows whether the system option is currently enabled or disabled.
Enable button	Click to enable the selected option.
Disable button	Click to disable the selected option.

SIMF/FCv2/FCSE System Options table (VSP G1000, G1500, and VSP F1500)

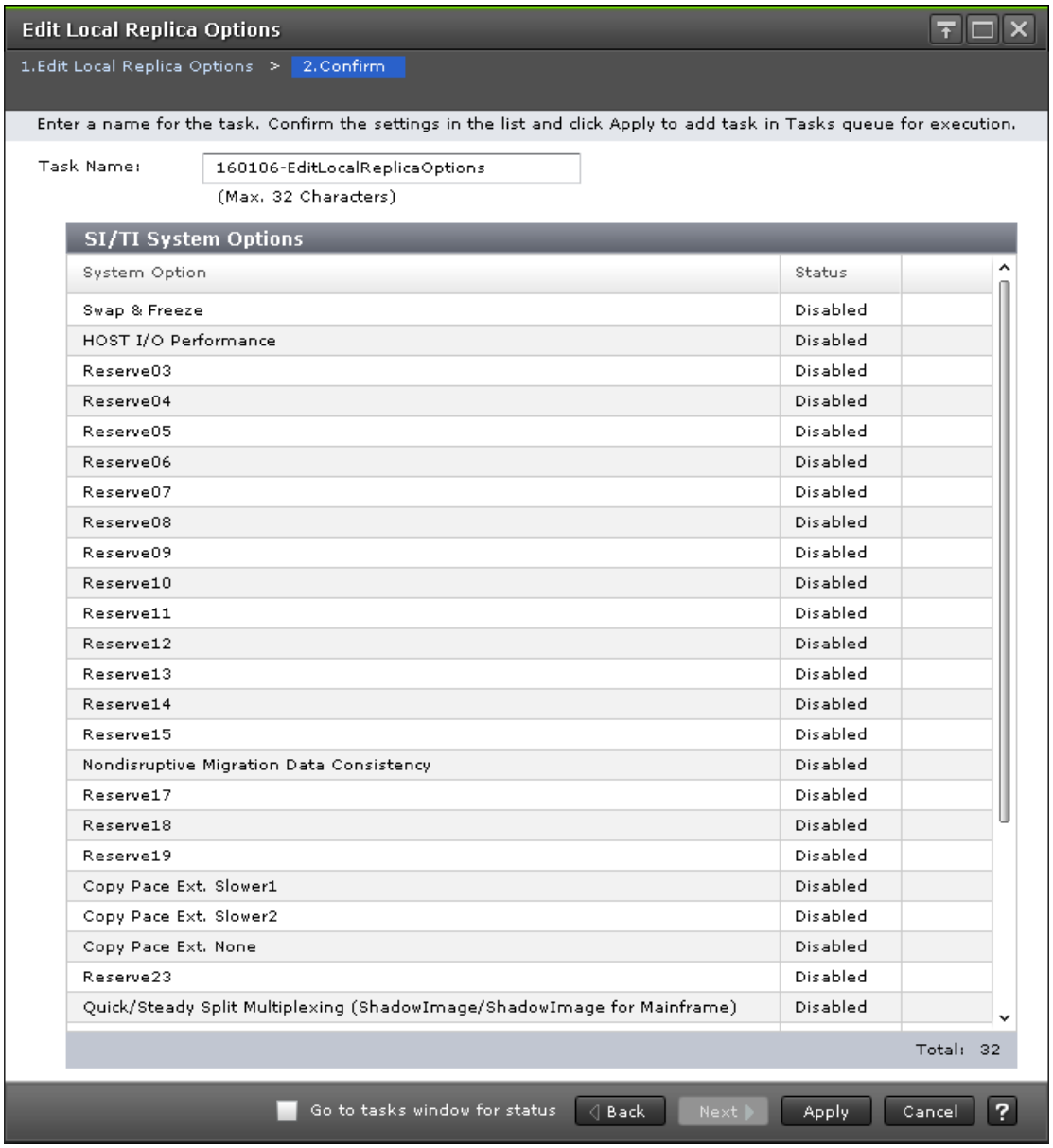
The following table lists the items in this table on the **Edit Local Replica Options** window.

Item	Description
System Option	Displays the system options. The number next to each item is the system option number. Values: • **Swap & Freeze (1):** Quick Restores and then saves the current data. Used with the Quick Restore, inhibits the Update Copy operation after performing Quick Restore, and the paired S-VOL (T-VOL for FCv2 or FCSE) is not updated. • **Host I/O Performance (2):** Use this option to give weight to I/O response rather than the copy time. This option controls copy operations and improves the host I/O response. • **FC Slower Copy1 (FCv2 or FCSE only) (3):** Reduces the multiplicity of background copy into half. • **FC Slower Copy 2 (FCv2 or FCSE only) (4):** Reduces the multiplicity of background copy into quarter. • **Nondisruptive Migration Data Consistency (16):** Use this option to keep the latest data in the migration source storage system instead of distributing data in both the destination and source storage systems during data migration. • **FC Ext. Slower Copy1 (17):** Inhibits background copy and improves host I/O response when the operating ratio of the MP blade (FCv2 or FCSE S-VOL or T-VOL is allocated) exceeds 65%. • **FC Ext. Slower Copy2 (18):** Inhibits background copy and improves host I/O response when the operating ratio of the MP blade (FCv2 or FCSE S-VOL or T-VOL is allocated) exceeds 50%. • **Copy Pace Ext. Slower1 (20), Copy Pace Ext. Slower2 (21), Copy Pace Ext. None (22):** Reducing the copy volume in the "DUPLEX" status curbs the influence to the I/O performance of the host server. This item is available to all pairs in "DUPLEX" status. The I/O performance of the host server is improved in order of Copy Pace Ext. Slower1, Copy Pace Ext. Slower2, and Copy Pace Ext. None. • **Quick/Steady Split Multiplexing (ShadowImage/ ShadowImage for Mainframe) (24):** Accelerates ShadowImage for Mainframe pair split. The multiplicity (the number of jobs for which copy processing can be executed concurrently) of copy processing for each pair is changed from 1 to 24. • **Reverse Copy Multiplexing (ShadowImage/ ShadowImage for Mainframe) (25):** Accelerates resynchronization of ShadowImage for Mainframe pairs. The multiplicity (the number of jobs for which copy processing can be executed concurrently) of copy processing for each pair is changed from 1 to 24.
Status	Shows whether the option is currently enabled or disabled.
Enable button	Click to enable the selected option.
Disable button	Click to disable the selected option.

Edit Local Replica Options confirmation window

This window is the second and last window of the **Edit Local Replica Options** wizard.

The following image shows this window.



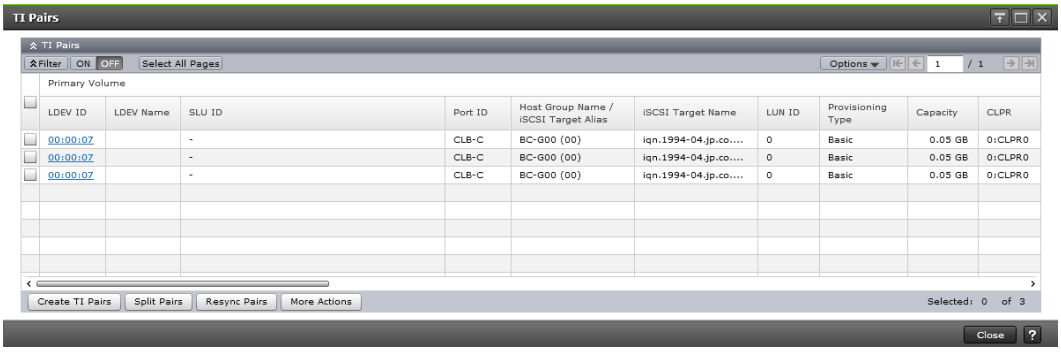
SI/TI or SIMF/FCv2/FCSE System Options table

The following table lists the items in this table on the **Confirm** window of the **Edit Local Replica Options** wizard.

Item	Description
System Option	Options that can be changed.
Status	Shows whether the option is currently enabled or disabled.

TI Pairs window

The following image shows the TI Pairs window.



The following table lists the items in the TI Pairs table on the TI Pairs window.

Item	Description

Primary Volume	The P-VOL information.
	
	Values:
	• **LDEV ID:** The P-VOL's LDEV identification number.
	• **LDEV Name:** The P-VOL's LDEV name.
	• **SLU ID:** The P-VOL's SLU ID. If the SLU attribute is not specified for the P-VOL, a hyphen (-) is displayed.
	• **Port ID:** The port name of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.
	• **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.
	• **iSCSI Target Name:** The P-VOL's iSCSI target name. If the LUN path is not defined, a blank is displayed.
	• **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. If the path is not defined, a blank is displayed.
	• **Provisioning Type:** The P-VOL's provisioning type.
	  ○ **Basic:** Internal volume
	  ○ **DP:** DP-VOL
	  ○ **External:** External volume
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute.
	• **Capacity:** The P-VOL's capacity.
	• **CLPR:** The P-VOL's CLPR ID.
	• **Encryption:** The P-VOL's encryption information.
	  ○ **Enabled:** Encryption is enabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.
	  ○ **Disabled:** Encryption is disabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.

Item	Description
	○ **Mixed:** The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. (VSP G1000, G1500, and VSP F1500) For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The P-VOL's T10 PI attribute information. ○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the P-VOL belongs. • **Virtual LDEV ID:** The identification number of the P-VOL's virtual LDEV. • **Virtual Device Name:** The name of the P-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Snapshot Group	The snapshot group name.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time you split the pairs to store snapshot data.
Snapshot SLU ID	The snapshot data SLU ID. If the SLU attribute is not specified for the snapshot data, a hyphen (-) is displayed.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. Click to open the **LDEV Properties** window. • **LDEV Name:** The S-VOL's LDEV name. • **Port ID:** The port name of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. • **iSCSI Target Name:** The S-VOL's iSCSI target name. If the LUN path is not defined, a blank is displayed. • **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path. If the path is not defined, a blank is displayed. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID. • (VSP G1000, G1500, and VSP F1500) **Encryption** S-VOL's encryption information.

Item	Description
	○ **Enabled:** Encryption is enabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ **Disabled:** Encryption is disabled for the parity group to which S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ **Mixed:** The pool to which S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled.. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. If you want to manage data encryption, use LDEVs with the Enabled or Disabled status. ○ If the LDEV is an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. • **T10 PI:** The P-VOL's T10 PI attribute information. ○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled. • **Virtual Storage Machine:** The model type and serial number of the virtual storage machine to which the S-VOL belongs. • **Virtual LDEV ID:** The identification number of the S-VOL's virtual LDEV. • **Virtual Device Name:** The name of the S-VOL's virtual device, in a combined format of "virtual emulation type", "number of virtual LUSE volumes", and "virtual CVS attribute". Each of these three items is displayed only if it is specified. If none of them are specified, a blank is displayed. • **Virtual SSID:** The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Pool Name (ID)	The pool name and identification number.
Pool Encryption	The pool's encryption information. • **Enabled:** Encryption is enabled for a pool created by the pool volume. • **Disabled:** Encryption is disabled for a pool created by the pool volume. • **Mixed:** A pool contains both pool volumes for which encryption is enabled and ones for which encryption is disabled, or volumes for which encryption is specified and an external volume. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For pools created in external volumes, or blocked pools, a hyphen (-) is displayed.
CTG ID	The consistency group identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.

Item	Description
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.
Layer (VSP G1000, G1500, and VSP F1500)	The layer of the pair based on the root volume.
Create TI Pairs button	Click to open the Create TI Pairs window.
Split Pairs button	Click to open the **Split Pairs** window.
Resync Pairs button	Click to open the **Resync Pairs** window.
More Actions	Click to view a list of tasks you can perform. Options: • **Assign Secondary Volumes:** Click to open the **Assign Secondary Volumes** window. • **Remove Secondary Volumes:** Click to open the **Remove Secondary Volumes** window. • **Delete Pairs:** Click to open the **Delete Pairs** window. • **View Pair Synchronization Rate:** Click to open the **View Pair Synchronization Rate** window. • **View Pair Properties:** Click to open the **View Pair Properties** window. • **Export:** Click to open the dialog from which you can download table information to a file.

Assign Secondary Volumes wizard

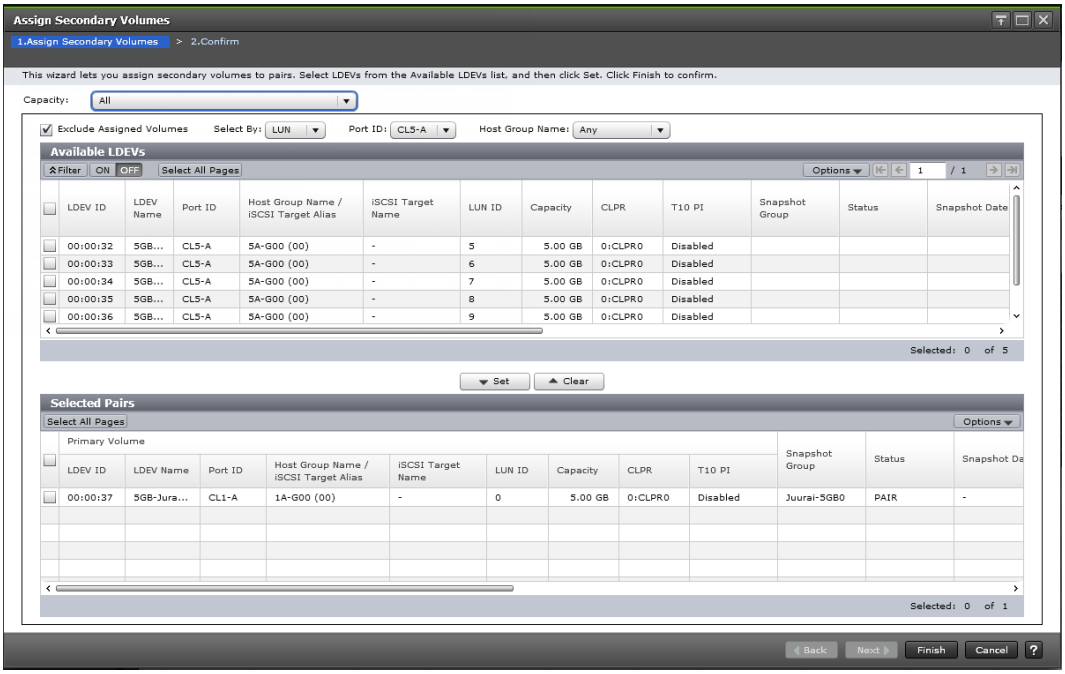
Related tasks

- Assigning secondary volumes to snapshot data of existing Thin Image pairs on page 150
- Changing assignment of secondary volumes to Thin Image pair snapshot data on page 153

Assign Secondary Volumes window

This window is the first window of the Assign Secondary Volumes wizard.

The following image shows this window.



The following table lists the items on this window.

Item	Description
Capacity	Click to select the capacity for which to filter the available LDEVs.
Exclude Assigned Volumes	Hide volumes that are already paired from the Selected Pairs table.
Selection Object (VSP Gx00 models and VSP Fx00 models)	Filters LDEVs in the Available LDEVs table according to port type.
Select By (VSP G1000, G1500, and VSP F1500)	Filters LDEVs in the Available LDEVs table by the specified object.
Port ID	Filters LDEVs in the Available LDEVs table by the Port ID. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Host Group Name	Filters LDEVs in the Available LDEVs table by the Host Group Name. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500) This item is displayed if you select a Fibre Channel port or a port for NAS user data (VSP Gx00 models, VSP Fx00 models only) for Port ID.

Item	Description
	Default: Any
Set button	Click to move an LDEV that you have selected in the Available LDEVs table to the Selected Pairs table. You can also click to configure a pair you have selected in the Available LDEVs table and a pair you have selected in the Selected Pairs table.
Clear button	Click to move the selected S-VOL from the Selected Pairs table back to the Available LDEVs table.

Available LDEVs table

The following table lists the items in this table on the Assign Secondary Volumes window.

Item	Description
LDEV ID	The LDEV identification number, which you can specify as the S-VOL.
LDEV Name	The LDEV's name.
Port ID	The port name of the LDEV's LUN path. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Host Group Name / iSCSI Target Alias	The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
iSCSI Target Name	The iSCSI target name. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
LUN ID	The LUN identification number of the LDEV's LUN path. This item is displayed if you select LUN for Select By. (VSP G1000, G1500, and VSP F1500)
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
T10 PI	The LDEV's T10 PI attribute information. • **Enabled:** The LDEV's T10 PI attribute is enabled. • **Disabled:** The LDEV's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status.

Item	Description
	For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed. • **Port ID:** The port name of the P-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. • **iSCSI Target Name:** The P-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.

Selected Pairs table

The following table lists the items in this table on the Assign Secondary Volumes window.

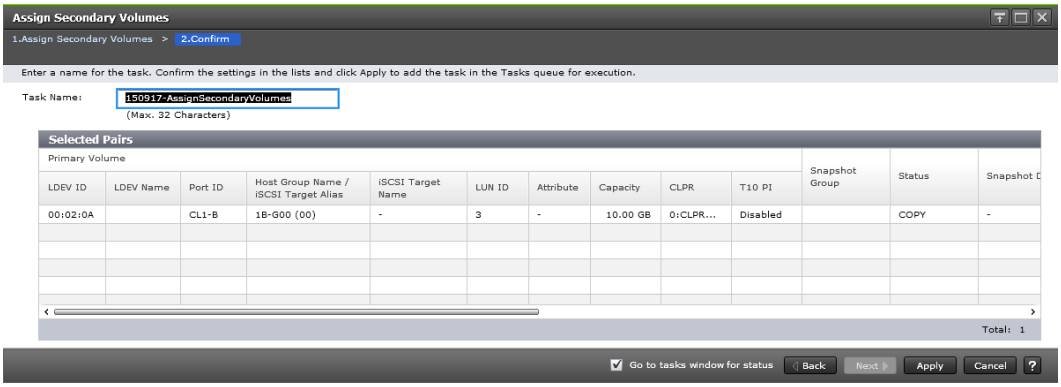
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Port ID:** The port name of the P-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. • **iSCSI Target Name:** The P-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID. • **T10 PI:** The P-VOL's T10 PI attribute information.

Item	Description
	○ **Enabled:** The P-VOL's T10 PI attribute is enabled. ○ **Disabled:** The P-VOL's T10 PI attribute is disabled.
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time you created the pair to store snapshot data.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. If you have not allocated an LDEV to the S-VOL, this item is blank. • **LDEV Name:** The S-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Port ID:** The port name of the S-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. • **iSCSI Target Name:** The S-VOL's iSCSI target name. • **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path. • **Attribute:** (VSP Gx00 models, VSP Fx00 models only) The S-VOL's attribute. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR ID. • **T10 PI:** The S-VOL's T10 PI attribute information. ○ **Enabled:** The S-VOL's T10 PI attribute is enabled. ○ **Disabled:** The S-VOL's T10 PI attribute is disabled.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Assign Secondary Volumes confirmation window

This window is the second window of the Assign Secondary Volumes wizard.

The following image shows this window.



Selected Pairs table

The following table lists the items in this table on the **Confirm** window.

Item	Description

Primary Volume	The P-VOL information.
	
	Values:
	• **LDEV ID:** The P-VOL's LDEV identification number.
	• **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed.
	• **Port ID:** The port name of the P-VOL LDEV's LUN path.
	• **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path.
	• **iSCSI Target Name:** The P-VOL's iSCSI target name.
	• **LUN ID:** The LUN identification number of the P-VOL LDEV's LUN path.
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute.
	• **Capacity:** The P-VOL's capacity.
	• **CLPR:** The P-VOL's CLPR ID.
	• **T10 PI:** The P-VOL's T10 PI attribute information.
	  ○ **Enabled:** The P-VOL's T10 PI attribute is enabled.
	  ○ **Disabled:** The P-VOL's T10 PI attribute is disabled.

Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identification number. If you have not allocated an LDEV to the S-VOL, this item is blank.

Item	Description

	• **LDEV Name:** The S-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed.
	• **Port ID:** Port name of the S-VOL LDEV's LUN path.
	• **Host Group Name / iSCSI Target Alias:** The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path.
	• **iSCSI Target Name:** The S-VOL's iSCSI target name.
	• **LUN ID:** The LUN identification number of the S-VOL LDEV's LUN path.
	• **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The S-VOL's attribute.
	• **Capacity:** The S-VOL's capacity.
	• **CLPR:** The S-VOL's CLPR ID.
	• **T10 PI:** The S-VOL's T10 PI attribute information.
	  ○ **Enabled:** The S-VOL's T10 PI attribute is enabled.
	  ○ **Disabled:** The S-VOL's T10 PI attribute is disabled.

Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Remove Secondary Volumes table

This table is displayed if a volume is selected that was already assigned to other snapshot data (by leaving the Exclude Assigned Volumes check box unselected in the **Assign Secondary Volumes** window).

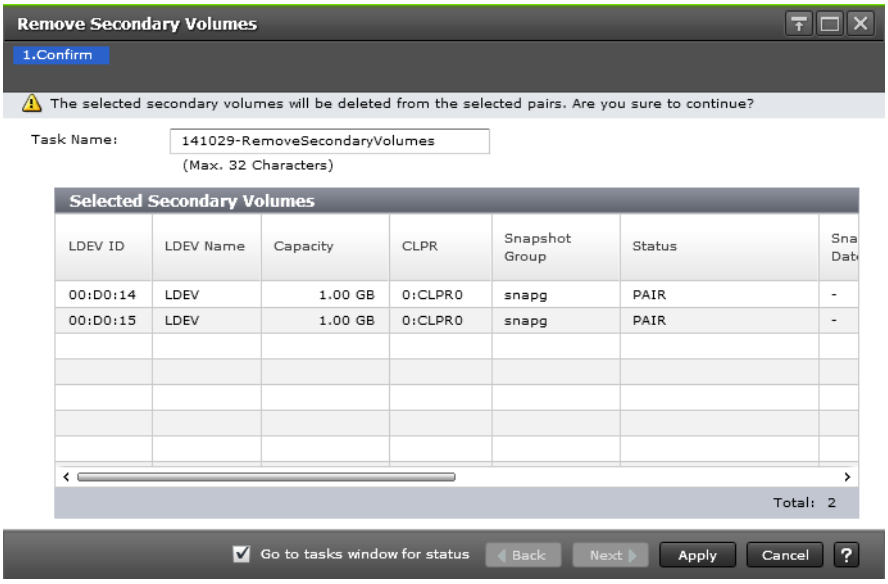
The following table lists the items in this table on the **Confirm** window.

Item	Description
LDEV ID	The LDEV identification number, which you can specify as the S-VOL.
LDEV Name	The LDEV's name.
Attribute	VSP Gx00 models and VSP Fx00 models only. The LDEV's attribute.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Remount Device	Indicates whether remounting the device is required.
Snapshot Group	The snapshot group name.

Item	Description
	Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Attribute:** (VSP Gx00 models and VSP Fx00 models only) The P-VOL's attribute. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Remove Secondary Volumes window

The following image shows this window.



Selected Secondary Volumes table

The following table lists the items in this window on the Remove Secondary Volumes window.

Item	Description
LDEV ID	The LDEV identification number, which you can specify as the S-VOL.
LDEV Name	The LDEV's name.
Attribute	VSP Gx00 models and VSP Fx00 models only. The LDEV's attribute.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Snapshot Group	The snapshot group name. Information is displayed for this item only if you have configured a snapshot group for the HTI pair.
Status	The pair status. For more information about pair status, see Thin Image pair status definitions on page 161.
Snapshot Date	The date and time that you created the pair to store snapshot data.
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identification number. • **LDEV Name:** The P-VOL's LDEV name. If you have not allocated an LDEV to the S-VOL, a hyphen (-) is displayed. • **Capacity:** The P-VOL's capacity.

Item	Description
	• **CLPR:** The P-VOL's CLPR ID.
Pool Name (ID)	The pool name and identification number.
Mirror Unit	The mirror unit number. If you have not allocated an LDEV to the S-VOL for an existing pair, a hyphen (-) is displayed.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether a cascaded pair can be created. • **Enabled:** Cascaded pairs can be created. • **Disabled:** Cascaded pairs cannot be created.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. • **Snapshot:** A pair with the snapshot attribute. • **Clone:** A pair with the clone attribute.
Pair Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The pair topology ID consists of the LDEV ID of the root volume and the mirror unit number.

Related tasks

- Releasing assignment of secondary volumes from Thin Image pair snapshot data on page 152

Glossary

#

3DC

three-data-center. Refers to the local, intermediate, and remote sites, or data centers, in which TrueCopy and Universal Replicator combine to form a remote replication configuration.

In a 3DC configuration, data is copied from a local site to an intermediate site and then to a remote site (3DC cascade configuration), or from a local site to two separate remote sites (3DC multi-target configuration).

A

administrative logical unit (ALU)

An LU used for the conglomerate LUN structure, a SCSI architecture model. In the conglomerate LUN structure, all host access is through the ALU, which functions as a gateway to sort the I/Os for the subsidiary logical units (SLUs) grouped under the ALU.

The host requests I/Os by using SCSI commands to specify the ALU and the SLUs grouped under the ALU. An ALU is called a Protocol Endpoint (PE) in vSphere. See also *subsidiary logical unit (SLU)*.

ALU

See *administrative logical unit (ALU)*.

B

blade

A computer module, generally a single circuit board, used mostly in servers.

C

cache logical partition (CLPR)

Consists of virtual cache memory that is set up to be allocated to different hosts in contention for cache memory.

capacity

The amount of data storage space available on a physical storage device, usually measured in bytes (MB, GB, TB, and so on).

cascade configuration

In a 3DC cascade configuration for remote replication, data is copied from a local site to an intermediate site and then to a remote site using TrueCopy and Universal Replicator. See also *3DC*.

In a ShadowImage cascade configuration, two layers of secondary volumes can be defined for a single primary volume. Pairs created in the first and second layer are called cascaded pairs.

cascade function

A ShadowImage function that allows a primary volume (P-VOL) to have up to nine secondary volumes (S-VOLs) in a layered configuration. The first cascade layer (L1) is the original ShadowImage pair with one P-VOL and up to three S-VOLs. The second cascade layer (L2) contains ShadowImage pairs in which the L1 S-VOLs are functioning as the P-VOLs of layer-2 ShadowImage pairs that can have up to two S-VOLs for each P-VOL. See also *root volume*, *node volume*, *leaf volume*, *layer-1 (L1) pair*, and *layer-2 (L2) pair*.

cascaded pair

A ShadowImage pair in a cascade configuration. See also *cascade configuration*.

CCI

Command Control Interface

CG

See *consistency group (CTG)*.

CLPR

See *cache logical partition (CLPR)*.

command device

A dedicated logical volume used only by Command Control Interface and Business Continuity Manager to interface with the storage system. Can be shared by several hosts.

configuration definition file

A text file that defines the configuration, parameters, and options of Command Control Interface (CCI) operations. It also defines the connected hosts and the volumes and groups known to the CCI instance.

consistency group (CTG)

A group of copy relationships between virtual disks that are managed as a single entity. A group of pairs on which copy operations are performed simultaneously. When a CTG ID is specified for a specific operation, the operation is performed simultaneously on all pairs belonging to the CTG while keeping data consistency.

copy pair

A pair of volumes in which one volume contains original data and the other volume contains the copy of the original. Copy operations can be synchronous or asynchronous, and the volumes of the copy pair can be located in the same storage system (local copy) or in different storage systems (remote copy).

A copy pair can also be called a volume pair, or just pair. A pair created by Compatible FlashCopy® is called a relationship.

copy-on-write (COW)

Point-in-time snapshot copy of any data volume within a storage system. Copy-on-write snapshots only store changed data blocks, therefore the amount of storage capacity required for each copy is substantially smaller than the source volume.

COW

See *copy-on-write (COW)*.

COW Snapshot

Hitachi Copy-on-Write Snapshot

D

data consistency

When the data on the secondary volume is identical to the data on the primary volume.

data path

The physical paths used by primary storage systems to communicate with secondary storage systems in a remote replication environment.

data pool

One or more logical volumes designated to temporarily store original data. When a snapshot is taken of a primary volume, the data pool is used if a data block in the primary volume is to be updated. The original snapshot of the volume is maintained by storing the changeable data blocks in the data pool.

delta resync

A disaster recovery solution in which TrueCopy and Universal Replicator systems are configured to provide a quick recovery using only differential data stored at an intermediate site.

device

A physical or logical unit with a specific function.

device emulation

Indicates the type of logical volume. Mainframe device emulation types provide logical volumes of fixed size, called logical volume images (LVIs), which contain EBCDIC data in CKD format. Typical mainframe device emulation types include 3390-9 and 3390-M. Open-systems device emulation types provide logical volumes of variable size, called logical units (LUs), that contain ASCII data in FBA format. The typical open-systems device emulation type is OPEN-V.

differential data

Changed data in the primary volume not yet reflected in the secondary volume of a copy pair.

disaster recovery

A set of procedures to recover critical application data and processing after a disaster or other failure.

disk adapter (DKA)

The hardware component that controls the transfer of data between the drives and cache. A DKA feature consists of a pair of boards.

disk controller (DKC)

The hardware component that manages front-end and back-end storage operations. The term DKC can refer to the entire storage system or to the controller components.

DKA

See *disk adapter (DKA)*.

DKC

See *disk controller (DKC)*.

DKCMAIN

disk controller main. Refers to the microcode or software for the storage system.

DP-VOL

Dynamic Provisioning virtual volume. A virtual volume that has no memory space that is used by Dynamic Provisioning.

DRU

Hitachi Data Retention Utility

Dynamic Provisioning (HDP)

An approach to managing storage. Instead of "reserving" a fixed amount of storage, it removes capacity from the available pool when data is actually written to disk.

E

emulation

The operation of a storage system to emulate the characteristics of a different storage system. For device emulation, the mainframe host recognizes the logical devices on the storage system as 3390-x devices. For controller emulation, the mainframe host recognizes the control units (CUs) on the storage system as 2105 or 2107 controllers.

The storage system operates the same as the storage system being emulated.

ext.

external

external volume

A logical volume whose data resides on drives that are physically located outside the Hitachi storage system.

F

FC

Fibre Channel; FlashCopy

free capacity

The amount of storage space (in bytes) that is available for use by the host systems.

G

GUI

graphical user interface

H

HDP

Hitachi Dynamic Provisioning. See *Dynamic Provisioning*.

HDS

Hitachi Data Systems

HDT

Hitachi Dynamic Tiering

HORC

Hitachi Open Remote Copy. Another name for Hitachi TrueCopy®.

HORCM

Hitachi Open Remote Copy Manager. Another name for Command Control Interface.

host failover

The process of switching operations from one host to another host when the primary host fails.

host group

A group of hosts of the same operating system platform.

I

I/O

input/output

I/O mode

I/O actions on the primary volume and secondary volume of a global-active device pair.

in-system replication

The original data volume and its copy are located in the same storage system. ShadowImage in-system replication provides duplication of logical volumes; Thin Image in-system replication provides "snapshots" of logical volumes that are stored and managed as virtual volumes (V-VOLs).

See also *remote replication*.

initial copy

An initial copy operation is performed when a copy pair is created. Data on the primary volume is copied to the secondary volume before any updates are processed.

intermediate site (I-site)

A site that functions as both a TrueCopy secondary site and a Universal Replicator primary site in a 3-data-center (3DC) cascading configuration.

internal volume

A logical volume whose data resides on drives that are physically located within the storage system. See also *external volume*.

J

JNLG

See *journal group (JNLG)*.

journal group (JNLG)

In a Universal Replicator system, journal groups manage data consistency between multiple primary volumes and secondary volumes. See also *consistency group (CTG)*.

journal volume

A volume that records and stores a log of all events that take place in another volume. In the event of a system crash, the journal volume logs are used to restore lost data and maintain data integrity.

In Universal Replicator, differential data is held in journal volumes until you copy it to the S-VOL.

L

L1 pair

See *layer-1 (L1) pair*.

L2 pair

See *layer-2 (L2) pair*.

layer-1 (L1) pair

In a ShadowImage cascade configuration, a layer-1 pair consists of a primary volume and secondary volume in the first cascade layer. You can pair an L1 primary volume with up to three L1 secondary volumes. See also *cascade configuration*.

layer-2 (L2) pair

In a ShadowImage cascade configuration, a layer-2 (L2) pair consists of a primary volume and secondary volume in the second cascade layer. You can pair an L2 primary volume with up to two L2 secondary volumes. See also *cascade configuration*.

LBA

logical block address

LDEV

See logical device.

LDKC

See *logical disk controller (LDKC)*.

leaf volume

A layer-2 secondary volume in a ShadowImage cascade configuration. The primary volume of a layer-2 pair is called a node volume. See also *cascade configuration*.

license key

A specific set of characters that unlocks an application and allows it to be used.

local copy

See *in-system replication*.

logical device (LDEV)

An individual logical device (on multiple drives in a RAID configuration) in the storage system. An LDEV might or might not contain any data and might or miight not be defined to any hosts. Each LDEV has a unique identifier, or address, within the storage system. The identifier is composed of the logical disk controller (LDKC) number, control unit (CU) number, and LDEV number. The LDEV IDs within a storage system do not change.

An LDEV formatted for use by mainframe hosts is called a logical volume image (LVI). An LDEV formatted for use by open-system hosts is called a logical unit (LU).

logical disk controller (LDKC)

A group of 255 control unit (CU) images in the RAID storage system that is controlled by a virtual (logical) storage system within the single physical storage system. For example, the Hitachi Universal Storage Platform V storage system supports two LDKCs, LDKC 00 and LDKC 01.

logical unit (LU)

A volume, or LDEV, created in an open storage system, or configured for use by an open-systems host, for example, OPEN-V.

logical unit (LU) path

The path between an open-systems host and a logical unit.

logical unit number (LUN)

A unique management number that identifies a logical unit (LU) in a storage system. A logical unit can be an end user, a file, a disk drive, a port, a host group that is assigned to a port, an application, or virtual partitions (or volumes) of a RAID set.

Logical unit numbers (LUNs) are used in SCSI protocols to differentiate disk drives in a common SCSI target device, such as a storage system. An open-systems host uses a LUN to access a particular LU.

logical volume (LV)

See *volume*.

logical volume image (LVI)

An LDEV that is configured for use by mainframe hosts (for example, 3390-3).

LU

See *logical unit (LU)*.

LUSE

LUN expansion; LU size expansion

LUSE volume

A combined LU composed of multiple OPEN-*x* devices. A LUSE device can be from 2 to 36 times larger than a fixed-size OPEN-*x* LU. LUSE lets the host access the data on the storage system using fewer LU numbers.

LV

logical volume. See *volume*.

M

main control unit (MCU)

A storage system at a primary, or main, site that contains primary volumes of remote replication pairs. The main control unit (MCU) is configured to send remote I/O instructions to one or more storage systems at the secondary, or remote, site, called remote control units (RCUs). RCUs contain the secondary volumes of the remote replication pairs. See also remote control unit (RCU).

main site

See *primary site*.

Mb

megabit

MB

megabyte

Mbps

megabits per second

MBps

megabytes per second

MCU

See main control unit.

MF, M/F

mainframe

MIH

missing interrupt handler

mirror

In Universal Replicator, each pair relationship in and between journal groups is called a "mirror." Each pair is assigned a mirror ID when it is created. The mirror ID identifies individual pair relationships between journal groups.

modify mode

The mode of operation of Device Manager - Storage Navigator that allows changes to the storage system configuration. See also *view mode*.

MP

microprocessor

MU

mirror unit

N

node volume

A layer-2 primary volume in a ShadowImage cascade configuration. The secondary volume of a layer-2 pair is called a leaf volume. See also *cascade configuration*.

NUM

number

O

OPEN-V

A logical unit (LU) of user-defined size for use by open-systems hosts.

OPEN-x

A logical unit (LU) of fixed size (for example, OPEN-3, OPEN-9) that is used primarily for sharing data between mainframe and open-systems hosts using Hitachi Cross-OS File Exchange.

P

P-VOL

See primary volume.

pair

Two logical volumes in a replication relationship in which one volume contains original data to be copied and the other volume contains the copy of the original data. The copy operations can be synchronous or asynchronous, and the pair volumes can be located in the same storage system (in-system replication) or in different storage systems (remote replication).

pair status

Indicates the condition of a copy pair. A pair must have a specific status for specific operations. When a pair operation completes, the status of the pair changes to a different status determined by the type of operation.

parity group

See *RAID group*.

PG

parity group. See *RAID group*.

pool

A set of volumes that are reserved for storing Hitachi Thin Image data or Dynamic Provisioning write data.

pool volume (pool-VOL)

A logical volume that is reserved for storing snapshot data for Thin Image operations or write data for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, or active flash for mainframe.

A logical volume that is reserved for storing snapshot data for Thin Image operations or write data for Dynamic Provisioning, Dynamic Tiering, or active flash.

PPRC

Peer-to-Peer Remote Copy

primary site

The physical location of a storage system that contains original data to be replicated and that is connected to one or more storage systems at a remote or secondary site via remote copy connections. A primary site can also be called a “main site” or “local site”.

The term "primary site" is also used for host failover operations. In that case, the primary site is the location of the host on which the production applications are running, and the secondary site is the location of the host on which the backup applications that run when the applications at the primary site have failed.

primary volume (P-VOL)

The volume in a copy pair that contains the original data to be replicated. The data on the P-VOL is duplicated synchronously or asynchronously on the secondary volume (S-VOL).

The following Hitachi products use the term P-VOL: Thin Image, Copy-on-Write Snapshot, ShadowImage, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, and High Availability Manager.

See also *secondary volume*.

Q

quick format

The quick format feature in Virtual LVI/Virtual LUN in which the formatting of the internal volumes is done in the background. This allows system configuration (such as defining a path or creating a TrueCopy pair) before the formatting is completed. To execute quick formatting, the volumes must be in blocked status.

quick restore

A reverse resynchronization in which no data is actually copied: the primary and secondary volumes are swapped.

quick split

A split operation in which the pair is split, and then the differential data is copied to the secondary volume (S-VOL). Any remaining differential data is copied to the S-VOL in the background. The benefit is that the S-VOL becomes immediately available for read and write I/O.

quorum disk

Used to determine the volume in the global-active device pair on which server I/O should continue when a failure occurs in a path or a storage system. Quorum disks reside in an external storage system.

R

R/W

read/write

RAID

redundant array of inexpensive disks

RAID group

A redundant array of inexpensive drives (RAID) that have the same capacity and are treated as one group for data storage and recovery. A RAID group contains both user data and parity information, which allows the user data to be accessed in the event that one or more of the drives within the RAID group are not available. The RAID level of a RAID group determines the number of data drives and parity drives and how the data is "striped" across the drives. For RAID1, user data is duplicated within the RAID group, so there is no parity data for RAID1 RAID groups.

A RAID group can also be called an array group or a parity group.

RAID level

The type of RAID implementation. RAID levels include RAID 0, RAID 1, RAID 2, RAID 3, RAID 4, RAID 5 and RAID 6.

RCU

See *remote control unit (RCU)*.

remote control unit (RCU)

A storage system at a secondary, or remote, site that is configured to receive remote I/O instructions from one or more storage systems at the primary, or main, site. See also main control unit.

remote site

See *secondary site*.

resync

resynchronize

RMI

Remote Method Invocation

root volume

A layer-1 primary volume in a ShadowImage cascade configuration. The secondary volume of a layer-1 pair is called a node volume. See also *cascade configuration*.

RTC

real-time clock

RTO

recovery time objective

S

S#

serial number

S-VOL

See *secondary volume* or *source volume*. When used for "secondary volume", "S-VOL" is only seen in the earlier version of the Device Manager - Storage Navigator GUI (still in use).

S/N

serial number

s/w

software

SAS

serial-attached SCSI

SC

storage control

SCDS

source control dataset

SCI

state change interrupt

scripting

The use of command line scripts, or spreadsheets downloaded by Configuration File Loader to automate storage management operations.

SCSI

Small Computer System Interface. A standard that defines I/O buses primarily intended for connecting storage systems and devices to hosts through host bus adapters.

secondary site

The physical location of the storage system that contains the primary volumes of remote replication pairs at the primary site. The storage system at the secondary site is connected to the storage system at the primary site via remote copy connections. The secondary site can also be called the “remote site”. See also *primary site*.

secondary volume (S-VOL)

The volume in a copy pair that is the copy of the original data on the primary volume (P-VOL). The following Hitachi products use the term "secondary volume": Thin Image, Copy-on-Write Snapshot, ShadowImage, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, and High Availability Manager.

See also *primary volume*.

service information message (SIM)

Messages generated by a RAID storage system when it detects an error or service requirement. SIMs are reported to hosts and displayed on Device Manager - Storage Navigator.

service processor (SVP)

The computer inside a RAID storage system that hosts the Device Manager - Storage Navigator software and is used by service personnel for configuration and maintenance of the storage system.

severity level

Applies to service information messages (SIMs) and Device Manager - Storage Navigator error codes.

shared volume

A volume that is being used by more than one replication function. For example, a volume that is the primary volume of a TrueCopy pair and the primary volume of a ShadowImage pair is a shared volume.

SI

Hitachi ShadowImage®

sidefile

An area of cache memory that is used to store updated data for later integration into the copied data.

SIM

service information message

Simple Network Management Protocol (SNMP)

An industry-standard protocol that is used to manage and monitor network-attached devices for conditions that warrant administrative attention. The devices can include disk devices, routers, and hubs. SNMP uses Simple Gateway Management Protocol (SGMP) to manage TCP/IP gateways.

SIz

Hitachi ShadowImage® for Mainframe

size

Generally refers to the storage capacity of a memory module or cache. Not usually used for storage of data on disk or flash drives.

SLU

See *subsidiary logical unit*.

SM

shared memory

SN

serial number; Device Manager - Storage Navigator

snapshot

A point-in-time virtual copy of a Hitachi Thin Image primary volume (P-VOL). The snapshot is maintained when the P-VOL is updated by storing pre-updated data (snapshot data) in a data pool.

SNMP

See *Simple Network Management Protocol*.

source volume (S-VOL)

The volume containing the original data that is duplicated on the target volume (T-VOL). Also known as *primary volume*.

space

Generally refers to the storage capacity of a data drive (for example, hard disk drive, flash drive).

SS

snapshot

SSB

sense byte

SSD

solid-state drive. Also called flash drive.

SSID

See *storage subsystem identifier*.

storage subsystem identifier (SSID)

In a mainframe environment, SSIDs are used for reporting information from the control unit (CU) image to the mainframe operating system. An SSID is assigned to each group of 64 or 256 volumes to define one or four SSIDs per CU image. The user-specified SSIDs are assigned during storage system installation and must be unique to all connected host operating environments.

subsidiary logical unit (SLU)

An LU used for the conglomerate LUN structure, a SCSI architecture model. An SLU is an LU that stores actual data. You can use a DP-VOL or snapshot data (or a V-VOL allocated to snapshot data) as an SLU. All host access to SLUs is through the administrative logical unit (ALU). An SLU is called a virtual volume (VVol) in vSphere. See *administrative logical unit*.

T

T-VOL

See *target volume*.

T10 PI

See *T10 Protection Information*.

T10 Protection Information (T10 PI)

A code standard defined in SCSI. T10 PI adds 8-byte protection information at every 512 bytes to validate data. By combining T10 PI with Data Integrity Extension (DIX), which enables data protection covering application and operating system, data protection from application to disk drives can be provided.

target volume (T-VOL)

The volume in a mainframe copy pair that is the copy of the original data on the source volume (S-VOL). The term is used only in the earlier version of the Device Manager - Storage Navigator GUI (still in use), for the following Hitachi products: ShadowImage for Mainframe, Dataset Replication, and Compatible FlashCopy® V2.

See also *source volume*.

TC

Hitachi TrueCopy®

TCz

Hitachi TrueCopy® for Mainframe

TID

target ID

total capacity

The aggregate amount of storage space in a data storage system.

U

update copy

An operation that copies differential data on the primary volume of a copy pair to the secondary volume. Update copy operations are performed in response to write I/Os on the primary volume after the initial copy operation is completed.

UR

Hitachi Universal Replicator

UR

Hitachi Universal Replicator

URz

Hitachi Universal Replicator software for Mainframe

URz

Hitachi Universal Replicator software for Mainframe

V

V

version; variable length and de-blocking (mainframe record format)

V-VOL

See *virtual volume*.

V-VOL management area

Contains the pool management block and pool association information for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, and Dynamic Tiering for Mainframe, and Thin Image operations. The V-VOL management area is created automatically when additional shared memory is installed.

VB

variable length and blocking (mainframe record format)

view mode

The mode of operation of Device Manager - Storage Navigator that allows viewing only of the storage system configuration. See also *modify mode*.

virtual device (VDEV)

A group of logical devices (LDEVs) in a RAID group. A VDEV typically consists of some fixed volumes (FVs) and some free space. The number of fixed volumes is determined by the RAID level and device emulation type.

Virtual LVI/LUN

A custom-size volume whose size is defined by the user using Virtual LVI/LUN. Also called a custom volume (CV).

virtual volume (V-VOL)

A logical volume in a storage system that has no physical storage space. Hitachi Thin Image uses V-VOLs as secondary volumes of copy pairs. In Hitachi Dynamic Provisioning, V-VOLs are referred to as DP-VOLs.

VOL, vol

See *volume (VOL or vol)*.

volume (VOL or vol)

A logical device (LDEV), or a set of concatenated LDEVs in the case of LUSE, that has been defined to one or more hosts as a single data storage unit. An open-systems volume is called a logical unit (LU), and a mainframe volume is called a logical volume image (LVI).

volume pair

See *copy pair*.

W

write order

The order of write I/Os to the primary volume (P-VOL) of a copy pair. The data on the secondary volume (S-VOL) is updated in the same order as on the P-VOL, particularly when there are multiple write operations in one update cycle. This feature maintains data consistency at the secondary volume. Update records are sorted in the cache at the remote system to ensure proper write sequencing.

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