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Hitachi ShadowImage®
User Guide

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Systems

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Contents

Preface

This guide provides instructions for setting up, planning, and operating Hitachi ShadowImage® on a Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP G200, G400, G600, G800) or Hitachi Virtual Storage Platform F400, F600, F800 (VSP F400, F600, F800) storage system.

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

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who install, configure, and operate the VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system and the *Hardware Reference Guide* for your storage system model.
- The Hitachi Command Suite software and the *Hitachi Command Suite User Guide*, or the Hitachi Device Manager - Storage Navigator software and the *System Administrator Guide* for your storage system model.

Product version

This document revision applies to firmware 83-02-0*x* 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.

Changes in this revision

- Added support for Hitachi Virtual Storage Platform F400, F600, F800 storage systems.
- Updated screenshots in several sections.
- Added Data Direct Mapping attribute information in several sections.
- Added T10 PI attribute information in several sections.
- Updated requirements in Considerations for creating SI pairs on page 4-6.
- Added differential data requirements for DP-VOLs greater than 4,194,304 MB (8,589,934,592 blocks) in Sharing volumes with Dynamic Provisioning and Dynamic Tiering on page 3-4.
- Added procedure Releasing differential data for ShadowImage pairs on page 4-14.
- Updated table in L1, L2 pair status and supported pair user tasks on page 5-7
- Added error codes in Locating and interpreting error codes and logs using the Command Control Interface on page 6-3.

- Added mixed encryption information in Appendix B, ShadowImage GUI reference on page B-1.

Referenced documents

- *Hitachi Command Suite User Guide*, MK-90HC172
- *Command Control Interface Command Reference*, MK-90RD7009
- *Command Control Interface User and Reference Guide*, MK-90RD7010
- *Hitachi Compatible FlashCopy® User Guide*, MK-92HM8010
- *Hitachi Virtual Storage Platform Performance Guide*, MK-94HM8012
- *Hitachi Virtual Storage Platform Provisioning Guide*, MK-94HM8014
- *Hitachi Device Manager - Storage Navigator Messages*, MK-94HM8017
- *Hitachi TrueCopy® User Guide*, MK-94HM8019
- *Hitachi Universal Replicator User Guide*, MK-94HM8023

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 G1000 • VSP Gx00 models
VSP Fx00 models	Refers to all of the following storage systems: • Hitachi Virtual Storage Platform F400 • Hitachi Virtual Storage Platform F600 • Hitachi Virtual Storage Platform F800
HDP	Hitachi Dynamic Provisioning
SI	ShadowImage
TC	TrueCopy
HTI	Hitachi Thin Image
UR	Universal Replicator

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: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.
↓*value*↓ floor floor(*value*)	Floor function (round down value to the next integer)
↑*value*↑ ceiling ceiling(*value*)	Ceiling function (round up *value* to the next integer)
_ (underlined text)	Default value

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.
	Important	Calls attention to important or additional information.

Icon	Label	Description
	Caution	Warns the user of adverse conditions or consequences (for example, disruptive operations).
	WARNING	Warns the user of severe conditions or consequences (for example, destructive operations).

Convention 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 KB	1,000 (10^3) bytes
1 MB	1,000 KB or $1{,}000^2$ bytes
1 GB	1,000 MB or $1{,}000^3$ bytes
1 TB	1,000 GB or $1{,}000^4$ bytes
1 PB	1,000 TB or $1{,}000^5$ bytes
1 EB	1,000 PB or $1{,}000^6$ bytes

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

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	• OPEN-V: 960 KB • Others: 720 KB
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 documentation is available on Hitachi Data Systems Support Connect: https://support.hds.com/en_us/documents.html. 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.

Hitachi Data Systems Community is a new global online community for HDS customers, partners, independent software vendors, employees, and prospects. It is the destination to get answers, discover insights, and make connections. **Join the conversation today!** Go to community.hds.com, register, and complete your profile.

Comments

Please send us your comments on this document: 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!

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ShadowImage overview

Hitachi ShadowImage® (SI) uses local mirroring technology to create and maintain a full copy of a data volume within a Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP G200, G400, G600, G800) or Hitachi Virtual Storage Platform F400, F600, F800 (VSP F400, F600, F800) storage system.

You can use SI copies as backups, with secondary host applications, for data mining, for testing, as well as for other uses, while business operations continue without stopping host application input/output (I/O) to the production volume.

How ShadowImage works

A pair is created when you:

- Select a volume that you want to duplicate. This becomes the primary volume (P-VOL).
- Identify another volume to contain the copy. This becomes the secondary volume (S-VOL).
- Associate the P-VOL and S-VOLs.
- Perform the initial copy.

During the initial copy, the P-VOL remains available for read/write. After the copy is completed, subsequent write operations to the P-VOL are regularly duplicated to the S-VOL.

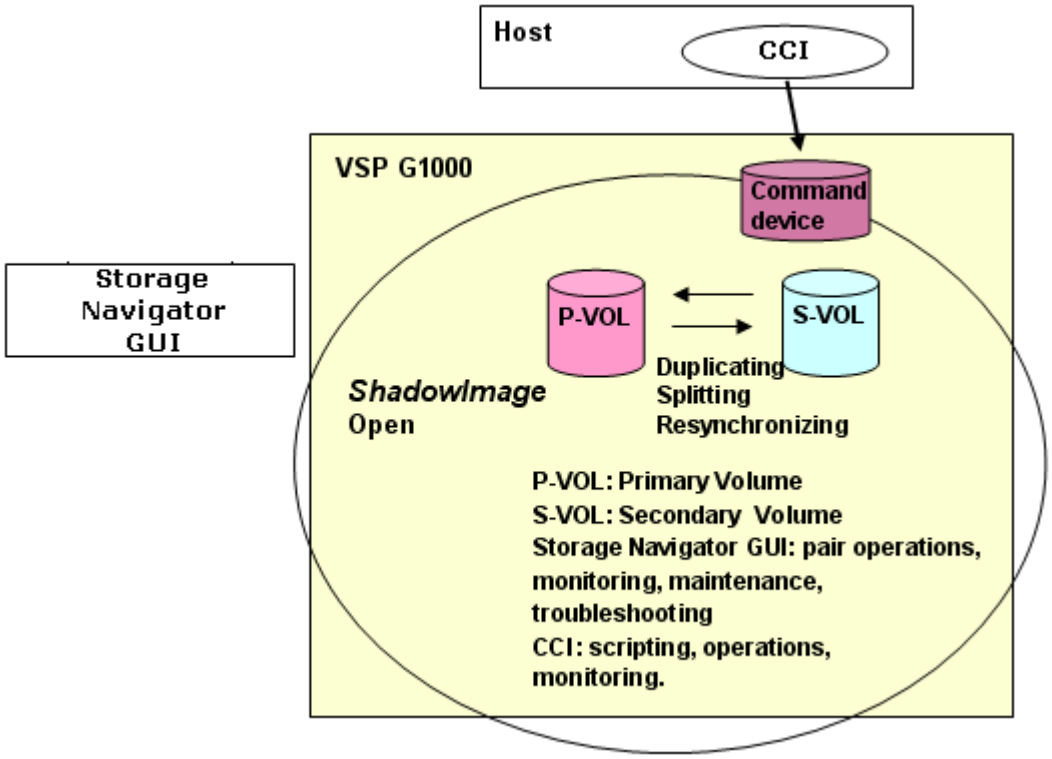
The P-VOL and S-VOLs remain paired until they are split. The P-VOL for a split pair continues to be updated but data in the S-VOL remains as it was at the time of the split. The S-VOL contains a mirror image of the original volume at that point in time.

- S-VOL data is consistent and usable. It is available for read/write access by secondary host applications.
- Changes to the P-VOL and S-VOL(s) are managed by differential bitmaps.
- You can pair the volumes again by resynchronizing the update data from P-VOL-to-S-VOL, or from S-VOL-to-P-VOL, as circumstance dictates.

Hardware and software components

A typical configuration consists of a VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system, a host connected to the storage system, the SI software, a primary volume (P-VOL), one or more secondary volumes (S-VOLs), and interface tools for operating SI.

The following image shows a typical configuration.



Interface tools

You use interface tools to operate SI.

Interface tools can include the following:

- HDvM - SN graphical user interface (GUI)
  Device Manager - Storage Navigator on page 1-3.
- The Command Control Interface software (CCI)
  For more information about the CCI, see The Command Control Interface on page 1-4.

Device Manager - Storage Navigator

Use HDvM - SN to complete the following:

- Install the SI license key, which enables it.
- Configure your storage system.
- Perform the initial and update copy operations.
- Monitor, maintain, and troubleshoot your storage system.

HDvM - SN is LAN-attached to the storage system and communicates with it over defined TCP/IP connections..

For more information about using HDvM - SN, see the *Hitachi Command Suite User Guide*.

The Command Control Interface

The CCI is a tool that uses the command line interface to run commands that perform most of the same tasks you can do with HDvM - SN. You can either run pair commands directly from a host, or you can script CCI commands to have pair operations performed automatically.

For more information about using the CCI, see the *Command Control Interface User and Reference Guide*.

Consistency groups

Use a consistency group (CTG) to perform tasks on the SI pairs in the group at the same time, including consistency group pair-split tasks. Using a CTG to perform tasks ensures the consistency of the pair status for all pairs in the group.

Related topics

- Supported ShadowImage consistency group actions and options on page A-2.
- ShadowImage system requirements on page 2-2.

Volume pairs

A volume pair consists of a P-VOL and one to three layer-1 (L1) pair S-VOLs.

Because S-VOLs are updated asynchronously, the P-VOL and S-VOLs may not be identical except immediately after a split. If a pair is split, any further updates to the P-VOL will not be reflected in the S-VOL.

Splitting or deleting a pair allows the host access to the S-VOL.

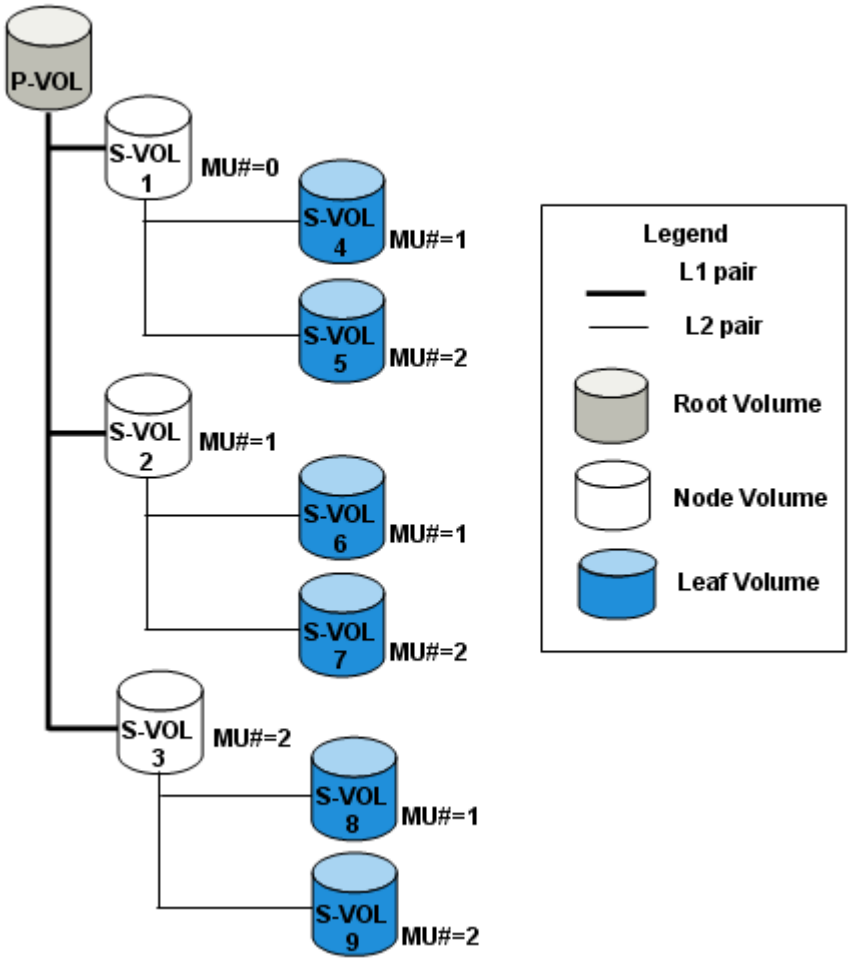
Related topics

- SI pair creation on page 4-5.
- Splitting SI pairs on page 4-18.
- SI pair resynchronization on page 4-28.
- SI pair deletion on page 4-36.

Cascaded pairs

Cascaded pairs are volume pairs created in the first and second layer. A pair that is made up of an L1 S-VOL and a layer-2 (L2) S-VOL is referred to as an L2 pair. You can pair each SI L1 S-VOL with two L2 S-VOLs. You can pair a maximum of nine L1 and L2 S-VOLs combined with a P-VOL.

The following image shows the structure of cascaded pairs.



In cascaded pairs, the P-VOL for an L1 pair is a root volume and the S-VOL is a node volume. The P-VOL for an L2 pair is the S-VOL of an L1 pair, a node volume, and the S-VOL is a leaf volume.

Related topics

- For more information about using L1 and L2 pairs with TrueCopy (TC), see Sharing volumes with TrueCopy on page 3-7.
  For more information about using L1 and L2 pairs where the SI P-VOLs and S-VOLs is shared with TC P-VOLs and S-VOLs, see Sharing volumes with Universal Replicator on page 3-8

Initial and update copy operations

Creating a pair causes the storage system to start the initial copy. During the initial copy, the P-VOL remains available for read and write operations from the host. After the initial copy, the storage system periodically copies the differential data in the P-VOL to the S-VOL. Subsequent write operations to the P-VOL are regularly duplicated to the S-VOL. The data in the P-VOL is copied to the S-VOL.

Initial copy workflow

Initial copy is an operation that is performed when you create a copy pair. Data on the P-VOL is copied to the S-VOL.

The storage system goes through the following workflow to create an initial copy:

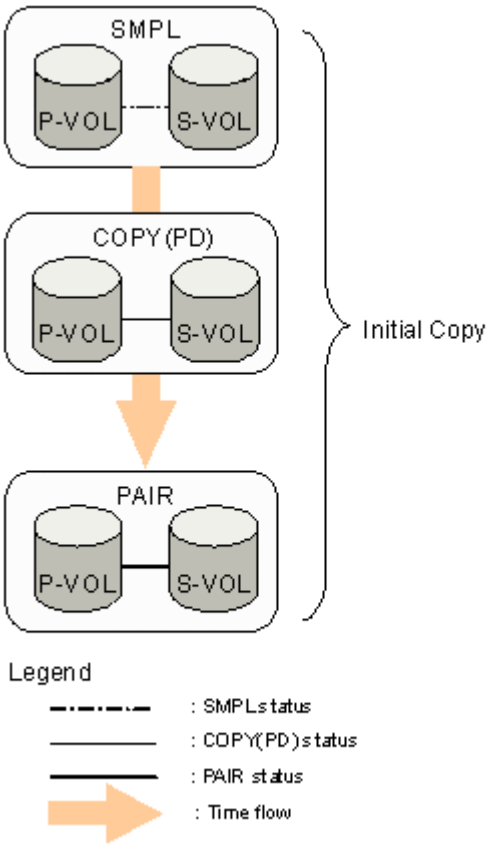
1. The S-VOLs are not paired. You create the copy pair.

Note: The storage system accepts read/write for unpaired volumes.

2. The initial copy is in progress ("COPY(PD)/COPY" status). The storage system copies the P-VOL data to the S-VOL.
3. The initial copy is complete and the volumes are paired ("PAIR" status).

Note: Data consistency is not ensured for SI pairs in "PAIR" status.

The following image shows the initial copy operation.



A P-VOL continues receiving updates from the host during the initial copy.

Related topics

- SI pair creation on page 4-5.

Update copy workflow

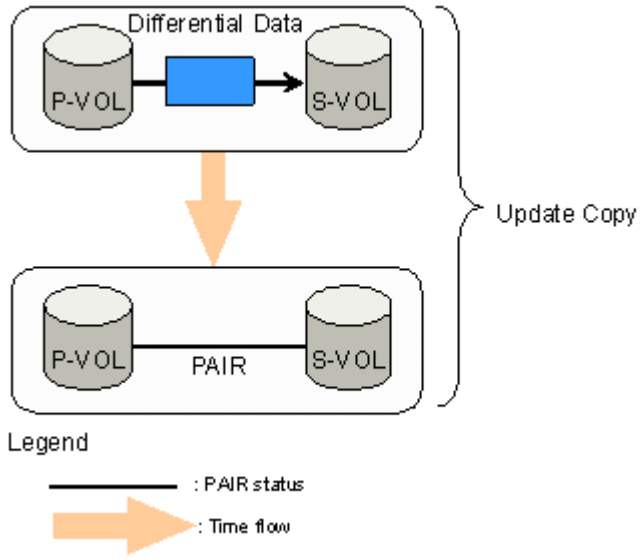
Update copy is an operation that is performed to asynchronously copy new data, differential data, on the P-VOL of a copy volume to the S-VOL.

The storage system goes through the following process to create an update copy:

1. The storage system marks I/O to the P-VOL in "PAIR" status as differential data and stores the location of the data in bitmaps for transfer to the S-VOL.
2. After there are write I/O operations to a P-VOL, the storage system starts the update copy operation.

Note: The timing of the update copy operation is based on the amount of differential data that accumulates and the elapsed time since the previous update.

The following image shows the update copy operation.



Related topics

- Splitting SI pairs on page 4-18.

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ShadowImage system requirements and planning

This chapter describes system requirements and planning tasks for SI storage systems.

ShadowImage system requirements

The following table shows minimum requirements for SI.

Item	Requirement
SI license capacity	The installed license capacity must be greater than or equal to the combined size of all P-VOLs and S-VOLs. For more information about license capacity requirements, see SI licensed capacity and licensed capacity requirements on page 2-3.
License key	Must be installed. For more information, see the *Hitachi Virtual Storage Platform System Administrator Guide*.
RAID level	RAID 1, RAID 5, RAID 6
HDvM - SN	Required.
CCI	Required if you are running commands through an in-band fibre channel connection. Otherwise, the CCI is not required. For more information about the CCI and running commands through an in-band fibre channel connection, see the *Command Control Interface User and Reference Guide*.
Pair volumes	The pair volumes. Values: • **Number of P-VOLs per S-VOL:** One • **Number of S-VOLs per P-VOL:** (For L1 pairs) Maximum: three (For L2 pairs) Maximum: two For more information about cascading pairs, see Cascaded pairs on page 1-4. • **Volume Capacity**: The P-VOL and S-VOL must be the same size in blocks. 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. • **Supported volume types:** o Internal volumes. o External volumes. **Note:** Universal Volume Manager license is required. • **Mirror Unit number (MU number):** Values: o (For L1 pairs) 0, 1, or 2 o (For L2 pairs) 1 or 2 You can share volumes with other software applications. For more information about sharing volumes, see Chapter 3, Sharing ShadowImage volumes on page 3-1. You cannot use the following volumes as pair volumes: • UR journal volumes • Virtual volumes (except Dynamic Provisioning (HDP) volumes)

Item	Requirement
	• Pool volumes You must set the same T10 PI attribute value for both the P-VOL and S-VOL.
Maximum number of pairs	Per VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system: 8,192 pairs (if you pair one S-VOL per P-VOL). **Note:** The maximum is dependent on the amount of installed control memory. For more information about installed control memory, see Tables and installed control memory on page 2-4. For more information about determining the number of pairs your configuration will support, see Workflow for determining the maximum number of SI pairs on page 2-4.
Consistency groups	Maximum per VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system: 256 (including SI and Thin Image (HTI)) You cannot place SI and HTI pairs in the same CTG. Maximum SI pairs per CTG: 8,192 You can only use CTGs that you created using the CCI in the CCI. CTG IDs are numbers between 0 and FF. CTG IDs 00 to 7F (or 0 to 127) are used for SI and HTI. CTG IDs 80 to FF (or 128 to 255) are used for HTI only.

SI licensed capacity and licensed capacity requirements

The total capacity of all P-VOLs and S-VOLs must be less than or equal to the installed license capacity. Volume capacity is counted only once, even if you use the volume more than once. You do not need to multiply the capacity by the number of times a volume is used (For example, a P-VOL used as the source volume for three pairs is counted only once).

For a normal volume, the total volume capacity is counted, but for a DP-VOL (a virtual volume used in Dynamic Provisioning, Dynamic Tiering, or active flash), the pool capacity being used by the volume is counted.

After you start performing pair tasks, monitor your capacity requirements to keep the used capacity within the capacity of the installed license.

You can use SI volumes in pairs for 30 days beyond the date the licensed capacity is exceeded. After 30 days, you can only delete SI pairs.

For more information about licensed capacity, see the *Hitachi Virtual Storage Platform System Administrator Guide*.

Related topics

- Sharing volumes with Dynamic Provisioning and Dynamic Tiering on page 3-4.

Workflow for determining the maximum number of SI pairs

Use the following workflow to determine the maximum number of SI pairs that you can create in your storage system:

1. Determine the number of differential and pair tables your storage system needs to create SI pairs:
   - Calculate the number of tables for volumes.
   - Query the number of differential tables required to create ShadowImage (SI) pairs.
     For more information, see Tables and installed control memory on page 2-4.

Note: These calculations assume that you are only using SI in the system.

   For more information about differential and pair tables, see Differential and pair tables on page 2-4.
2. Determine the maximum number of SI pairs that you can create on your storage system (see Comparing with the maximum number of SI pairs on page 2-6).

Related topics

- Tables and installed control memory on page 2-4.
- Software applications that use tables on page 2-4.

Differential and pair tables

Differential tables and pair tables are required to create SI pairs. Differential tables are tables that manage the differential bitmaps. Pair tables are tables that contain the information needed to manage SI pairs. Create enough tables to handle the SI pairs you plan to create.

The storage system uses a single pair table for up to 36 differential tables.

Software applications that use tables

The following software applications use differential tables:

- Volume Migration

The following software applications use pair tables:

- Volume Migration (using migration plans)

Tables and installed control memory

The number of differential and pair tables that are present in the storage system depends on the amount of installed control memory. Ensure that you have sufficient control memory to handle the number of SI pairs you plan to create.

The following table shows the maximum amounts of differential and pair tables you can create based on the amount of installed control memory.

Control memory	VSP G200		VSP G400/VSP G600/VSP G800	
	Differential table limit	Pair table limit	Differential table limit	Pair table limit
Base (No additional control memory)	26,176	8,192	0	0
Extension 1	209,600	16,384	104,768	16,384
Extension 2	209,600	16,384	209,600	16,384
Extension 3	-	-	419,200	16,384
Extension 4	-	-	419,200	16,384

For example, if you have VSP G200 with no additional control memory, the number of differential tables is 26,176 and the number of pair tables is 8,192. If you have control memory extension 1 or 2, the number of differential tables is 209,600 and the number of pair tables is 16,384.

Note: You can use CCI's inqraid command to query the number of the differential tables required when you create SI pairs. For SI, you can also query the number of differential tables not used in the storage system with this command.
For more information about the inqraid command, see the *Command Control Interface User and Reference Guide*.

Calculating the number of tables for each pair

You can calculate the number of differential and pair tables you will need for each pair.

Note: Differential tables are not used if a DP-VOL exceeds 4 TB, so in this case, no calculation is required.

1. Use the following formula:

   ```
   Total number of the differential tables per pair = (volume capacity KB ÷ 256) ÷ 20,448*
   ```

   * The number of slots that a differential table can manage.
2. Round up the total number to the nearest whole number.

For example, if the capacity of the divided volume is 3,019,898,880 KB, use the following calculation to get the total number of the differential tables:

```
(3,019,898,880 ÷ 256) ÷ 20,448 = 576.9014...
```

Round up 576.9014 to the nearest whole number, 577. Use the following formula for calculating total number of the pair tables per pair:

```
Total number of the pair tables per pair = Total number of the
differential tables per pair ÷ 36

577 ÷ 36 = 16.0277...
```

Round up 16.0277 to the nearest whole number and it will become 17. Therefore, total number of the pair tables per pair is 17 in this example.

Comparing with the maximum number of SI pairs if planned number of pairs can be created

If the necessary number of differential and pair tables are determined, use following formula to check if planned number of pairs can be created.

Note: Necessary number of differential and pair tables for a pair will be different depending on the volume capacity.

Calculating necessary number of the differential table for planned number of pairs

```
Necessary number of differential table for planned number of
pairs = Necessary number of differential table for a pair x
Planned number of SI pairs
```

Calculating necessary number of the pair table for planned number of pairs

```
Necessary number of pair table = Necessary number of pair table
for a pair x Planned number of SI pairs
```

Comparing with the maximum number of SI pairs

You can compare the planned number of SI pairs with the maximum number of SI pairs your storage system can support. In the calculation, you use the results of calculating the number of differential and pair tables. Use the following formula:

```
The required number of differential tables per pair (per previous
calculation) ≤ The number of differential tables available in the
system
```

and

```
The required number of pair tables per pair (per previous
calculation) ≤ The number of pair tables available in the system
```

Note: The number of differential tables available in the system and the number of pair tables available in the system in this calculation are dependent on the amount of installed control memory.

For example, if you plan to create 20 SI pairs in a VSP G200, G400, G600, G800 storage system that has 57,600 differential tables, use the following calculation:

`577 x 20 = 11,570`, which is ≤ 57,600

If the capacity of the volume is 3,019,898,880 kB, you will need 577 differential tables and 17 pair tables.

Apply these numbers to the following formula:

```
577 x 20 = 11,570 ≤ 57,600
```

and

```
17 x 20 = 340 ≤ 8,192
```

Thus, you can create 20 SI pairs.

Preparing volumes for SI

You must set up and prepare the P-VOLs and S-VOLs for SI pairing before creating SI pairs. The volumes you plan to use must meet the requirements for pair volumes.

The following table provides example volumes to guide you in preparing for SI volumes.

CU	Port	GID: LUN	Pair Volume Type	Associated L1 S-VOLs	Associated L1 P-VOLs	AssociatedL2 S-VOLs	Associated L2 P-VOL
0	1A	0:00	L1 P-VOL	1B-0:00, 2A-0:00, 2B-0:00	NA	NA	NA
0	1A	0:01	L1 P-VOL	1B-0:01, 2A-0:01, 2B-0:01	NA	NA	NA
0	1B	0:00	L1 S-VOL L2 P-VOL	NA	1A-0:00	3A-0:00, 3A-0:01	NA
0	1B	0:01	L1 S-VOL L2 P-VOL	NA	1A-0:00	3B-0:00, 3B-0:01	NA
0	2A	0:00	L1 S-VOL L2 P-VOL	NA	1A-0:00	4A-0:00, 3B-0:01	NA
0	2A	0:01	L1 S-VOL L2 P-VOL	NA	1A-0:00	4B-0:00, 3B-0:01	NA
0	3A	0:00	L2 S-VOL	NA	NA	NA	1B-0:00
0	3A	0:01	L2 S-VOL	NA	NA	NA	1B-0:00

Related topics

- For more information about pair volume requirements, see ShadowImage system requirements on page 2-2.

System options that affect performance

The following system options that affect performance. They can be enabled and disabled using HDvM - SN:

- **Swap & Freeze.** Enable this system option to suppress copy operations (the S-VOLs to remain unchanged) during pair restoration using Quick Restore. Differential data is not copied to the new S-VOL.
- **HOST I/O Performance.** Enable this system option to reduce the impact of copy operations regardless of the workload and to maximize server I/O performance.

Note: This system option increases the copy time, which slows copy operations.

- **Copy Threshold.** (For SI/HTI and Volume Migration) Enable this system option to temporarily reduce the impact of copy operations when the storage system's workload is heavy and to maximize host I/O performance during peak periods.

Note: A service representative must enable this system option.

- **Copy Pace.** Enable this system option to determine the rate at which the storage system copies data, to suppress copy processing, and to maximize host server I/O performance.

  Use one of the following processing-suppression/performance-improvement levels:

  - **Copy Pace Ext. Slower1.** This is the third most effective processing-suppression/performance-improvement level.
  - **Copy Pace Ext. Slower2.** This is the second most effective processing-suppression/performance-improvement level.
  - **Copy Pace Ext. None.** This is the most effective processing-suppression/performance-improvement level. This level stops copy processing.

  Note: This processing-suppression/performance-improvement level requires more time to synchronize when you split a pair, which prolongs the time that the pair is in the process of being Quick Split ("PSUS(SP)/PSUS" status) or Steady Split ("COPY(SP)/COPY" status). If this is a problem, complete one of the following:

  - Minimize the time that the pair status is "PAIR".
  - Use one of the other copy pace processing-suppression/performance-improvement levels.

  For more information about the methods you can use to split pairs, see Pair splitting methods on page 4-19.

Related topics

- Pair splitting methods on page 4-19.

- Changing system options on page 5-18.
- Types of pair resynchronization on page 4-29.

Quick Split and Steady Split performance planning

The following dependencies affect the performance of pairs that are in the process of Quick Split ("PSUS(SP)/PSUS" status) or Steady Split ("COPY(SP)/COPY" status):

- System option mode (SOM) 459 is ON.
- Whether the S-VOL is an external or internal volume.
- If the S-VOL is a DP-VOL.

The following table shows the effects of these conditions.

SOM 459	S-VOL*	PSUS(SP)/PSUS or COPY(SP)/COPY status
OFF	Internal volume	Differential data is copied to the cache in the storage system. The pair is in the process of Quick Split ("PSUS(SP)/PSUS" status).
	External volume	
ON	Internal volume	
	External volume	Differential data is copied to the cache in the storage system and destage to the external storage system has completed. The pair is split ("PSUS" status).
* If the S-VOL is a DP-VOL, this indicates the type of the top pool volume allocated to the S-VOL.		

Related topics

- Splitting SI pairs on page 4-19.
- Pair splitting methods on page 4-19.

Performance planning and I/O performance effect for SI system

Performing pair tasks, such as creating, splitting, and resynchronizing SI pairs, can affect host server I/O performance on the storage system.

Consider the following items for performance planning:

- Host server I/O performance versus number of SI pairs.
  - Compare the importance of host server I/O performance with the number of SI pairs and the copy pace.
  - Assigning multiple S-VOLs to a P-VOL uses more system resources and lowers the potential performance.
- Load sharing on parity groups.

    - S-VOLs and P-VOLs should be assigned to different parity groups in case of failure. Make sure that enough parity groups are used to provision the P-VOLs and S-VOLs and provide the performance capability desired.
    - The P-VOLs and S-VOLs should be distributed across the appropriate parity groups. If you plan to have multiple copies of the same P-VOLs, consider placing the S-VOLs in different combinations of parity groups.
    - SI can create high levels of internal activity in your storage system. Make sure the configuration is appropriate for the internal and host workload. Items that may help are additional parity groups, channel blades, cache, DKBs, and MPUs.
    - Limit the number of volumes performing initial copy operations provisioned in the same parity group.
- If you plan to simultaneously use multiple software applications, make sure that your storage system is configured for optimal performance, such as sufficient cache. Concurrent use affects the performance and operation of the other software applications.

  For more information about configuring your storage system for optimal performance, call the Support Center.
- If you plan to use AIX host servers, for best performance, place the P-VOLs on an AIX host server and the paired S-VOLs on another.

  Using a single AIX host server for the P-VOLs and S-VOLs changes the P-VOL and S-VOLs to the same PVID when you create or resynchronize the SI pairs. If the PVIDs are the same and you reboot the host server, the volumes can be misidentified. For example, the S-VOL can be identified as the P-VOL.
- Quick Restore. You can maximize performance when you restore pairs using Quick Restore (see Workflow for maximizing Quick Restore performance on page 2-11).

For more information about the guidelines for maximizing host server I/O performance while performing pair operations, see Guidelines for maximizing host server I/O performance on page 5-21.

Related topics

- System options that affect performance on page 2-8.
- SI pair creation on page 4-5.
- Splitting SI pairs on page 4-18.
- Resynchronizing or restoring SI pairs on page 4-32.
- Information about system and device maintenance on page 5-17.
- Sharing volumes with Cache Residency Manager on page 3-2.
- Types of pair resynchronization on page 4-29.

Workflow for maximizing Quick Restore performance

Use the following workflow to maximize the performance of restoring pairs using Quick Restore:

1. Use the same RAID level and HDD device type for the P-VOL and S-VOL.

   For more information about HDD and HDD device types, see the *Hitachi Command Suite User Guide*.
2. Perform one of the following actions:
   - Place the P-VOL and S-VOLs into the same cache partition if they are in different partitions.
   - If Cache Residency Manager is being used, release specific data areas on the LDEV from the Cache Residency Manager cache, and then place the LDEVs into cache using Cache Residency Manager.

     For more information about Cache Residency Manager, including how to place LDEVs into cache and release specific data areas on LDEVs from cache, see the *Hitachi Virtual Storage Platform Performance Guide*.
3. Restore the pairs using Quick Restore.

   For more information about restoring pairs using Quick Restore, see Reverse resynchronization on page 4-30.
4. Resume the original RAID levels if they were changed by a reverse resynchronization action.

   For more information about resuming RAID levels, see Workflow for setting the RAID level on page 4-35.

3

Sharing ShadowImage volumes

You can share SI volumes with other Hitachi software application volumes. This topic discusses the requirements, restrictions, and guidelines for sharing volumes.

Sharing volumes with Cache Residency Manager

You can use volumes with Cache Residency Manager settings as SI P-VOLs and S-VOLs.

Sharing volumes and Data Retention Utility access attributes

You can share volumes on which you set Data Retention Utility access attributes.

Access attributes and supported ShadowImage tasks

You can create SI pairs using volumes on which you set Data Retention Utility access attributes.

Note: Performing SI tasks does not change Data Retention Utility access attributes.

The volume access attributes that you have specified for the SI pair determines the SI pair tasks that you can perform. The pair tasks you can perform are different depending on whether you set Data Retention Utility access attributes using HDvM - SN or CCI.

The following table shows a list of the volume access attributes specified for the SI pair and the pair tasks that you can perform when using HDvM - SN to set access attributes.

Volume access attributes specified for the SI pair		SI pair tasks		
P-VOL	**S-VOL**	**Create, Split, Suspend, Resync (Normal Copy)**	**Resync (Reverse Copy)**	**Delete**
Read/Write	Read/Write	YES	YES	YES
Read Only, Protect, S-VOL Disable	Read/Write	YES	NO	YES
Read/Write, Read Only, Protect, S-VOL Disable	Read Only, Protect, S-VOL Disable	NO	NO	YES

The following table shows a list of the volume access attributes specified for the SI pair and the pair tasks that you can perform when using CCI to set access attributes.

Volume access attributes specified for the SI pair		SI pair tasks		
P-VOL	**S-VOL**	**Create, Split, Suspend, Resync (Normal Copy)**	**Resync (Reverse Copy)**	**Delete**
Read/Write, Read Only, Protect	Read/Write, Read Only, Protect	YES	YES	YES
S-VOL Disable	Read/Write, Read Only, Protect	YES	NO	YES
Read/Write, Read Only, Protect, S-VOL Disable	S-VOL Disable	NO	NO	YES

Access attribute setting for existing pair volumes

A pair's status determines the access attributes you can set for existing P-VOLs or S-VOLs. Depending on the SI pair status, you may not be able to set access attributes for SI P-VOLs and S-VOLs from the Data Retention Utility. Access attribute settings also depend on whether you set Data Retention Utility access attributes using HDvM - SN or CCI.

The following table shows which attributes you can set depending on the pair status when using HDvM - SN to set access attributes.

Volume specified by SI		Attribute setting	
Pair status	**Volume**	**Read/Write**	**Read Only, Protect, or S-VOL Disable**
COPY	P-VOL	YES	YES
	S-VOL	YES	NO
PAIR	P-VOL	YES	YES
	S-VOL	YES	NO
COPY(SP)/COPY	P-VOL	YES	YES
	S-VOL	YES	NO
PSUS(SP)/PSUS	P-VOL or S-VOL	YES	YES
PSUS	P-VOL or S-VOL	YES	YES
SMPL(PD)	P-VOL or S-VOL	YES	YES
COPY(RS)/COPY	P-VOL	YES	YES
	S-VOL	YES	NO
COPY(RS-R)/ RCPY	P-VOL or S-VOL	YES	NO

Volume specified by SI		Attribute setting	
Pair status	Volume	Read/Write	Read Only, Protect, or S-VOL Disable
PSUE	P-VOL or S-VOL	YES	YES

The following table shows which attributes you can set depending on the pair status when using CCI to set access attributes.

Volume specified by SI		Attribute setting	
Pair status	Volume	Read/Write, Read Only, or Protect	S-VOL Disable
COPY	P-VOL	YES	YES
	S-VOL	YES	NO
PAIR	P-VOL	YES	YES
	S-VOL	YES	NO
COPY(SP)/COPY	P-VOL	YES	YES
	S-VOL	YES	NO
PSUS(SP)/PSUS	P-VOL or S-VOL	YES	YES
PSUS	P-VOL or S-VOL	YES	YES
SMPL(PD)	P-VOL or S-VOL	YES	YES
COPY(RS)/COPY	P-VOL	YES	YES
	S-VOL	YES	NO
COPY(RS-R)/ RCPY	P-VOL or S-VOL	YES	NO
PSUE	P-VOL or S-VOL	YES	YES

Sharing volumes with Dynamic Provisioning and Dynamic Tiering

Volumes created using HDP or Hitachi Dynamic Tiering software (HDT) can be used as SI P-VOLs or S-VOLs.

If you are using an HDP volume as an SI P-VOL or S-VOL, the capacity of the HDP pool allocated to the volume is added to the SI licensed capacity.

Restrictions

The following restrictions apply:

- Because the S-VOL uses the same pool capacity as the P-VOL, the following volume combinations are not recommended:

    - Using only the S-VOL as a Dynamic Provisioning volume (DP-VOL).
    - Using the P-VOL as a DP-VOL with the Data Direct Mapping attribute, and the S-VOL as a normal DP-VOL.
- You cannot perform a Quick Restore if only the P-VOL or only the S-VOL is a Dynamic Provisioning volume. For Quick Restore, you must use DP-VOLs for both the P-VOL and S-VOL.
- You can use a maximum size Dynamic Provisioning as an SI P-VOL or S-VOL. For information about the maximum size for Dynamic Provisioning volumes, see the *Hitachi Virtual Storage Platform Provisioning Guide*.
- When you create an SI pair using a DP-VOL greater than 4,194,304 MB (8,589,934,592 blocks), the differential data is managed in a pool associated with the SI pair volume. In this case, the required pool capacity for managing the differential data varies depending on the product configuration, with a maximum of four pages for every 4,123,168,604,160 bytes.
- Performing an SI paircreate or pairresync operation while zero pages are being reclaimed (including operations by Writesame, Unmap, and Rebalance) results in the zero-page reclamation being interrupted.
- An SI create pair operation may be rejected if the Unmap command operation is in progress with system option mode 905 ON. Retry the SI operation after a while. If the operation still fails, set system option mode 905 to OFF and retry.

Related topics

- SI licensed capacity and licensed capacity requirements on page 2-3.
- Releasing differential data for ShadowImage pairs on page 4-14

Sharing volumes with LUN Manager

LUN Manager tasks do not affect SI tasks. You can assign volumes that are under secure ports and/or that are assigned to World Wide Name (WWN) groups and/or LUN groups to SI pairs. You can also use volumes that are assigned to SI pairs in LUN Manager tasks, such as assignment to WWN groups and/or LUN groups.

A host cannot access SI S-VOLs except when you split the pair.

Sharing volumes with Resource Partition Manager

You can share SI P-VOLs and S-VOLs with Resource Partition Manager by specifying them in a Resource Partition Manager resource group.

For more information about Resource Partition Manager, see the *Hitachi Virtual Storage Platform Provisioning Guide*

Prerequisite: The resource group must be assigned to a user group for which you have privileges.

Sharing volumes with Thin Image

You can share SI volumes with HTI volumes. You can assign shared pairs to CTGs, though not to the same CTG.

The following table shows how you can share HTI volumes.

HTI volumes	SI volume	
	P-VOL	S-VOL
P-VOL (all statuses except "RCPY")[1]	YES	YES [2]
HTI V-VOL	NO	NO
HTI pool volume	NO	NO

1. SI cannot use an HTI P-VOL in "RCPY" status.
For more information about sharing volumes, see the following tables.
2. You must create the SI pair before you create the HTI pair.

SI pair tasks that you can perform are limited according to the HTI pair status. The following topics show the SI supported tasks.

Pair tasks with Thin Image primary volume shared with ShadowImage primary volume

The following table shows the pair tasks that you can perform when you share the SI P-VOL with the HTI P-VOL.

SI task (CCI command)	HTI pair status						
	COPY [1]	PAIR, PFUL	PSUS, PFUS	SMP L(PD)	COPY [2]	RCPY	PSUE
Create a pair (paircreate)	YES	YES	YES	YES	YES	NO	YES
Create and split a pair (paircreate -split)	YES	YES	YES	YES	YES	NO	YES
Split a pair (pairsplit)	YES	YES	YES	YES	YES	NO	YES
Resynchronize a pair (pairresync)	YES	YES	YES	YES	YES	NO	YES
Reverse Copy a pair (pairresync -restore)	YES	YES[3]	YES	YES	YES	NO	YES
Quick Restore a pair (pairresync -restore)	NO	NO	NO	NO	NO	NO	NO
Suspend a pair task (pairsplit -E)	YES	YES	YES	YES	YES	YES	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES	YES

1. "COPY" status during an initial copy.
2. "COPY" status during resynchronization.
3. After issuing pairsplit command for HTI pair which consistency group is configured, please confirm that all the pairs in HTI consistency group are PSUS status then execute SI task. Otherwise, HTI

SI task (CCI command)	HTI pair status						
	COPY [1]	PAIR, PFUL	PSUS, PFUS	SMP L(PD)	COPY [2]	RCPY	PSUE
snapshot data and P-VOL data at which the storage system accepted pairsplit command will not be consistent. Please refer to *Hitachi Thin Image User Guide* for more information.							

Pair tasks with Thin Image primary volume shared with ShadowImage secondary volume

The following table shows the pair tasks that are supported when you share the SI S-VOL with the HTI P-VOL.

SI task (CCI command)	HTI pair status						
	COPY [1]	PAIR, PFUL	PSUS, PFUS	SMP L(PD)	COPY [2]	RCPY	PSUE
Create a pair (paircreate)	NO	NO	NO	NO	NO	NO	NO
Create and split a pair (paircreate -split)	NO	NO	NO	NO	NO	NO	NO
Split a pair (pairsplit)	YES	YES [3]	YES	YES	YES	NO	YES
Resynchronize a pair (pairresync)	YES	YES [3]	YES	YES	YES	NO	YES
Reverse Copy a pair (pairresync -restore)	YES	YES [3]	YES	YES	YES	NO	YES
Quick Restore a pair[4] (pairresync -restore)	NO	NO	NO	NO	NO	NO	NO
Suspend a pair task (pairsplit -E)	YES	YES	YES	YES	YES	NO	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES	YES

1. "COPY" status during an initial copy.
2. "COPY" status during resynchronization.
3. After issuing pairsplit command for HTI pair which consistency group is configured, please confirm that all the pairs in HTI consistency group are PSUS status then execute SI task. Otherwise, HTI snapshot data and P-VOL data at which the storage system accepted pairsplit command will not be consistent. Please refer to *Hitachi Thin Image User Guide* for more information.
4. You can use the HTI P-VOL data when the host accesses the HTI S-VOL. You cannot Quick Restore to exchange the SI P-VOL and S-VOL.

Sharing volumes with TrueCopy

You can share both SI P-VOLs and S-VOLs with TC P-VOLs and S-VOLs. However, you cannot share SI S-VOLs with TC S-VOLs.

The write operation on the TC P-VOL takes more time when you share an SI P-VOL with a TC S-VOL. This is especially true when the SI pair is in the

process of being Quick Split ("PSUS(SP)/PSUS" status) because of the SI pair copying time.

For more information about the methods you can use to split pairs, see Pair splitting methods on page 4-19.

- You can use SI cascaded pairs as TC pairs. TC does not distinguish between node and leaf volumes in cascaded pairs. Both are considered S-VOLs.

  For more information about cascaded pairs, see Cascaded pairs on page 1-4.
- If you plan to Quick Restore the SI pair, you must first suspend the TC pair.
- You can perform a CTG pair-split on SI pairs that share volumes with TC S-VOLs.

  For more information about CTG pair-split for shared volumes, see Using consistency group pair-split with shared volumes on page 4-23.

Related topics

- For more information about sharing SI and TC volumes, see the *Hitachi TrueCopy® User Guide*.

Sharing volumes with Universal Replicator

You can share SI P-VOLs with UR P-VOLs and S-VOLs.

- You can use SI cascaded pairs as UR pairs. In cascaded pairs, UR does not distinguish between node and leaf volumes. Both are considered as S-VOLs.

  For more information about cascaded pairs, see Cascaded pairs on page 1-4.
- If you plan to Quick Restore the SI pair, do not suspend the UR pair.

  For more information about Quick Restore, see Reverse resynchronization on page 4-30.
- You can perform a CTG pair-split on SI pairs that share volumes with UR S-VOLs.

  For more information about using CTG pair-split on pairs with shared volumes, see Using consistency group pair-split with shared volumes on page 4-23.

For more information about sharing SI and UR volumes, see the related appendix in the *Hitachi Universal Replicator User Guide*.

Sharing volumes with Universal Volume Manager

You can create SI pairs using Universal Volume Manager external volumes.

For more information about Universal Volume Manager external volumes, see the *Hitachi Universal Volume Manager User Guide*.

Sharing volumes with Hitachi Volume Migration

You can assign the following SI volumes to volumes reserved for Volume Migration:

- L1 P-VOL with up to two S-VOLs.
- L2 P-VOL with an S-VOL.

Workflow for assigning SI volumes to volumes reserved for Volume Migration

Use the following workflow to assign SI volumes to volumes reserved for Volume Migration:

1. If you are assigning SI volumes other than the ones you can assign to volumes reserved for Volume Migration, delete the SI pair. Otherwise, skip this step.
2. Complete one of the following:
   - Assign the SI volumes to a volume reserved for Volume Migration.
   - Migrate the volumes.
3. If you assigned the SI volumes to a volume reserved for Volume Migration, complete the following:
   a. Release the pair volumes from the volume reserved for Volume Migration.
   b. Perform SI pair tasks.

Sharing volumes with global-active device

The following table lists the volumes that can be shared between global-active device (GAD) and ShadowImage.

GAD volume	ShadowImage volume	
	P-VOL	S-VOL
GAD P-VOL	YES	NO
GAD S-VOL	YES	NO
GAD reserve attribute volume	NO	NO
GAD quorum disk volume	NO	NO

Pair tasks with ShadowImage P-VOL shared with GAD P-VOL

The following table lists the pair tasks that you can perform when you share an SI P-VOL with a GAD P-VOL.

Note:

- If a pair which cannot be split exists in a consistency group (CTG), all pairs within the CTG will be suspended (PSUE status) when executing a CTG pair split function for ShadowImage.
- If you want to split a ShadowImage pair which links with a GAD pair and acquire a backup, you must stop I/O for the target backup volume, and then split the ShadowImage pair. If you split the ShadowImage pair before stopping the I/O, sometimes it fails to keep consistency for the ShadowImage S-VOL.

ShadowImage task (CCI command)	GAD pair status and I/O mode					
	COPY	PAIR	PSUS		PSUE	
	Mirror(RL)	Mirror(RL)	Local	Block	Local	Block
Create a pair (paircreate)	YES	YES	YES	YES	YES	YES
Create and split a pair (paircreate -split)	YES	YES	YES	YES	YES	YES
Split a pair (pairsplit)	YES	YES	YES	YES	YES	YES
Resynchronize a pair (pairresync)	YES	YES	YES	YES	YES	YES
Normal Reverse Copy a pair (pairresync -restore)	NO	NO	YES	NO	YES	NO
Fast Reverse Copy a pair (pairresync -restore)	NO	NO	NO	NO	NO	NO
Suspend a pair task (pairsplit -E)	YES	YES	YES	YES	YES	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES

Pair tasks with ShadowImage P-VOL shared with GAD S-VOL

The following table lists the pair tasks that you can perform when you share an SI P-VOL with a GAD S-VOL.

ShadowImage task (CCI command)	GAD pair status and I/O mode				
	COPY	PAIR	SSUS	PSUE	SSWS
	Block	Mirror(RL)	Block	Block	Local
Create a pair (paircreate)	YES	YES	YES	YES	YES
Create and split a pair (paircreate -split)	NO	YES	YES	YES	YES
Split a pair (pairsplit)	NO	YES	YES	YES	YES
Resynchronize a pair (pairresync)	NO	YES	YES	YES	YES
Normal Reverse Copy a pair (pairresync -restore)	NO	NO	NO	NO	YES
Fast Reverse Copy a pair (pairresync -restore)	NO	NO	NO	NO	NO
Suspend a pair task (pairsplit -E)	YES	YES	YES	YES	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES

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

4

Managing ShadowImage pairs

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

Workflow for managing ShadowImage pairs

During most pair user tasks, the P-VOL remains available to the host for I/O operations. You must have the Storage Administrator (Local Copy) role to perform SI pair user tasks.

Use the following workflow to complete pair user tasks:

1. Check the pair status (see Checking SI pairs on page 4-4).
   For more information about the required status for pair user tasks, see Pair status and supported pair user tasks on page 5-7.
2. Create the SI pairs (see SI pair creation on page 4-5).
3. (Optional) Suspend the SI pair creation.
   For more information about suspending SI pair creating, see Suspending SI pair creation on page 4-15.
4. (Optional) Suppress update copy operations during pair restoration (see Suppressing update copy operations during pair restoration on page 4-35).
5. Split the pairs. You can do the following:
   - Split SI pairs (see Splitting SI pairs on page 4-19).
   - Split SI pairs in a CTG (see Splitting pairs using consistency groups on page 4-23).
6. Resynchronize or restore the SI pairs (see Resynchronizing or restoring SI pairs on page 4-32).
7. (Optional) If you have performed a Quick Resync on the pair ("PAIR" status), suppress copy processing (see Suppressing update copy operations during pair restoration on page 4-35).
8. Delete the SI pairs, which ends the pair relationship between the pair volumes (see Deleting SI pairs on page 4-36).

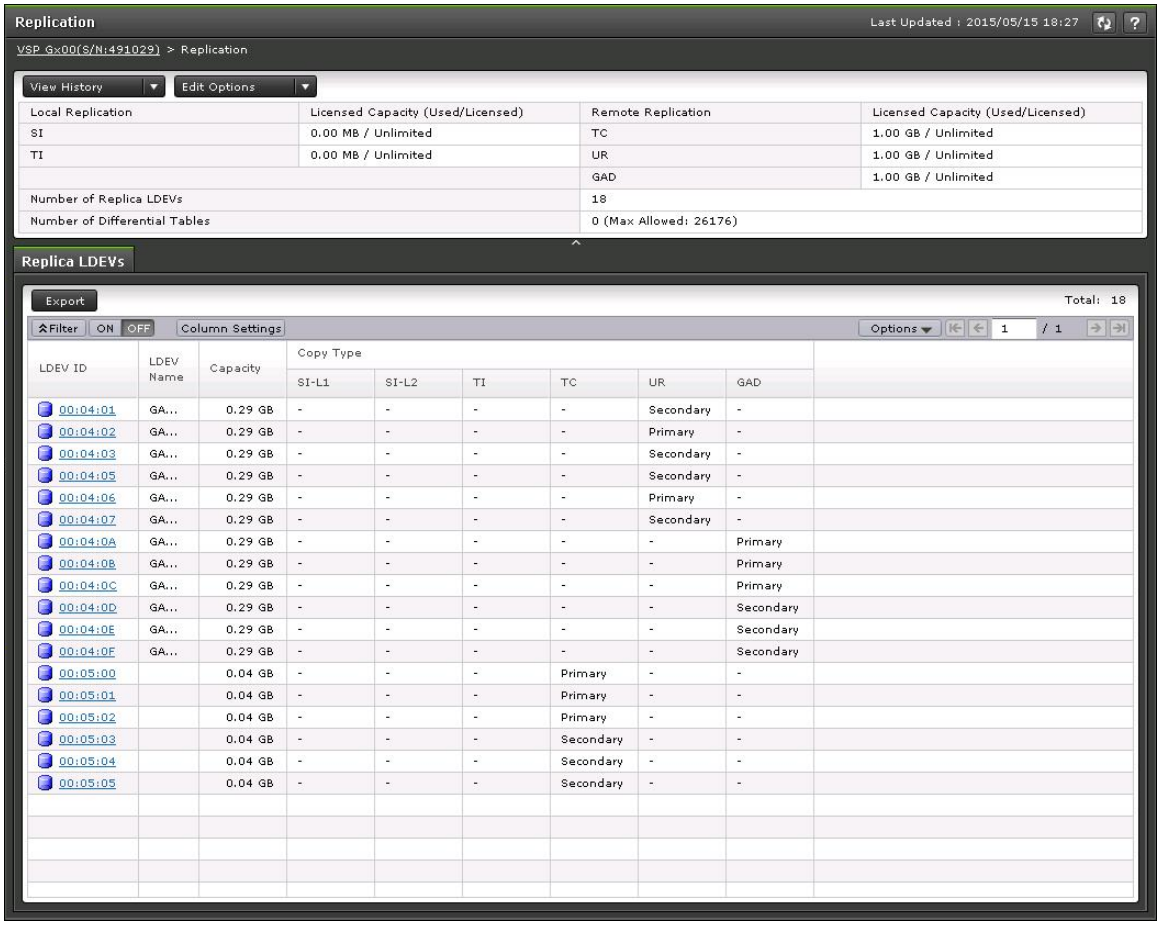
In ShadowImage, it might take a lot of time before a copy operation starts. This is because before a copy operation starts, differential tables are initialized for the relevant pairs, one pair after another, within the system. Especially when the pairs use a large volume of data, initialization can be a very long process.

Setting HOST I/O Performance option

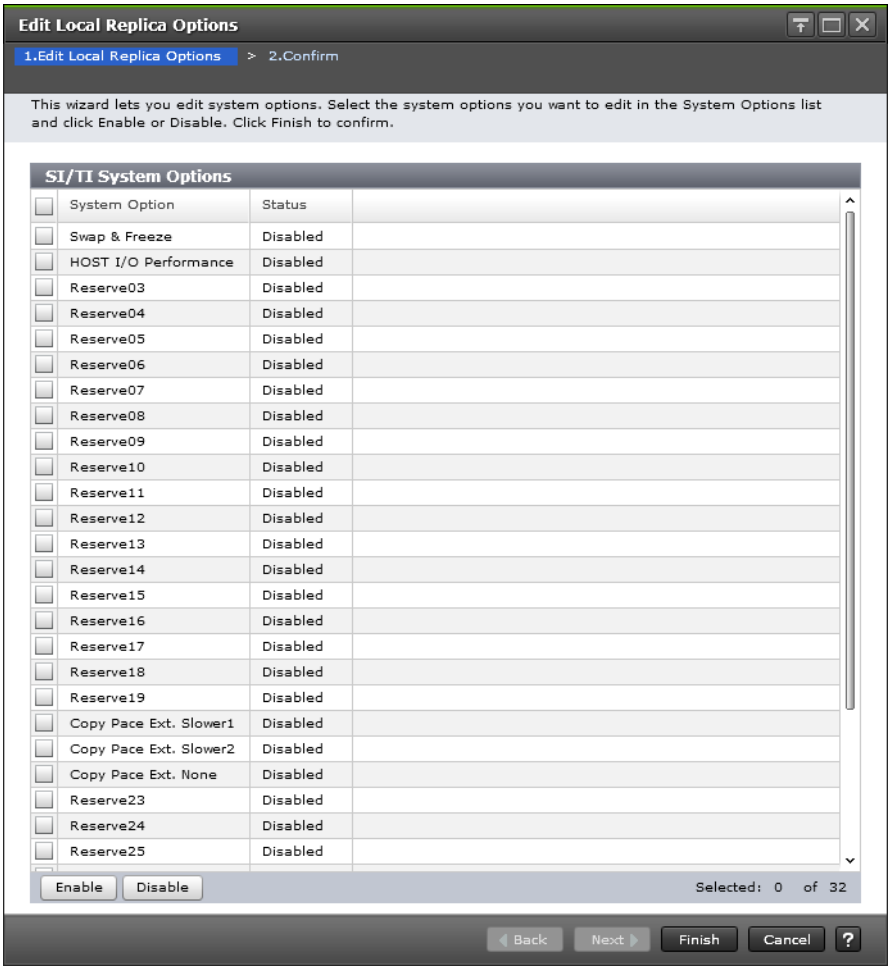
Use the following procedure to set the host I/O performance option:

1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, 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. From the **SI/TI System Options** table, select **HOST I/O Performance**, and then click **Enable**.
4. Click **Finish**.
5. Enter a task name and click **Apply** to apply the setting to the storage system. The setting is queued as a task and performed in order.

Tip: To open the task window after closing the wizard, select **Go to tasks window for status** and click **Apply** in the wizard.

6. Open the task window to verify the result of the operation. A task can be suspended or canceled if the processing of the task is not started.

Checking SI pairs

Check the SI pair status to determine if you can perform a task. Check the status of related L1 and L2 pairs to determine if you can perform a task.

Related topics

- For more information about pair status definitions and instructions for finding pair status, see Monitoring the ShadowImage system on page 5-2.
- For more information about maintaining your system, see Monitoring SI pair status and available activity on page 5-3.
- For more information about related L1 and L2 pair status, see L1, L2 pair status and supported pair user tasks on page 5-7.

SI pair creation

When you create a pair, the storage system performs an initial copy to copy data in the P-VOL to the S-VOL. You can create the SI pair and immediately split the pair so that you can access the S-VOL. You can also create a cascaded pairs.

Creating an SI pair causes the MP unit that is responsible for processing the P-VOL LDEV's I/O to assume processing responsibility for the S-VOL LDEV's I/O operations.

Related topics

- Considerations for creating SI pairs on page 4-6.
- Creating SI pairs on page 4-6.
- Cascaded pairs on page 1-4.
- Initial copy workflow on page 1-6.
- Update copy workflow on page 1-7.
- Create SI Pairs wizard on page B-26.
- MP units and deleting pairs on page 4-38.

Workflow for creating ShadowImage pairs

Use the following workflow to create an SI pair:

1. If you are creating L1 and L2 pairs, check the status.
   For more information about L1 and L2 status and the tasks that you can perform, see L1, L2 pair status and supported pair user tasks on page 5-7.
2. Select the volume that you want to duplicate. This becomes the primary volume (P-VOL).

Note: You cannot use volumes in use by SI as destination volumes.

3. Identify the volume that will contain the copy. This becomes the secondary volume (S-VOL).

If you are creating L1 and L2 pairs with different topologies, specify the pair configuration settings

For more information about setting up pair configurations, see Creating L1 and L2 pairs with different topologies on page 4-12.

4. Create the pair by associating the P-VOL and the S-VOLs.

   The storage system starts the initial copy.

   For more information:

   - About how to create SI pairs, see Creating SI pairs on page 4-6.
   - About the workflow of the initial copy, see Initial copy workflow on page 1-6.

5. (Optional) Suppress copy processing.

   For more information about suppressing copy processing, see Suppressing update copy operations during pair creation on page 4-14.

Considerations for creating SI pairs

Keep the following considerations in mind when creating SI pairs:

- The P-VOL and S-VOL must be the same size in blocks. 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 your storage system has encryption DKAs, you can copy an encrypted volume to an unencrypted volume. There is no guard logic to enforce copying encrypted P-VOLs to only encrypted S-VOLs, so unless there is a specific reason for the data to become unencrypted, make sure you maintain the encryption by using only encrypted S-VOLs.
- The larger the volume capacity, the longer the time from creation of a pair until its transition to PAIR status. For virtual volumes, the more pages allocated to a virtual volume, the longer the time from pair creation to PAIR status. Note that even when no pages are allocated to a virtual volume, if the volume capacity is 256 TB, it takes at least an hour until the status changes to PAIR after pair creation.

Creating SI pairs

Creating an SI pair copies the P-VOL to the S-VOL.

Note: SI 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 retry again.

Prerequisites:

- The P-VOL and S-VOL are unpaired.
- If the P-VOL is already paired with other S-VOLs ("PAIR" status), you have determined that the status of existing S-VOLs is the status that is required to create the new pair.

For more information about S-VOL status, see Unaffected S-VOL status and pair user tasks on page 5-9.

- If you are concerned with host server I/O performance, make sure that the I/O load is light.

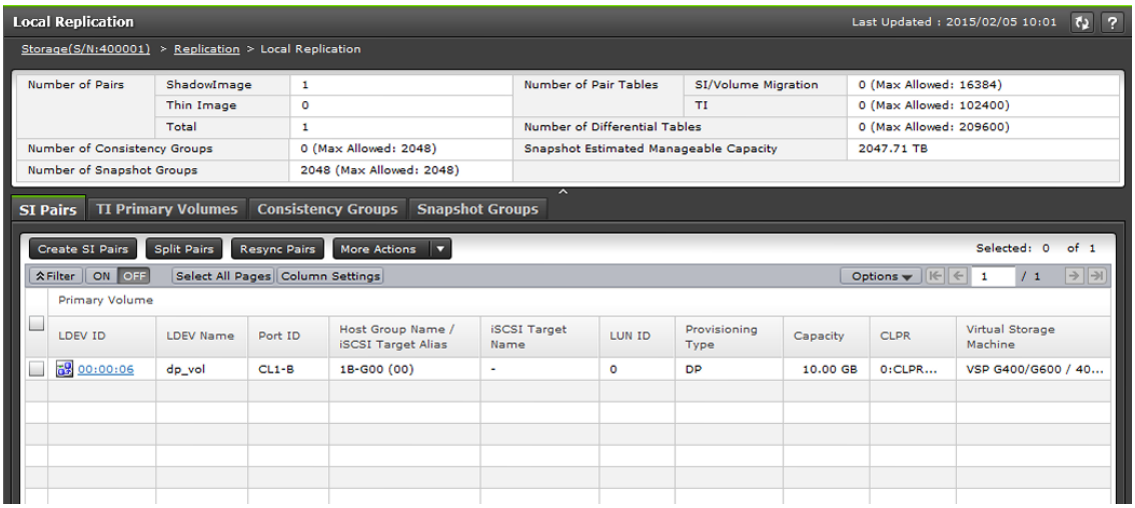
  For more information about checking I/O performance-related information, see the *Hitachi Command Suite User Guide*.
- You must set the same T10 PI attribute value for both the P-VOL and S-VOL.

1. In Hitachi Command Suite:

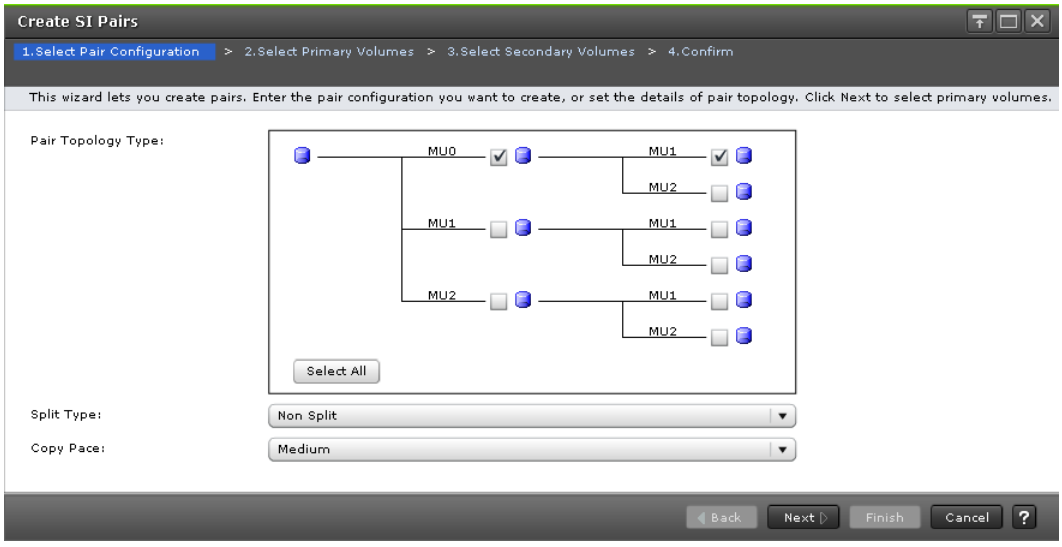
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication > Local Replication**.
2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, click **Create SI Pairs**.



4. In the **Select Pair Configuration** window of the **Create SI Pairs** wizard, complete the following and then click **Next**:

   - For **Copy Type**, select **ShadowImage**.
   - For **Pair Topology Type**, select the pair topologies that match your configuration.

     For more information about creating L1 and L2 pairs with different topologies, see Creating L1 and L2 pairs with different topologies on page 4-12.
   - For **Split Type**, select how you want to split the pair.

     Values:

     - **Non Split:** The pair is not split.

     Note: If you are simultaneously creating an L1 pair and an L2 pair, to prevent a failure and splitting the L2 pair before the pair is split ("PSUS" status), select **Non Split**.

     - **Quick Split:** Splits the new pair and then copies the data so that the S-VOL is immediately available for read and write I/O. The storage system copies the remaining differential data to the S-VOL in the background.

     - **Steady Split:** Copies the differential data to the S-VOL and then splits the new pair.

     Default: **Quick Split**
   - For **Copy Pace**, select the rate at which you want the storage system to copy data.

     Values:

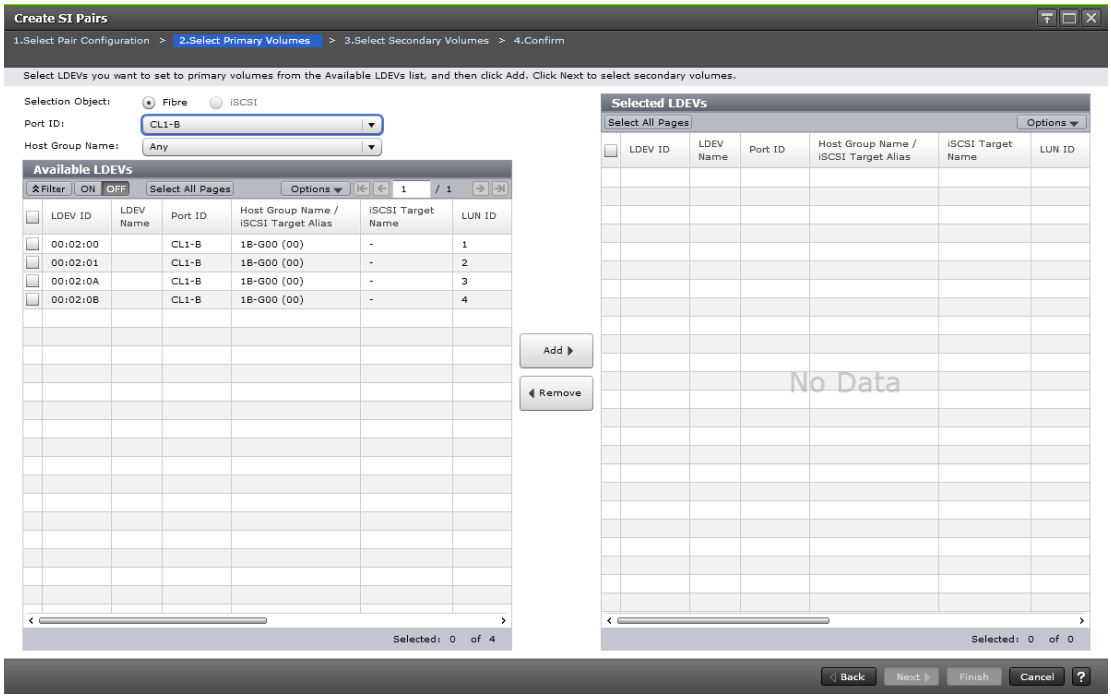
     - **Slower:** Improved host server I/O performance but slower processing speed.

     - **Medium:** Average processing speed and host server I/O performance.

     - **Faster:** Faster processing speed but slower host server I/O performance.

     Note: Processing speed and host server I/O performance are affected by the pace you select.

     For more information about performance, see Performance planning and I/O performance effect for SI system on page 2-9.



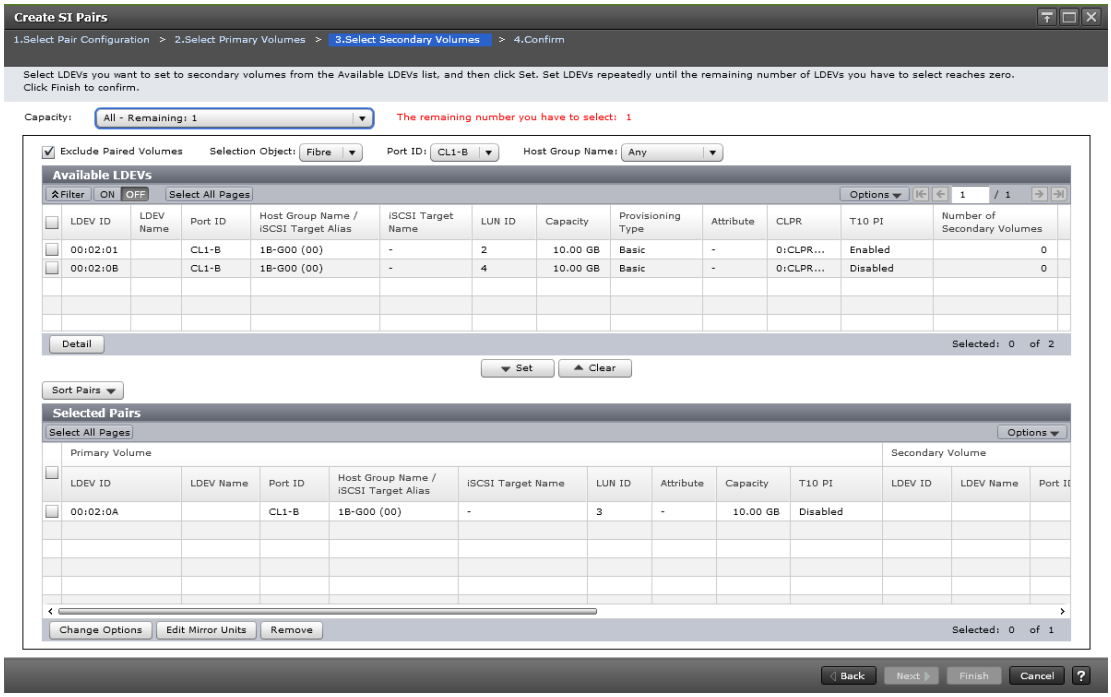
5. In the **Select Primary Volumes** window of the **Create SI Pairs** wizard, complete the following:

   a. In the **Available LDEVs** table, select the LDEV you want to be the P-VOL and then click **Add**.

Note: You can filter LDEV by Port ID, Host Group Name or iSCSI Target Alias.

   The LDEV is moved to the **Selected LDEVs** table.

   b. Click **Next**.



6. In the **Select Secondary Volumes** window of the **Create SI Pairs** wizard, assign LDEVs as S-VOL to the specified P-VOL LDEV (or LDEVs). Complete the following and then click **Finish**:

   - If you specified one P-VOL, select a secondary LDEV from the **Available LDEVs** table, and click **Set**. Repeat this step to assign additional S-VOLs.
   - If you specified multiple P-VOLs, select an LDEV from the **Available LDEVs** table and then select a P-VOL LDEV from the **Selected Pairs** table, and click **Set**. Repeat this step as many times as needed to make all your pairings.

Note: If you do not select a P-VOL from the **Selected Pairs** table, the S-VOL you select and set is assigned to P-VOLs in the order they are listed in the table.

   - (Optional) To sort the **Available LDEVs** and **Selected Pairs** tables according to the capacity, for **Capacity**, choose a capacity item by which to sort the tables.

     The remaining number you have to select refers to the P-VOLs that do not have an assigned S-VOL, as seen in the **Selected Pairs** table.
   - (Optional) To select LDEVs to be displayed in the **Available LDEVs** table by each port ID, host group name or iSCSI target alias, choose from Port ID, Host Group Name or iSCSI target alias.
   - (Optional) To sort the **Selected Pairs** table, click **Sort** in the middle-left.
   - (Optional) To change the split type and the rate at which data is copied, which applies to all new pairs, change the pair options.

For more information about changing pair options, see Changing SI pair options on page 4-16.

- (Optional) To change MU numbers, do the following:

  a. Select the line for the LDEV in the **Selected Pairs** table.

  b. Click **Edit Mirror Units**.

  c. In the **Edit Mirror Units** dialog box, specify the S-VOL's L1 and L2 mirror unit numbers, and click **OK**.

  The pair topology is modified.

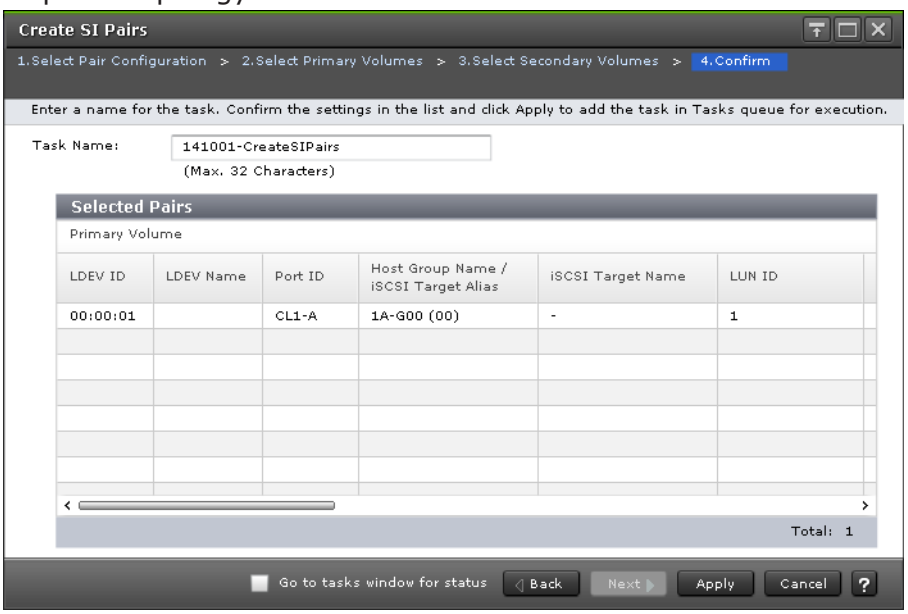
  For more information about changing a pair's topology, see Creating L1 and L2 pairs with different topologies on page 4-12.

- (Optional) Change the pair options.

  For more information about changing pair options, see Changing SI pair options on page 4-16.

- (Optional) To remove an unwanted LDEV or pair from the **Selected Pairs** table, select the line for the LDEV or pair you want to remove and click **Remove**.

  The pair's topology is refined.



7. In the **Confirm** window of the **Create SI Pairs** wizard, complete the following and then click **Apply**. The setting is queued as a task and performed in order.

   - For **Task Name**, type a name for the task.

     Default: *date-window name*

     Character and symbol limit: 32 alphanumeric except / : , ; * ? " < > |

     Case sensitive: Yes

   - For **Go to tasks window for status**, select to open the **Tasks** window.

   The SI pair is created and the status is "PAIR".

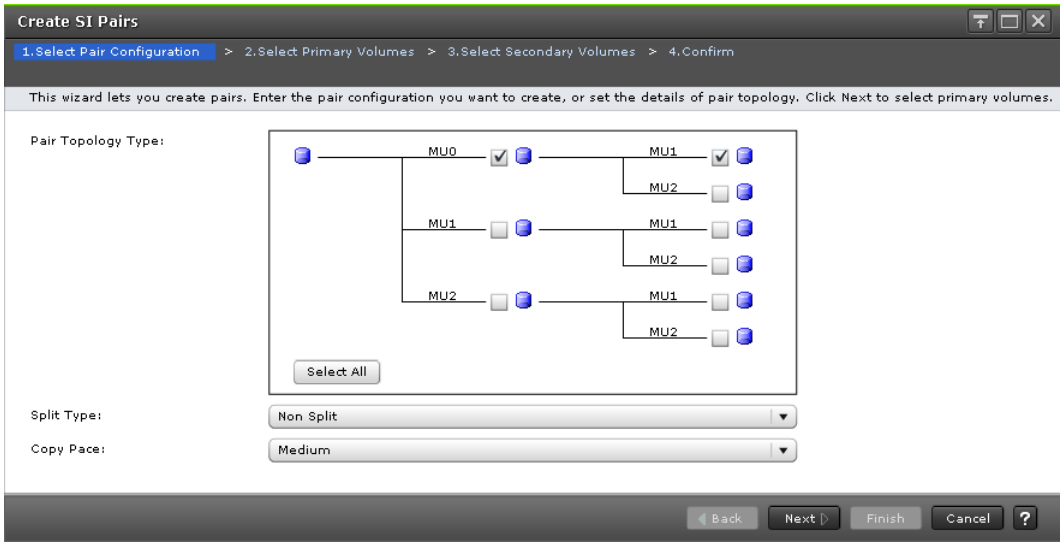
8. Open the **Tasks** window to verify the result of the operation. A task can be suspended or canceled if the processing of the task is not started.

Related topics

- Quick Split and Steady Split performance planning on page 2-9.
- Considerations for creating SI pairs on page 4-6.
- Changing SI pair options on page 4-16.
- Viewing pair information for local replication on page 5-2.

Creating L1 and L2 pairs with different topologies

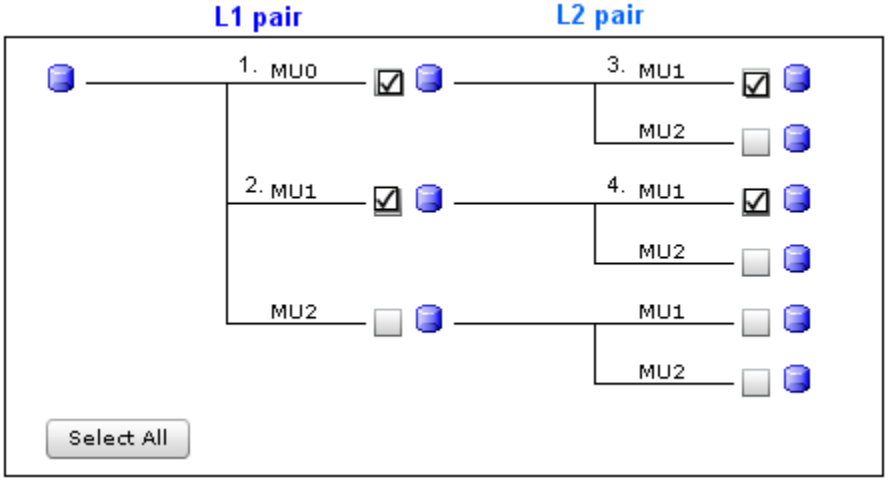
Begin creating a pair by specifying the L1 and L2 pair topology in the **Select Pair Configuration** window of the **Create SI Pairs** wizard.



Specify the pair topology one time. This topology applies to all P-VOLs in the task.

To change L1 and L2 pair configuration, set the topology for the pair with the largest topology.

The following image shows an example of the P-VOL with the largest topology of all the pairs you create in a single task.

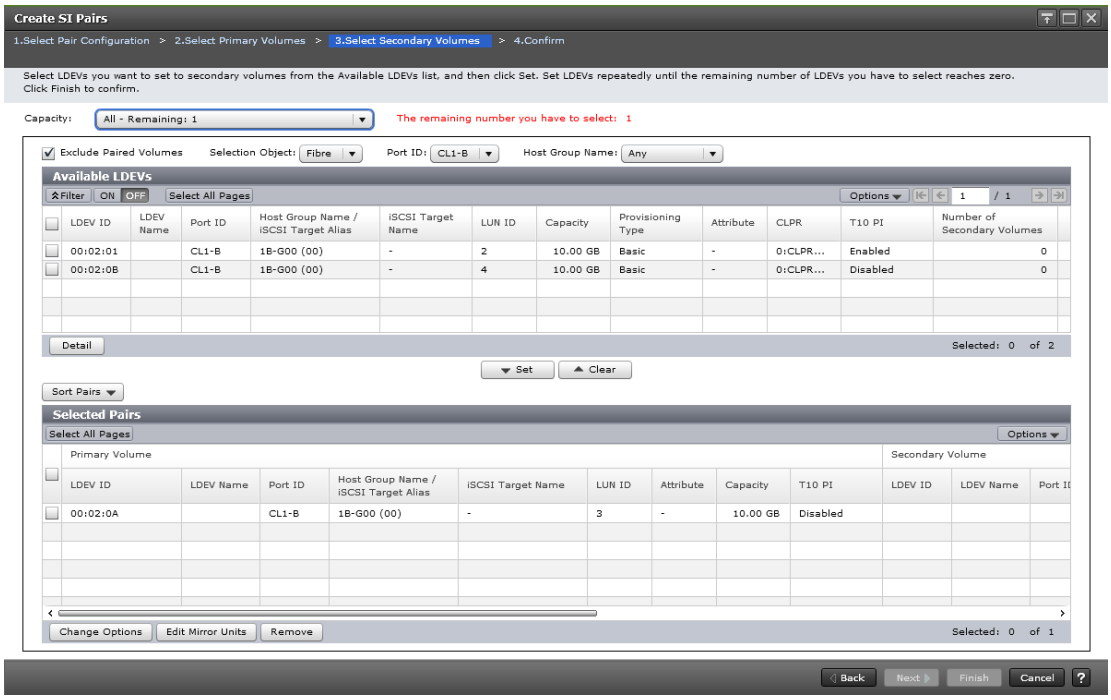


Example: Changing a pair's L1 and L2 combination

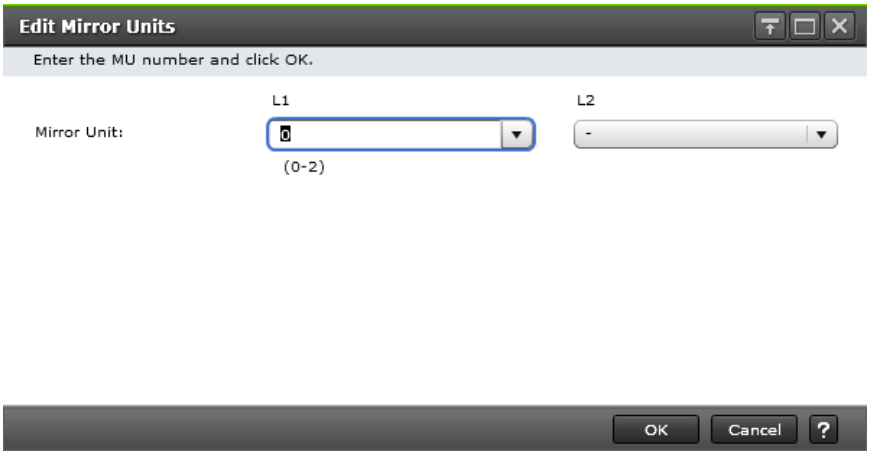
You can change L1 and L2 pair configurations that do not match the specified configuration in the **Create SI Pairs** wizard. This is also true when you create a new pair using an existing P-VOL with an existing configuration.

For example, use the following steps to pair the L2 S-VOL labelled 4 (MU1) in the preceding topology with the L1 volume labelled 1 (MU0).

1. Open the **Select Secondary Volumes** window of the **Create SI Pairs** wizard.



2. In the **Select Secondary Volumes** window of the **Create SI Pairs** wizard, from the **Selected Pairs** table, select the line for the S-VOL that has the pair topology you want to configure, and then click **Edit Mirror Units**.

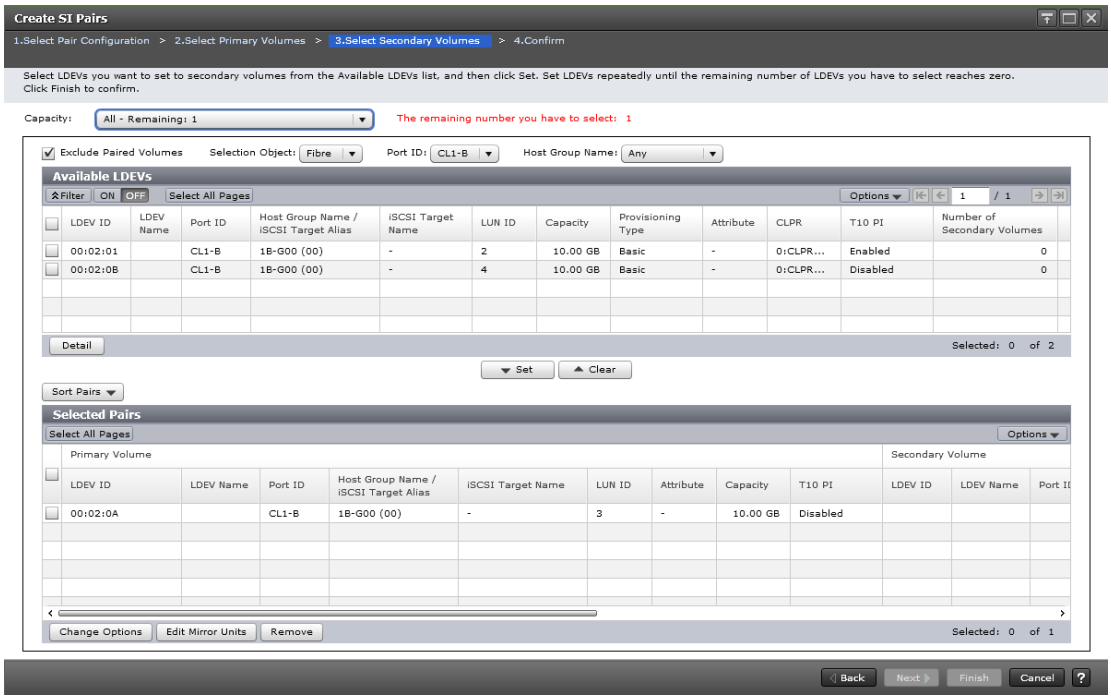


3. In the **Edit Mirror Units** dialog box, for **Mirror Unit**, select 0 for L1, and select 2 for L2.

Refining pair topology

You can refine a pair's topology by removing unwanted volumes.

1. Open the **Select Secondary Volumes** window of the **Create SI Pairs** wizard.



2. In the **Selected Pairs** table, select the line for the pair you want to remove and click **Remove**.

   The volume is removed from the table.

Suppressing update copy operations during pair creation

You can suppress update copy operations after you create pairs. Suppressing update copy operations keeps the P-VOL and S-VOL unsynchronized and reduces the effect on host server I/O performance.

Prerequisite: The pair status is "PAIR".

1. Enable the **Swap & Freeze** system option.

   For more information about how to enable this system option, see Changing system options on page 5-18.

Related topics

- System options that affect performance on page 2-8.

Releasing differential data for ShadowImage pairs

1. Delete all pairs using the V-VOL containing the differential data (pages) that needs to be released.
2. Set system option mode 755 to OFF, so that you can reclaim zero pages.

3. Restore the blocked pool.
4. Release pages in the V-VOL.

   To release pages in Device Manager - Storage Navigator, use the **Reclaim Zero Pages** window. In **CCI**, use the **`raidcom modify ldev`** command. Releasing pages might take some time.

Suspending SI pair creation

Suspending a pair creation copies the entire P-VOL to the S-VOL. The P-VOL continues accepting write I/O operations from the hosts, and host data written to the P-VOL after the suspend is issued will be marked as differential data.

The storage system automatically suspends a pair in the following cases:

- An error condition related to an update copy operation is detected.
- It cannot keep the pair mirrored.

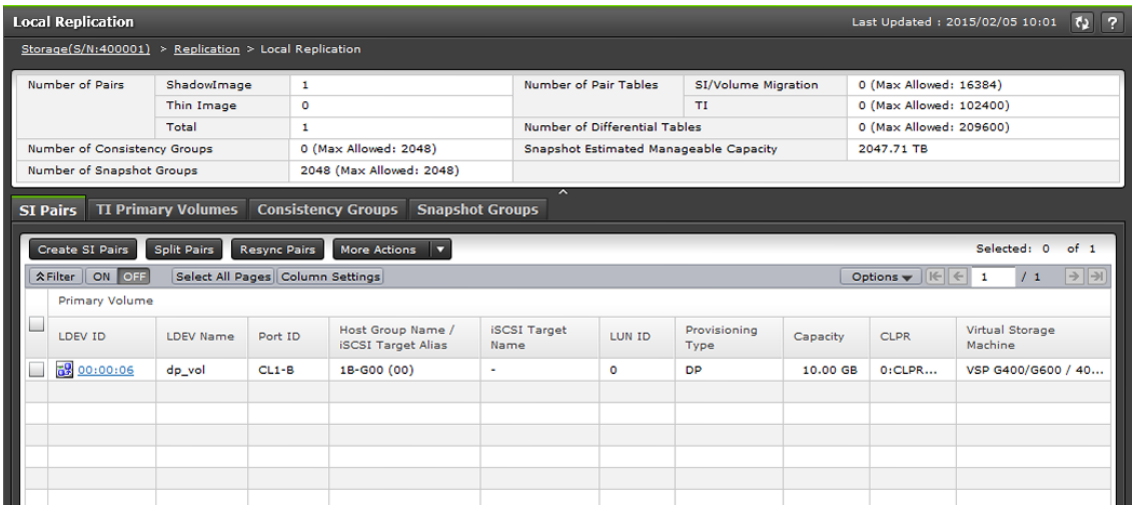
1. In Hitachi Command Suite:

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

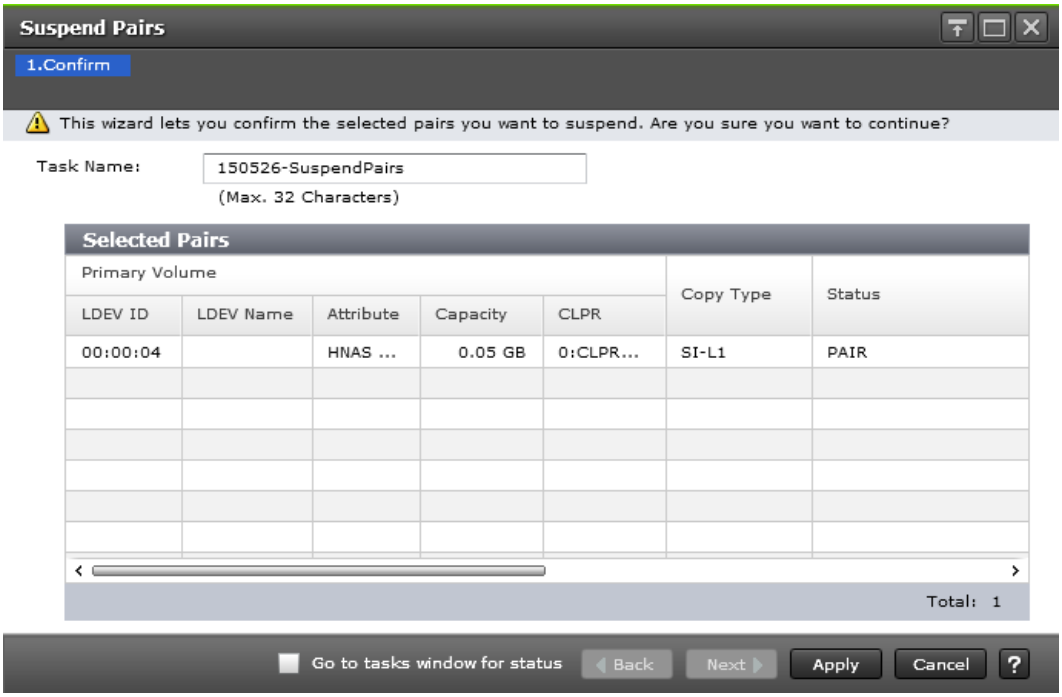
   In Device Manager - Storage Navigator:

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

2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, select the pair that you do not want to create and click **More Actions > Suspend Pairs**.



4. In the **Suspend Pairs** window, complete the following and then click **Apply**. The setting is queued as a task and performed in order.
   - For **Task Name**, type a name for the task.
     Default: *date-window name*
     Character and symbol limit: 32 alphanumeric except / : , ; * ? " < > |
     Case sensitive: Yes
   - For **Go to tasks window for status**, select to open the **Tasks** window.

   The pair is suspended ("PSUE" status).
5. Open the **Tasks** window to verify the result of the operation. A task can be suspended or canceled if the processing of the task is not started.

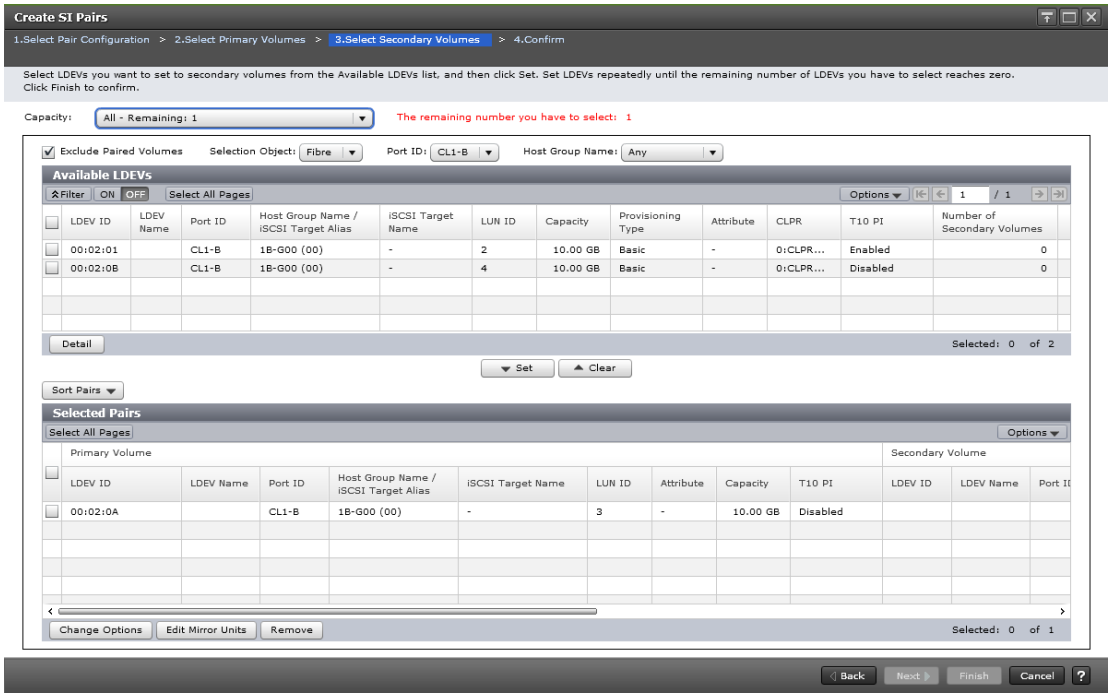
Related topics

- SI pair creation on page 4-5.
- Initial copy workflow on page 1-6.
- Update copy workflow on page 1-7.

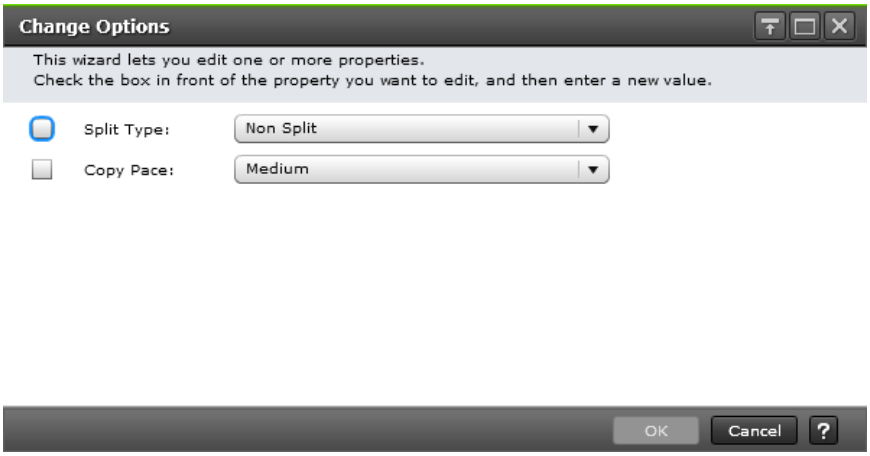
Changing SI pair options

You can change the default setting for the **Split Type** and **Copy Pace** system options for all new pairs that you create.

1. Open the **Select Secondary Volumes** window of the **Create SI Pairs** wizard.



2. In the **Select Secondary Volumes** window of the **Create SI Pairs** wizard, click **Change Options**.



3. In the **Change Options** dialog box, complete the following and then click **OK**:

   - For **Split Type**, select a split type.

     Values:

     - **Non Split:** The pair is not split.

     - **Quick Split:** The pair is split and then the differential data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background.

     - **Steady Split:** Differential data is copied and then the pair is split.

     Default: **Non Split**

   - For **Copy Pace**, select the rate at which you want the storage system to copy data.

Values:

- **Slower:** Improved host server I/O performance but slower processing speed.
- **Medium:** Average processing speed and host server I/O performance.
- **Faster:** Faster processing speed but slower host server I/O performance.

Default: **Medium**

Related topics

- Initial copy workflow on page 1-6.
- Pair splitting methods on page 4-19.
- Performance planning and I/O performance effect for SI system on page 2-9.

Splitting SI pairs

Splitting an SI pair suspends the pairing of the P-VOL and S-VOLs until a resync or delete operation is performed. Host updates to the P-VOL continue and are tracked as delta tracks in the bitmap. The S-VOL data is available and can be accessed.

Splitting an SI pair ensures data consistency and ensures that the data in the S-VOL at the time of the split is consistent and usable. The S-VOL contains a mirror image of the original volume at that point in time. It is available for read/write access by secondary host applications.

The P-VOL for a split pair continues to be updated, but the S-VOL remains unchanged. The differential data that accrues while the pair is split is stored in the differential bitmaps. Changes to the P-VOL and S-VOLs are managed in these differential bitmaps. The differential data accrues until you resynchronize the pair, which copies the differential data to the S-VOL.

If you have assigned an SI P-VOL or S-VOL to a volume reserved for Volume Migration, splitting the volume cancels migration.

If you are splitting SI pairs with shared TC or UR volumes, see the restrictions (see Requirements, restrictions, and guidelines for using consistency group pair-split with shared SI and TC or UR volumes on page 4-25).

If you are sharing SI S-VOLs with UR P-VOLs and the R-JNL has a timeout period that ends after the split time, the storage system may not detect the journal data. In this case, the SI split operation runs after the timeout period.

You set the timeout value according to your requirements.

Default: 6 hours

For more information about the timeout period, see the *Hitachi Business Continuity Manager User Guide*.

Related topics

- Pair splitting methods on page 4-19.
- Splitting SI pairs on page 4-19.
- Splitting pairs using consistency groups on page 4-23.
- SI pair resynchronization on page 4-28.
- Sharing volumes with Hitachi Volume Migration on page 3-9.
- Split Pairs wizard on page B-40.

Pair splitting methods

You can use one of the following methods to split pairs:

- **Steady Split**: Copies the differential data to the S-VOL then splits the pair. The split S-VOL is identical to the P-VOL at the time of the split.

Note: You cannot Steady Split pairs that are assigned to a CTG.

- **Quick Split**: The pair is split prior to data copy so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background.

  CCI is required.
- **Consistency group pair-split**: Simultaneously split all of the pairs in a CTG. You can use this method with the CCI.

  (For CCI) You can Quick Split and Steady Split.

  For more information about the methods you can use to split pairs using BCM, see the *Hitachi Business Continuity Manager User Guide*.

Related topics

- Quick Split and Steady Split performance planning on page 2-9.
- Splitting pairs using consistency groups on page 4-23.

Workflow for quickly splitting existing pairs

Use the following workflow to quickly split an existing pair:

1. Stop host access to the P-VOL.
2. Split the pair.

   For more information about splitting SI pairs, see Splitting SI pairs on page 4-19.

Splitting SI pairs

Prerequisites:

- The pair status must be one of the following:
  - If you are splitting an existing pair, the pair status must be "PAIR".

- If you are creating and then immediately splitting an L1 pair, the volumes are unpaired (SMPL).
- If you want to split an L1 pair that has L2 pairs, see L1, L2 pair status and supported pair user tasks on page 5-7.
- If you are splitting, or creating and immediately splitting, an L2 pair, the status of the L1 pair must be "PSUS".

- If you are concerned with host server I/O performance, check to make sure the I/O load is light.

  For more information about checking I/O performance-related information, see the *Hitachi Command Suite User Guide*.

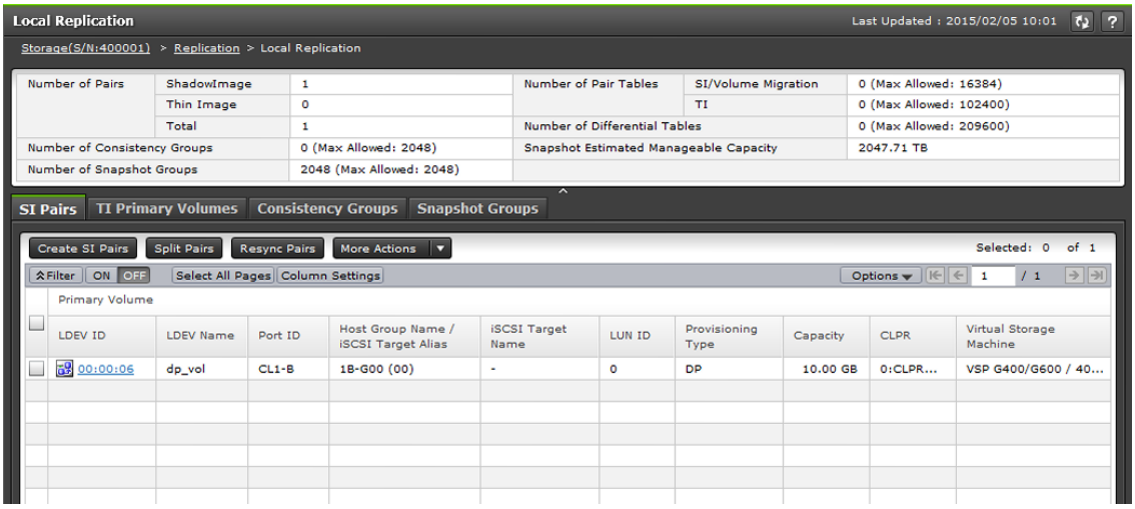
1. In Hitachi Command Suite:

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

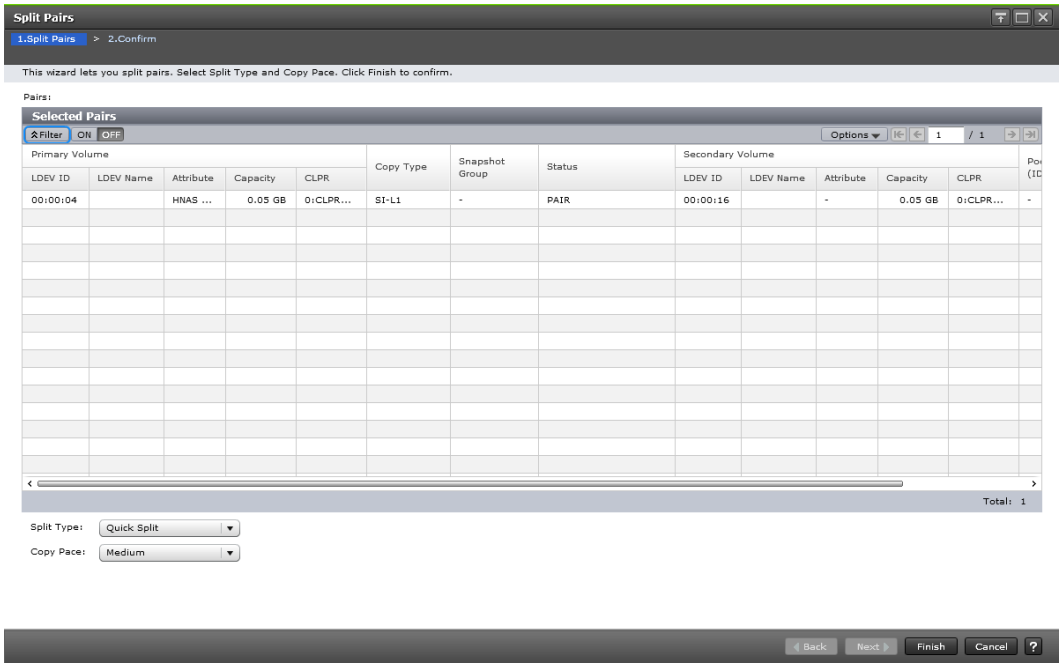
   In Device Manager - Storage Navigator:

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

2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, select the pair you want to split, and then click **Split Pairs**.



4. In the **Split Pairs** window of the **Split Pairs** wizard, complete the following and then click **Finish**:

   - For **Split Type**, select the split type.

     Values:

     - **Quick Split:** Splits the new pair and then copies the data so that the S-VOL is immediately available for read and write I/O. The storage system copies the remaining differential data to the S-VOL in the background.

     - **Steady Split:** Copies the differential data to the S-VOL and then splits the new pair.

     Default: **Quick Split**

     For more information about the methods you can use to split pairs, see Pair splitting methods on page 4-19.

   - For **Copy Pace**, select the rate at which you want the storage system to copy data.

     Values:

     - **Slower:** Improved host server I/O performance but slower processing speed.

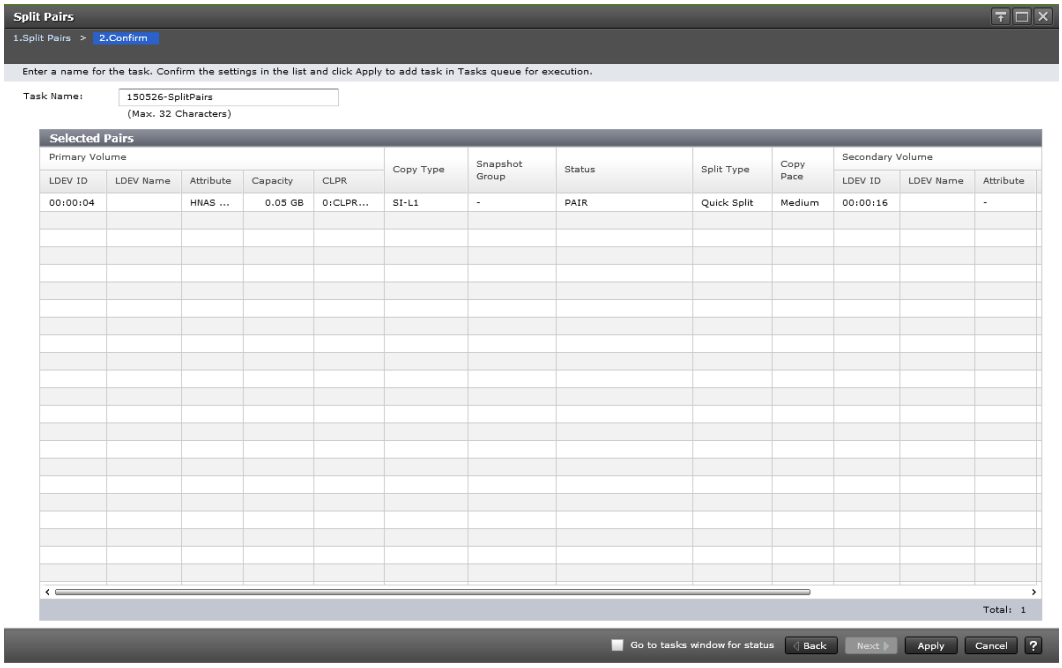
     - **Medium:** Average processing speed and host server I/O performance.

     - **Faster:** Faster processing speed but slower host server I/O performance.

     Default: **Medium**

Note: Processing speed and host server I/O performance are affected by the pace you select.

For more information about performance, see Performance planning and I/O performance effect for SI system on page 2-9.



5. In the **Confirm** window of the **Split Pairs** wizard, complete the following and then click **Apply**. The setting is queued as a task and performed in order.

   - For **Task Name**, type a name for the task.
     Default: *date-window name*
     Character and symbol limit: 32 alphanumeric except / : , ; * ? " < > |
     Case sensitive: Yes
   - For **Go to tasks window for status**, select to open the **Tasks** window.

   The SI pair is split and the pair status changes from "PSUS(SP)/PSUS" or "COPY(SP)/COPY" to "PSUS". The snapshot data is consistent with the P-VOL data and is ready to use in SI pair user tasks.

6. Open the **Tasks** window to verify the result of the operation. A task can be suspended or canceled if the processing of the task is not started.

Related topics

- Quick Split and Steady Split performance planning on page 2-9.
- Pair splitting methods on page 4-19.
- Splitting pairs using consistency groups on page 4-23.
- HDvM - SN pair status names and descriptions on page 5-4.
- L1, L2 pair status and supported pair user tasks on page 5-7
- Guidelines for maximizing host server I/O performance on page 5-21.

Splitting pairs using consistency groups

A consistency group lets you perform tasks and change pair status on a group of SI pairs. When you create pairs, indicate the same consistency group ID (CTG ID) to the pairs in a group. With consistency group (CTG) pair-split, you can simultaneously split all of the pairs in a CTG and thus can keep SI S-VOLs consistent. You can also keep SI S-VOLs consistent when you create multiple pairs by sharing the P-VOL of an SI pair with the S-VOL of a UR or TC pair.

Workflow for consistency group pair-split

Use the following workflow to perform a CTG pair-split:

1. Define a CTG to which you want to assign the SI pairs using PPRC or CCI.
2. Ensure that all the SI pairs that are required to be consistent are assigned to the same SI CTG to ensure consistent backup operations.
3. If the pair-split operation fails, perform troubleshooting for CTG pair-split failures (see Troubleshooting consistency group pair-split failures on page 6-12).
4. Create the pairs.

   Resynchronizing or restoring SI pairs on page 4-32.

Related topics

- Restrictions for consistency group pair-split on page 4-23.
- Requirements, restrictions, and guidelines for using consistency group pair-split with shared SI and TC or UR volumes on page 4-25.
- Pair splitting methods on page 4-19.

Restrictions for consistency group pair-split

Consistency group (CTG) pair-split has the following restrictions:

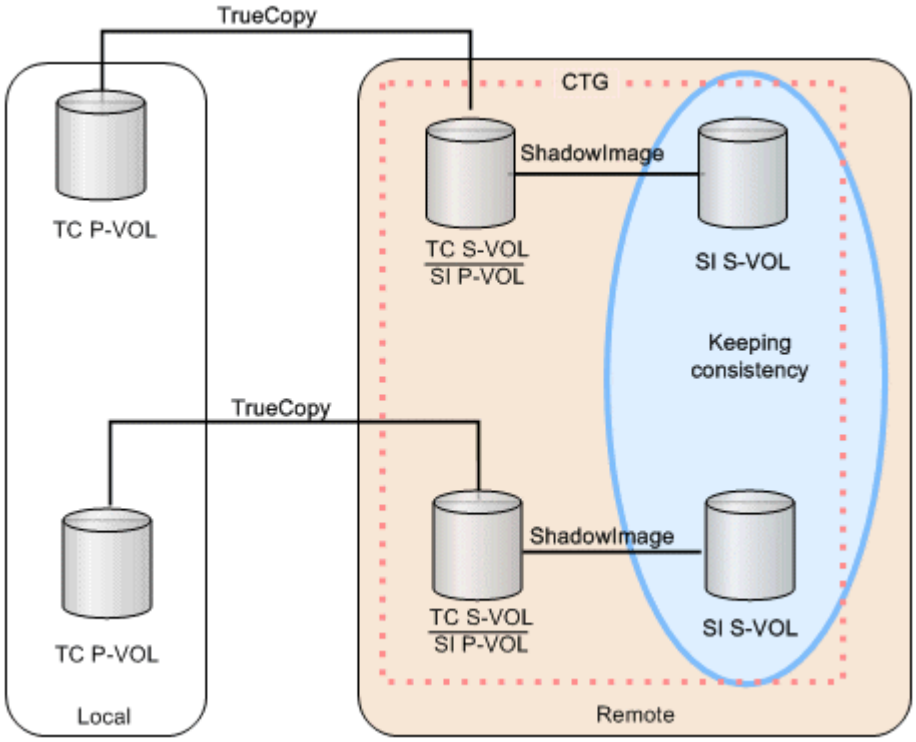
- To perform a CTG pair-split on SI pairs, the pairs must have been created using PPRC or CCI. You cannot use CTG pair-split if the pairs were created using the HDvM - SN.

Related topics

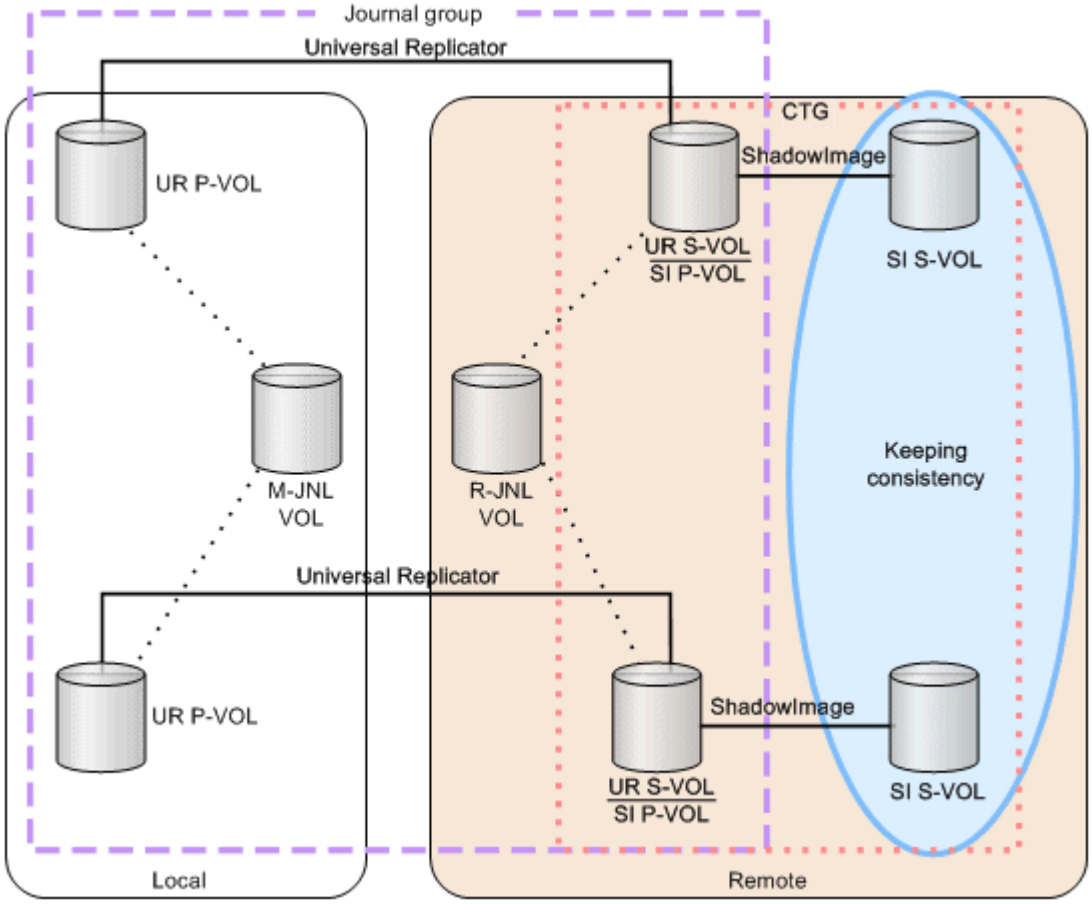
- Requirements, restrictions, and guidelines for using consistency group pair-split with shared SI and TC or UR volumes on page 4-25.

Using consistency group pair-split with shared volumes

The following images illustrate CTG pair-split with TC.



The following images illustrate CTG pair-split with UR.



When you perform a CTG pair-split on shared UR P-VOLs, the following operations occur:

1. UR restores the journal data that was created before you restored the split time to UR S-VOLs (SI P-VOLs).

Note: If an SI pair is suspended due to a failure, the split time and the actual task start time must be the same in order to restore UR journal data that you created before the split time to the UR/SI volume after the split. The task start time is determined by the amount of journal data in the journal volume at the time of the split.

For example, if the journal volume contains data that needs one hour to be restored, the starting time of the split operation delays for an hour.

2. The SI pair is split.
3. UR resumes the suspended R-JNL operations.

Requirements, restrictions, and guidelines for using consistency group pair-split with shared SI and TC or UR volumes

You can share SI P-VOLs with TC or UR S-VOLs but there are requirements, restrictions, and guidelines for using consistency group (CTG) pair-split in these cases.

Requirements

If you are sharing SI P-VOLs with TC or UR S-VOLs, CTG pair-split has the following requirements:

- All pair operations must be performed using the CCI.
- You must share SI P-VOLs with the TC or UR S-VOLs.
- The TC or UR S-VOLs that you are sharing with the SI CTG pairs must have the same status.
- If you are sharing SI volumes with UR volumes, the pair status must be the following:
  - (For UR) "PAIR" or "PSUS".
  - (For SI) "PAIR" or "COPY(PD)/COPY".
- If you are sharing SI volumes with TC volumes, the pair status must be the following:
  - (For TC) "PAIR" or "PSUS".
  - (For SI) "PAIR" or "COPY(PD)/COPY".

Restrictions

If you are sharing SI P-VOLs with TC or UR S-VOLs, CTG pair-split has the following restrictions:

- You can perform one split operation per SI CTG.
- You can:
  - Split each UR journal up to three times (equivalent to three SI CTGs).
  - Quick Split or Steady Split the pairs.
    For more information about the methods you can use to split pairs, see Pair splitting methods on page 4-19.

Guidelines

If you are sharing SI P-VOLs with TC or UR S-VOLs, use the following guidelines when performing a CTG pair-split:

- Make sure that the SI S-VOLs are in a consistent state.
  For more information about maintaining consistent backups of volumes, see Workflow for maintaining consistent ShadowImage secondary volume backups on page 4-28.
- Ensure that all SI pairs in the CTG are in "PAIR" or "COPY(PD)/COPY" status.

Note: If you share SI pair P-VOLs with UR S-VOLs and you include SI pairs in a status other than "PAIR" or "COPY(PD)/COPY" in the CTG, you cannot maintain SI S-VOL consistency.

Supported pair statuses for consistency group pair-split

The pair status for all of the SI pairs in the CTG determines if you can perform a consistency group (CTG) pair-split. If all of the SI pairs in the CTG are paired ("PAIR" status), you can perform a CTG pair-split.

The following table shows when you can perform a CTG pair-split, based on the SI pairs in the CTG that are not paired (a status other than "PAIR"), and the resulting pair status after you perform the pair-split.

The status of the pairs in the CTG that have a status other than PAIR	Can you perform a CTG pair-split?	Status after you perform a CTG pair-split
COPY(PD)/COPY	YES	PSUS
COPY(SP)/COPY	YES[2]	PSUS
PSUS(SP)/PSUS	YES[2]	PSUS
PSUS	YES[2]	PSUS
COPY(RS)/COPY	NO The command ends abnormally and shows the following information: `[EX_CMDRJE] An order to the control/command device was rejected` [1]	The pair statuses remain the same.
COPY(RS-R)/RCPY	NO The command ends abnormally and shows the following information: `[EX_CMDRJE] An order to the control/command device was rejected` [1]	The pair statuses remain the same.
PSUE	NO The command ends abnormally and shows the following information: `[EX_CMDRJE] An order to the control/command device was rejected`	The pair statuses remain the same.

Notes:

1. If you share a UR S-VOL and an SI P-VOL, the command may end normally after you perform a CTG pair-split. Ensure the status of the pairs within the CTG have changed to "PSUS" (use the **`pairdisplay`** command).
2. Consistency is guaranteed only for SI pairs in "PAIR" or "COPY(PD)/COPY" status.

The following are examples of when you can perform a CTG pair-split based on status of the SI pairs in the CTG:

- Example 1
  There are six SI pairs in a CTG. Two of the pairs are paired ("PAIR" status), two are in "COPY(PD)/COPY" status, and two are in "PSUS"

status. In this case, you can perform a CTG pair-split, and doing so changes the status of all of the pairs in the CTG to "PSUS". However, the S-VOLs that were in PSUS may not be consistent with the other volumes in the CTG.

- Example 2

  There are two SI pairs in a CTG and one is paired ("PAIR" status) and the other is in the process of being resynchronized ("COPY(RS)/COPY" status). In this case, you cannot perform a CTG pair-split.

- Example 3

  The are six SI pairs in a CTG. Two of the pairs are paired ("PAIR" status), two are in the process of Quick Split ("PSUS(SP)/PSUS" status), and two are in "PSUE" status. In this case, the CTG pair-split ends abnormally and the status of all of the pairs in the CTG remains the same.

Workflow for maintaining consistent ShadowImage secondary volume backups

If you are sharing SI P-VOLs with TC or UR S-VOLs, assign UR pairs to the same journal group to maintain a consistent backup of SI S-VOLs.

For more information about assigning SI pairs to journals, see the *Hitachi Universal Replicator User Guide*.

Related topics

- Requirements, restrictions, and guidelines for using consistency group pair-split with shared SI and TC or UR volumes on page 4-25.

Workflow for ensuring snapshot data is consistent with P-VOL data

Split the pair to ensure the snapshot data is consistent with the P-VOL data and is ready to use in an SI pair user task.

Complete one of the following to split the pair.

- If you are using HDvM - SN, split the SI pairs in the CTG.

  The volume is split ("PSUS" status).

  For more information about how to perform a CTG pair-split, see Splitting pairs using consistency groups on page 4-23.

- If you are using the CCI to run commands, run the following command on the SI pair:

  `pairsplit`

SI pair resynchronization

You can resynchronize split ("PSUS" status) or suspended ("PSUE" status) pairs. Resynchronization causes the split volume pairs to become PAIR. Resynchronizing a split pair copies the P-VOL's differential data to the S-VOL and again pairs the S-VOL with the P-VOL. Resynchronizing a suspended pair copies the entire P-VOL to the S-VOL.

Resynchronizing a suspended pair copies the P-VOL to the S-VOL and takes the same amount of time as the initial copy operation.

Caution: Resynchronizing a pair does not ensure data consistency. Data in the two volumes is the same only if:

- The P-VOL is offline.
- The pair is split (the S-VOL status is "PSUS").

  For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.

Note: If you perform a Quick Restore for a pair consisting of an encrypted volume and an unencrypted volume, the encryption statuses of the volumes are reversed.

Related topics

- Types of pair resynchronization on page 4-29.
- Workflow for resynchronizing SI pairs on page 4-31.
- Resynchronizing or restoring SI pairs on page 4-32.
- Volume pairs on page 1-4.
- Initial and update copy operations on page 1-5.

Types of pair resynchronization

You can forward or reverse resynchronize pairs. A forward resynchronization resynchronizes from the P-VOL to the S-VOL. A reverse resynchronization restores pairs by resynchronizing from the S-VOL to the P-VOL.

Related topics

- Forward resynchronization on page 4-29.
- Reverse resynchronization on page 4-30.

Forward resynchronization

You can use one of the following methods to forward resynchronize pairs, including the requirements and restrictions:

- **Normal Copy (Primary > Secondary).** A full forward resynchronization from the P-VOL to the S-VOL. During a Normal Copy, only the P-VOL is accessible to hosts for read/write operations.
- **Quick Resync (Primary > Secondary).** A forward resynchronization from the P-VOL to the S-VOL where data is not copied or resynchronized. The volumes are paired ("PAIR" status). The update copy operation copies the differential data to the S-VOL.

  During a Quick Resync, the P-VOL is accessible to hosts for read/write operations. Quick Resync, even when a host I/O does not exist, does not ensure data consistency.

Related topics

- Splitting SI pairs on page 4-18.

Reverse resynchronization

You can use one of the following methods to restore pairs, including the requirements and restrictions:

- **Reverse Copy (Secondary > Primary).** A full restoration from the S-VOL to the P-VOL. The differential data is updated to the P-VOL.

  During a Reverse Copy you can delete or suspend the pairs, but you cannot create, split, or resynchronize pairs that share the same P-VOL. The P-VOL is inaccessible to hosts.

  If you are sharing a TC or UR volume with an SI volume, you cannot create a TC or UR pair with the shared volume.

  You cannot use Reverse Copy with the following pairs:

  - An SI L2 pair.
  - If you are sharing the P-VOL with an FCv2/FCSE volume.
- **Quick Restore (Secondary > Primary).** A partial restoration that does not copy the data but does the following:
  - Swaps the P-VOL and S-VOL including their RAID levels, HDD types, and Cache Residency Manager settings.
  - Pairs the volumes ("PAIR" status).
  - Exchanges the P-VOL and S-VOL encryption statuses if an SI pair consists of encrypted volumes and a non-encrypted volume.

Caution: To prevent the two volumes from being swapped, the P-VOL and S-VOLs must be assigned to the same cache partition (CLPR).

During a Quick Restore, the P-VOL and S-VOL are inaccessible. After a Quick Restore, the P-VOL is accessible.

Best Practice: If you have a small amount of differential data, use Reverse Copy instead of Quick Restore, since Reverse Copy completes faster.

If you use volumes for which you set Data Retention Utility access attributes, Quick Restore does not exchange the P-VOL and S-VOL access attributes.

For more information about using volumes for which you set Data Retention Utility access attributes, see Sharing volumes and Data Retention Utility access attributes on page 3-2.

Note: HDvM - SN can show outdated information after a Quick Restore. To show the latest information, click **Refresh View**.

Note: To minimize the time it takes to Quick Restore an SI pair, do not perform LDEV maintenance while the Quick Restore is processing.

You can delete or suspend the pair while you are restoring the pair using Quick Restore but you cannot do the following:

- Create, split, or resynchronize pairs that share the same P-VOL.
- Create a TC or UR pair with a volume shared by SI.

You cannot Quick Restore the following pairs:

- An SI L2 pair
- A pair volume for which you are formatting either internal volume using Quick Format.

  For more information about formatting volumes using Quick Format, see the *Hitachi Virtual Storage Platform Provisioning Guide*.
- A pair in which one volume is a DP-VOL, though not both.
- An SI S-VOL you are sharing with an HTI volume.

Workflow for resynchronizing SI pairs

Use the following workflow to resynchronize SI pairs:

1. Place the S-VOL offline.
2. Split or suspend the pair.

Note: The pair can also be in the process of being Quick Split ("PSUS(SP)/PSUS" status).

3. (Optional) If you are concerned about host server I/O performance, check to make sure the I/O load is light.

   For more information about checking I/O performance-related information, see the *Hitachi Command Suite User Guide*.
4. Resynchronize the pair.

   For more information about resynchronizing SI pairs, see Resynchronizing or restoring SI pairs on page 4-32.

Related topics

- System options that affect performance on page 2-8.
- Guidelines for maximizing host server I/O performance on page 5-21.
- Forward resynchronization on page 4-29.
- Pair splitting methods on page 4-19.

Workflow for restoring SI pairs

Use the following workflow to restore SI pairs:

1. Place the P-VOL offline.
2. Split or suspend the pair.

   If you plan to restore pairs using Reverse Copy, split or suspend the pairs sharing the same P-VOL.

   If the SI pair you plan to restore shares a volume with TC or UR, suspend the TC or UR pair.

For more information about splitting SI pairs, see Splitting SI pairs on page 4-19.

For more information about suspending pairs, see Suspending SI pair creation on page 4-15.

3. Restore the pair.

   For more information about restoring pairs, see Resynchronizing or restoring SI pairs on page 4-32.

Related topics

- System options that affect performance on page 2-8.
- Reverse resynchronization on page 4-30.
- Pair splitting methods on page 4-19.
- For more information about sharing SI volumes with TC or UR:
  - See Sharing volumes with TrueCopy on page 3-7
  - See Sharing volumes with Universal Replicator on page 3-8.

Resynchronizing or restoring SI pairs

Use this task to resynchronize or restore split or suspended pairs.

Running this command typically takes less time than resynchronizing suspended pairs ("PSUE" status). Split pairs typically contain much less accumulated differential data than the total amount of data in the P-VOL.

Prerequisites:

- You can only resynchronize L2 pairs.
- After performing a Quick Split, wait 20 seconds before a Normal Copy or Quick Resync resynchronization, otherwise the operation might end abnormally.

If you are using the CCI to run commands, run the following command to resynchronize split pairs ("PSUS" status):

```
pairresync
```

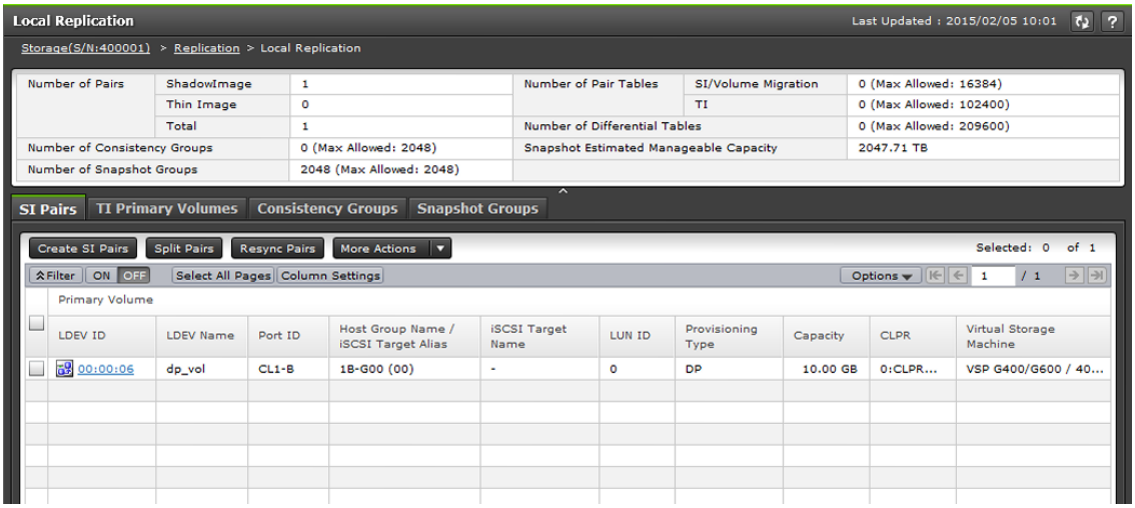
1. In Hitachi Command Suite:

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

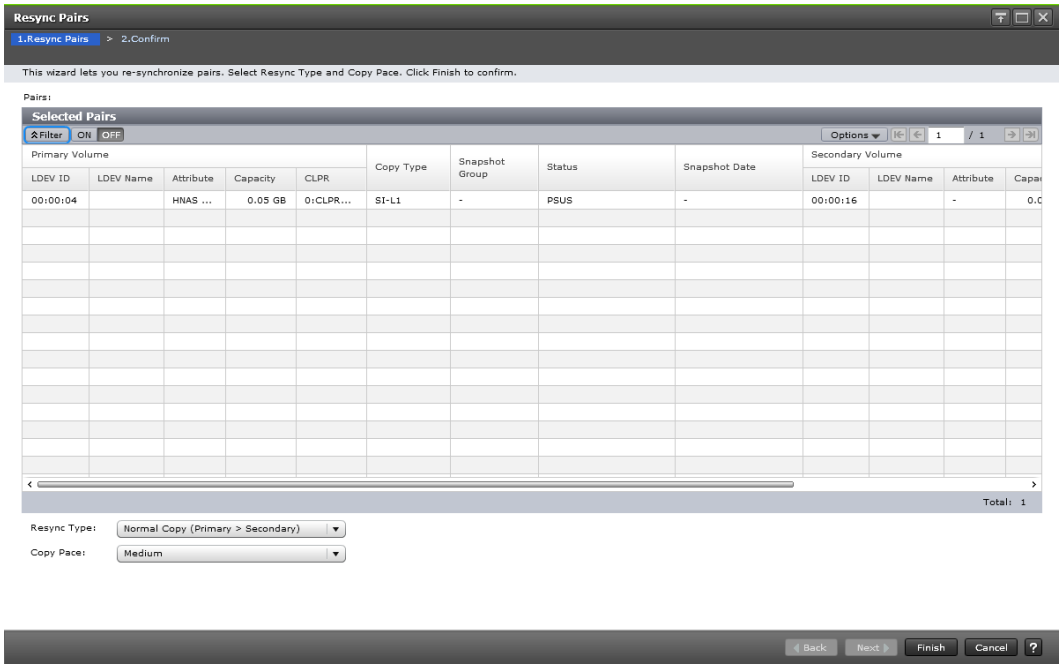
   In Device Manager - Storage Navigator:

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

2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab of the **Local Replication** window, select the pair you want to resynchronize and then click **Resync Pairs**.



4. In the **Resync Pairs** window of the **Resync Pairs** wizard, complete the following and then click **Finish**:

   - For **Resync Type**, select the type of resynchronization you want to perform.

     Values:

     - **Normal Copy (Primary > Secondary):** A full forward resynchronization.

     - **Quick Resync (Primary > Secondary):** A partial forward resynchronization.

     - **Reverse Copy (Secondary > Primary):** A full restoration of the P-VOL from the S-VOL.

- **Quick Restore (Secondary > Primary):** A partial restoration of the P-VOL from the S-VOL.

  Default: **Normal Copy (Primary > Secondary)**

  For more information about the types of SI pair resynchronization you can use, including complete descriptions of the types, see Types of pair resynchronization on page 4-29.

- For **Copy Pace**, select the rate at which you want the storage system to copy data.

  Values:

  - **Slower:** Improved host server I/O performance but slower processing speed.

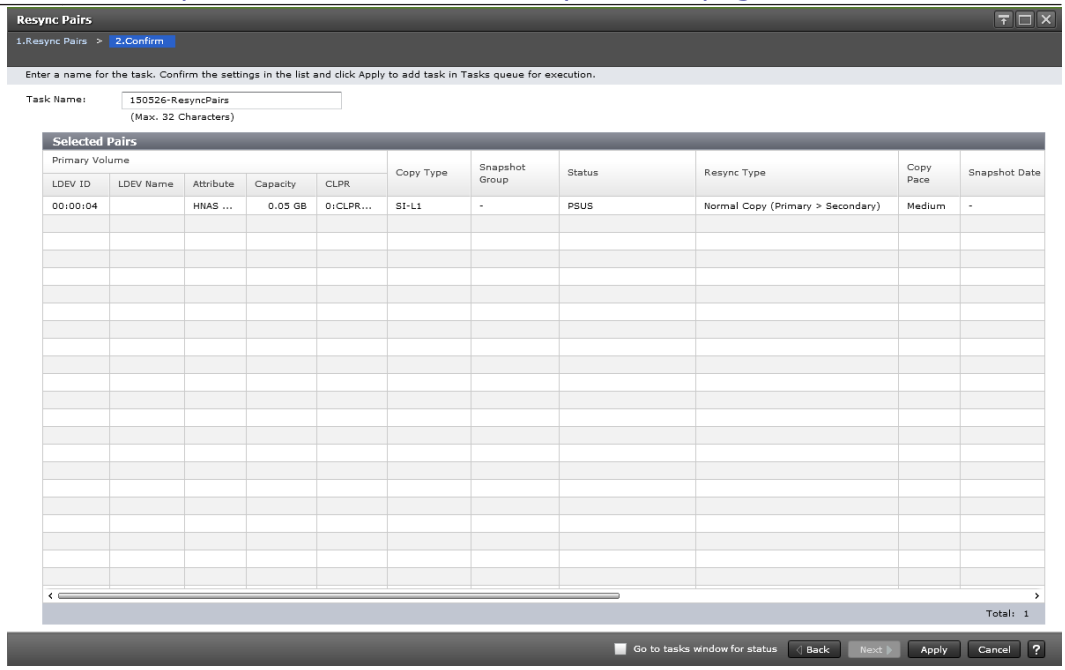
  - **Medium:** Average processing speed and host server I/O performance.

  - **Faster:** Faster processing speed but slower host server I/O performance.

  Default: **Medium**

Note: The pace you select affects processing speed and host server I/O performance

For more information about performance, see Performance planning and I/O performance effect for SI system on page 2-9.



5. In the **Confirm** window of the **Resync Pairs** wizard, complete the following and then click **Apply**. The setting is queued as a task and performed in order.

   - For **Task Name**, type a name for the task.

     Default: *date-window name*

     Character and symbol limit: 32 alphanumeric except / : , ; * ? " < > |

     Case sensitive: Yes

- For **Go to tasks window for status**, select to open the **Tasks** window.

6. Open the **Tasks** window to verify the result of the operation. A task can be suspended or canceled if the processing of the task is not started.

The pairs are resynchronized and the volumes are paired ("PAIR" status).

Note: If you are reverse resynchronizing and the task ends abnormally, the pair is suspended ("PSUE" status).
For more information about the "PSUE" status, see HDvM - SN pair status names and descriptions on page 5-4.

Related topics

- Resync Pairs wizard on page B-44.
- Types of pair resynchronization on page 4-29.
- System options that affect performance on page 2-8.
- L1, L2 pair status and supported pair user tasks on page 5-7.

Suppressing update copy operations during pair restoration

You can suppress update copy operations when you restore pairs using Quick Restore. Suppressing update copy operations keeps the P-VOL and S-VOL unsynchronized and reduces the effect on host server I/O performance.

Prerequisite: The pair status is "PAIR".

1. Enable the **Swap & Freeze** system option.
   For more information about how to enable this system option, see Changing system options on page 5-18.

Related topics

System options that affect performance on page 2-8.

Workflow for setting the RAID level

Use the following process to return to the original RAID level for the S-VOL and P-VOL after a Quick Restore when the RAID levels of the volumes are different.

1. Split the pair.
   For more information about how to split pairs, see Splitting SI pairs on page 4-19.
2. Restore the pair using Quick Restore.
   For more information about how to restore pairs using Quick Restore, see Resynchronizing or restoring SI pairs on page 4-32.

SI pair deletion

Delete the SI pairs that you no longer need. Deleting a pair unpairs the P-VOL and S-VOL but does not delete their data. You can use the volumes of deleted pairs in another pair.

Related topics

- Prerequisites for deleting SI pairs on page 4-36
- Deleting SI pairs on page 4-36
- Monitoring SI pair status and available activity on page 5-3.
- MP units and deleting pairs on page 4-38.

Prerequisites for deleting SI pairs

The pair must be unpaired and not in the process of being deleted and the volumes are not in the process of being unpaired ("SMPL(PD)" status).

Workflow for deleting SI pairs

Use the following workflow to delete an SI pair:

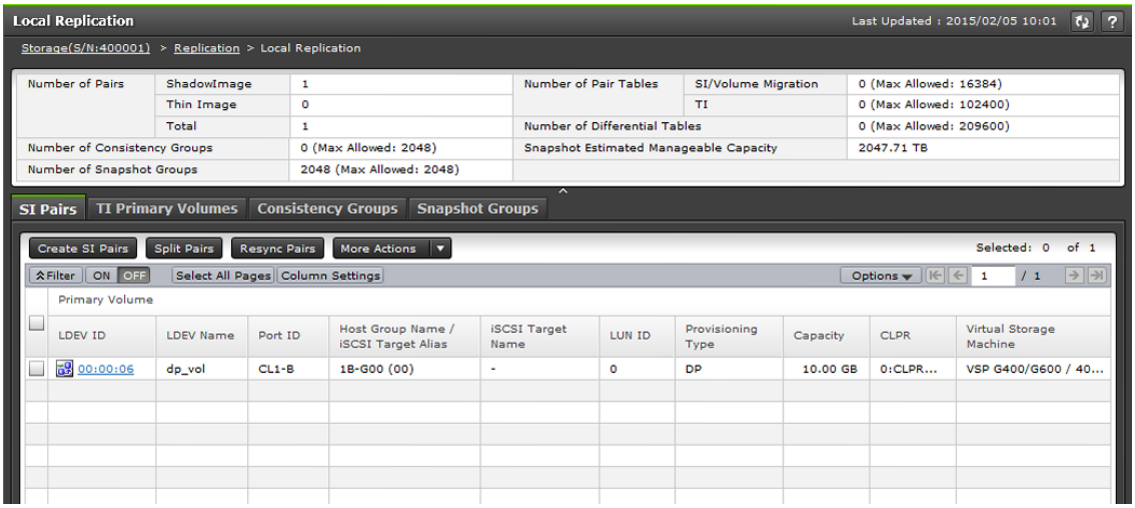
1. Ensure that all of the write I/O operations to the P-VOL have completed and that all secondary host applications that access the P-VOL have stopped.
2. Set the P-VOL offline.
3. Verify that the SI pair is unpaired and not in the process of being unpaired ("SMPL(PD)" status) using BCM, PPRC, HDvM - SN, or CCI.
4. Split the SI pair.
   For more information about splitting SI pairs, see Splitting SI pairs on page 4-19.
5. Delete the SI pair.
   For more information about deleting SI pairs, see Deleting SI pairs on page 4-36.

Deleting SI pairs

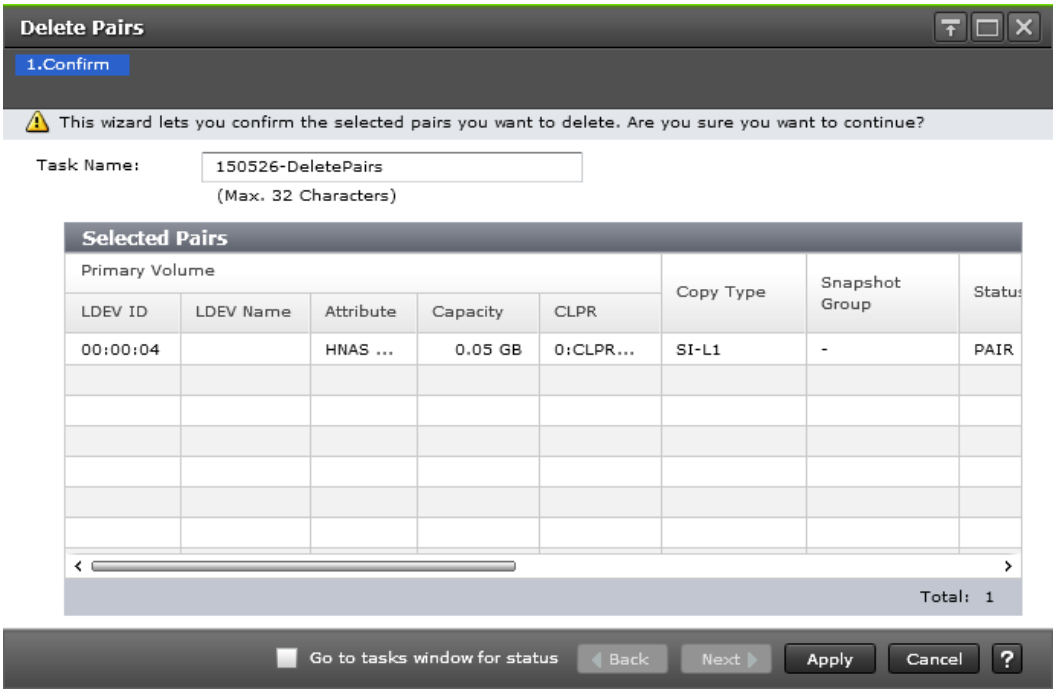
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

   In Device Manager - Storage Navigator:

   a. In the **Explorer** pane, click **Storage Systems**, expand the storage system tree, and then click **Replication > Local Replication**.
2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, select the pair you want to delete and click **More Actions > Delete Pairs**.



4. In the **Delete Pairs** window, complete the following and then click **Apply**:
   - For **Task Name**, type a name for the task.
     Default: *date-window name*
     Character and symbol limit: 32 alphanumeric except / : , ; * ? " < > |
     Case sensitive: Yes
   - For **Go to tasks window for status**, select to open the **Tasks** window.

Note: To prevent the task from ending abnormally, wait until the P-VOL and S-VOL are unpaired (about 10 seconds) before completing another pair user task, such as creating pairs, or event waiting.

The pair is deleted and the P-VOL and S-VOL are unpaired.

Related topics

- Prerequisites for deleting SI pairs on page 4-36.
- Delete Pairs window on page B-49.
- Viewing pair information for local replication on page 5-2.

MP units and deleting pairs

Creating a pair allocates the MP unit assigned to the P-VOL's I/O operations to also be allocated to the I/O operations for the S-VOL. Deleting the pairs returns the allocation of processor responsibility to the state it was before the pairs were created.

5

Monitoring and maintaining ShadowImage

This chapter provides information and instructions to monitor and maintain the SI system.

- Monitoring the ShadowImage system
- Maintaining the system

Monitoring the ShadowImage system

Monitor the SI system on an ongoing basis to keep track of pairs and volumes and their current and past conditions.

You can monitor the system in the following ways:

- Viewing pair information for local replication on page 5-2.
- Monitoring SI pair status and available activity on page 5-3. This includes the status definitions, the user tasks that you can complete based on the status, and the user tasks that you can complete for L1 and L2 pairs.
- Monitoring SI pair and volume details on page 5-10.
- Monitoring SI pair synchronization rates on page 5-11.
- Monitoring consistency groups on page 5-13.
- Monitoring pair user task history on page 5-15.

Viewing pair information for local replication

After you have deleted the pairs, the summary section of the **Local Replication** window shows the number of pairs and other information.

You can view pair information for local replication in the **Replication** window and in the summary section of the **Local Replication** window. These windows show information such as the number of pairs in the storage system.

Note: If the information in the summary section is not up to date, the system has not completed processing the information. Click the **Refresh View** icon to refresh the information in the window.

The **Replica LDEVs** tab shows a list of LDEVs. From this window, you can complete the following:

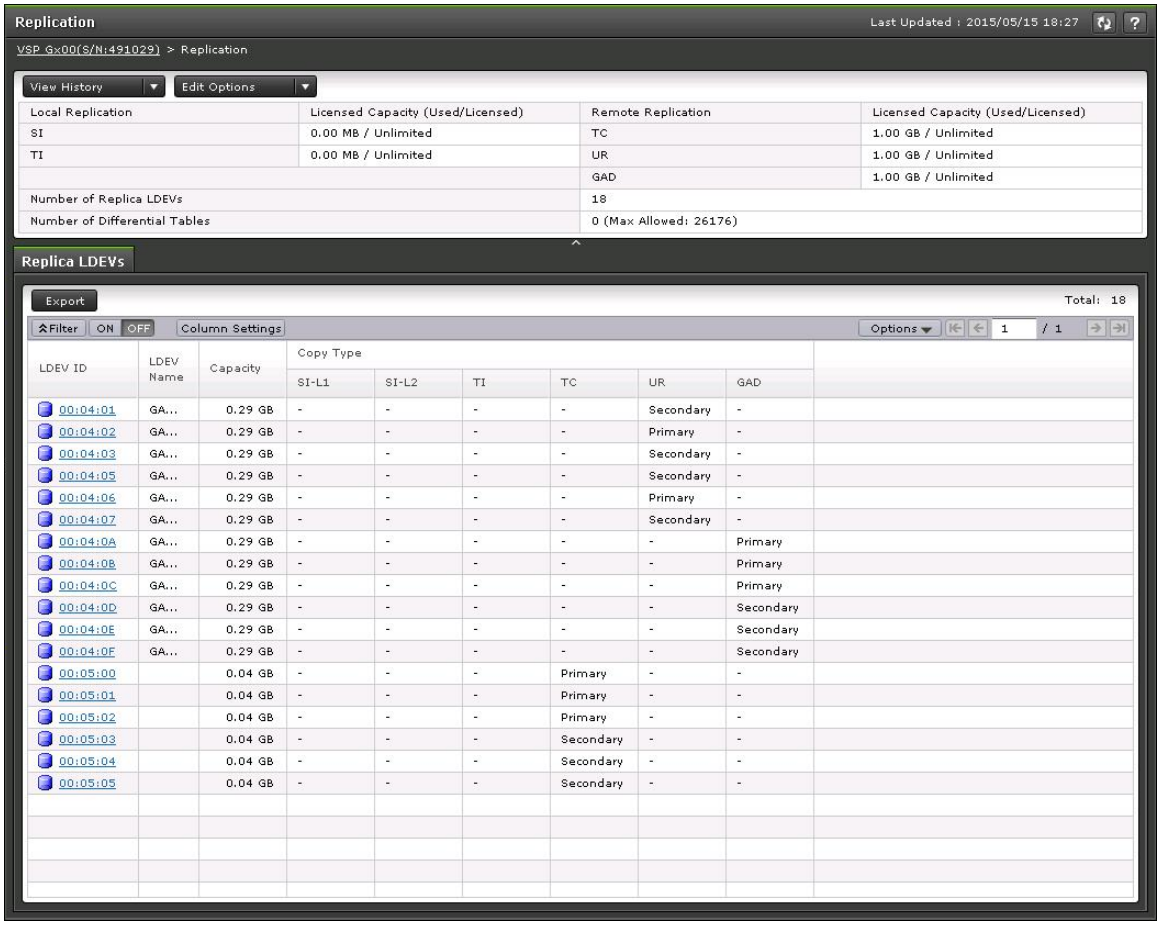
- Click the LDEV ID for a specific replica LDEV and open the **LDEV Properties** window.
- View information for a list of replica LDEVs for the selected LDEV.

1. In Hitachi Command Suite:

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



Monitoring SI pair status and available activity

The activity and status of SI pairs can be monitored using BCM, PPRC, z/OS console messages, and HDvM - SN. This section explains how to use HDvM - SN to monitor SI pairs.

The status of pairs displayed by HDvM - SN changes as the pairs status change in the storage system and the displayed state is refreshed by HDvM - SN. If you want the HDvM - SN displayed information to refresh sooner than it regularly does, click the refresh icon in the upper left.

Note: Unpaired P-VOLs and S-VOLs are not shown in HDvM - SN.

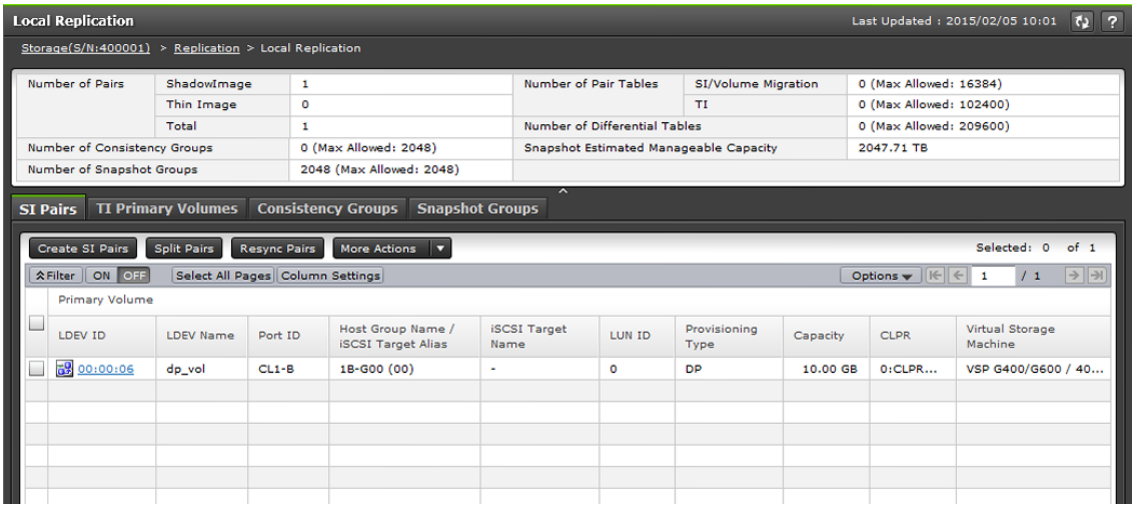
1. In Hitachi Command Suite:

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

2. Select the **SI Pairs** tab.



3. In the summary section of the **Local Replication** page, view license information. (Optional) If the information in the window is not up to date, click the **Refresh View** icon to refresh the information in the window.
4. In the **SI Pairs** tab, complete the following:
   a. Locate the pair for which you want to review the status.
   b. In the **Status** column, review the pair status.
      HDvM - SN and the CCI pair status names are shown in the **Status** column in the format of *"HDvM - SN status"/"CCI status"*, unless the names are the same. If they are the same, only the HDvM - SN status is shown.

   For more information about the items on this tab, see Monitoring SI pair and volume details on page 5-10.
5. (Optional) Click **More Actions > View Pair Properties** to view more details for a selected pair.

Related topics

- HDvM - SN pair status names and descriptions on page 5-4.
- Command Control Interface pair status names on page 5-6.
- Pair status and supported pair user tasks on page 5-7.
- L1, L2 pair status and supported pair user tasks on page 5-7.
- Unaffected S-VOL status and pair user tasks on page 5-9.
- Local Replication window on page B-4.
- Monitoring SI pair and volume details on page 5-10.

HDvM - SN pair status names and descriptions

The following table shows a list of HDvM - SN pair status names and descriptions, including the level of S-VOL access.

HDvM - SN status	Description	P-VOL access	S-VOL access
SMPL	The volume is not part of a pair.	Read/write enabled	Read/write enabled
SMPL(PD)	The pair is in the process of being deleted.	Read/write disabled[4]	Read/write disabled
COPY(PD)/COPY[2]	The paircreate initial copy is in progress.[1] The storage system accepts read/write to the P-VOL but does not accept write operations to the S-VOL.	Read/write enabled	Read only
PAIR	The initial copy operation has completed and the volumes are paired. The storage system performs update copy operations. Data consistency is not ensured for SI pairs in this status. For more information about the initial and update copy operations, see Initial and update copy operations on page 1-5.	Read/write enabled	Read only
COPY(SP)/COPY[2]	The pair is in the process of being Steady Split. The storage system: 1. Copies the differential data to the S-VOL.[1] The data in the S-VOL is identical to data in the P-VOL. 2. Splits the pair. For more information about the Steady Split method of splitting pairs, see Pair splitting methods on page 4-19.	Read/write enabled	Read only
PSUS(SP)/PSUS[2]	The pair is in the process of being Quick Split. The differential data is copied to the S-VOL in the background.[1] You cannot delete pairs in this status. For more information about the Quick Split method of splitting pairs, see Pair splitting methods on page 4-19.	Read/write enabled	Read/write enabled
PSUS [3]	The pair has been split. The storage system stops performing update copy operations but accepts write I/Os for the S-VOL. The storage system keeps track of updates to split P-VOLs and S-VOL so that you can Quick Resync.	Read/write enabled	Read/write enabled
COPY(RS)/COPY[2]	The **pairresync** CCI command is in progress. The storage system does not accept write I/Os for S-VOL. Resynchronizing split pairs copies only the differential data to the S-VOL.	Read/write enabled	Read only
COPY(RS-R)/ RCPY [2]	The **reverse pairresync** CCI command is in progress. The storage system copies only the S-VOL differential data to the P-VOL. The storage system does not perform update copy operations during a Reverse Copy or a Quick Restore. The storage system does not accept write I/O operations to S-VOL.[1]	Read/write disabled	Read only

HDvM - SN status	Description	P-VOL access	S-VOL access
PSUE	The storage system does the following: • Suspends the pair. • Continues accepting read and write I/Os to the P-VOL. • Stops update copy operations to the S-VOL. • Marks the P-VOL as differential data. Resynchronizing a pair copies the P-VOL to the S-VOL.	Read/write enabled	Read only

1. The starting time of the copy depends on the numbers of pairs and the storage system environment.
2. The pair status will be displayed as "Pair status on screen/Pair status of CCI".
3. CCI will be displayed as following:
   - P-VOL: PSUS
   - S-VOL: SSUS
4. If the status was Read/write enabled before the transition to SMPL(PD), it is Read/write enabled.

Related topics

- Command Control Interface pair status names on page 5-6.

Command Control Interface pair status names

The CCI pair status names can match HDvM - SN pair status names.

The following table shows a list of the HDvM - SN pair status names and the corresponding pair status name in CCI. SMPL status will not be displayed on the **SI Pairs** tab in **Local Replication** window.

HDvM - SN pair status name	CCI pair status name
SMPL	SMPL
COPY(PD)/COPY	COPY
PAIR	PAIR
COPY(SP)/COPY	COPY
PSUS(SP)/PSUS	PSUS
PSUS	(P-VOL) PSUS (S-VOL) SSUS
COPY(RS)/COPY	COPY
COPY(RS-R)/RCPY	RCPY
PSUE	PSUE

Related topics

- HDvM - SN pair status names and descriptions on page 5-4

Pair status and supported pair user tasks

A pair's status determines the actions you can perform. The following table shows the pair actions based on the pair status.

The following table shows the required pair status for each action.

Pair status	Pair user task					
	Create pairs	Split pairs	Resynchronize pairs (Normal Copy)	Resync pairs (Reverse Copy)	Suspend pairs	Delete pairs
SMPL(PD)	NO	NO	NO	NO	NO	NO
COPY(PD)/COPY	YES	YES	NO	NO	YES	YES
PAIR	YES	YES	NO	NO	YES	YES
COPY(SP)/COPY	YES	NO	NO	NO	YES	YES
PSUS(SP)/PSUS	YES	NO	YES	NO	YES	NO
PSUS	YES	NO	YES	YES	YES	YES
COPY(RS)/COPY	YES	NO	NO	NO	YES	YES
COPY(RS-R)/RCPY	NO	NO	NO	NO	YES	YES
PSUE	YES	NO	YES	NO	NO	YES

Related topics

- L1, L2 pair status and supported pair user tasks on page 5-7
- Unaffected S-VOL status and pair user tasks on page 5-9

L1, L2 pair status and supported pair user tasks

The user tasks you can complete on cascaded pairs depend on the L1 and L2 pair status. The user tasks are dependent on the following:

- To perform an L1 user tasks, the status of the L2 pair.
- To perform an L2 user tasks, the status of the L1 pair.
- Supported read/write on L1 and L2 S-VOLs.

The following table shows the L1 pair user tasks that you can complete based on the related L2 status.

L2 pair status	L1 pair user task				
	Create pairs	Split pairs	Resynchronize pairs	Suspend pairs	Delete pairs
COPY(PD)/ COPY	YES	YES	YES	YES	YES
PAIR	YES	YES	YES	YES	YES

L2 pair status	L1 pair user task				
	Create pairs	Split pairs	Resynchronize pairs	Suspend pairs	Delete pairs
COPY(SP)/ COPY	NO	NO	NO	YES	YES
PSUS(SP)/ PSUS	NO	NO	NO	YES	YES
PSUS	YES	YES	YES	YES	YES
COPY(RS)/ COPY	YES	YES	YES	YES	YES
COPY(RS-R)/ RCPY	NO	NO	NO	YES	YES
PSUE	YES	YES	YES	YES	YES

The following table shows the L2 pair user tasks that you can perform based on the related L1 status.

L1 pair status	L2 pair user task				
	Create pairs	Split pairs	Resynchronize pairs[1]	Suspend pairs	Delete pairs
COPY(PD)/ COPY	YES	NO	YES	YES	YES
PAIR	YES	NO	YES	YES	YES
COPY(SP)/ COPY	YES	NO	YES	YES	YES
PSUS(SP)/ PSUS	NO	NO	YES	YES	YES
PSUS	YES	YES[2]	YES	YES	YES
COPY(RS)/ COPY	YES	NO	YES	YES	YES
COPY(RS-R)/ RCPY	YES	NO	YES	YES	YES
PSUE	YES	NO	YES	YES	YES

1. For more information about resynchronizing L2 pairs, see Resynchronizing or restoring SI pairs on page 4-32.
2. For more information about the prerequisites for splitting L2 pairs, see Splitting SI pairs on page 4-19.

The following table shows the node volume read/write L1 and L2 pair status.

L1 Pair Status	L2 pair status						
	COPY(PD) /COPY	PAIR	COPY(SP) /COPY	PSUS(SP) /PSUS	PSUS	COPY(RS) /COPY	PSUE
COPY(PD)/COPY	Read only	Read only	Read only	Read only	Read only	Read only	Read only
PAIR							
COPY(SP)/COPY							
PSUS(SP)/PSUS	Read/Write	Read/Write	Read/Write	Read/Write	Read/Write	Read/Write	Read/ Write
PSUS							
COPY(RS)/COPY	Read only	Read only	Read only	Read only	Read only	Read only	Read only
COPY(RS-R)/ RCPY							
PSUE							

The following table shows the leaf vol read/write per L2 pair status.

L2 pair status						
COPY(PD)/ COPY	PAIR	COPY(SP) /COPY	PSUS(SP)/PSUS	PSUS	COPY(RS)/COPY	PSUE
Read only	Read only	Read only	Read/ Write	Read/Write	Read only	Read only

Unaffected S-VOL status and pair user tasks

The SI pair actions you can perform depend on the pair's status and the status of unaffected S-VOLs.

The following table shows the actoins you can perform based on the status of S-VOLs related to the P-VOL in other pairs.

Status of unaffected S-VOLs	Pair action					
	Create pairs	Split pairs	Resynchro nize pairs (Normal Copy)	Resynchro nize pairs (Reverse Copy)	Suspend pairs	Delete pairs
SMPL(PD)	NO	NO	NO	NO	NO	NO
COPY(PD)/COPY	YES	YES	YES	NO	YES	YES
PAIR	YES	YES	YES	NO	YES	YES
COPY(SP)/COPY	YES	YES	YES	NO	YES	YES
PSUS(SP)/PSUS	YES	YES	YES	NO	YES	YES
PSUS	YES	YES	YES	YES	YES	YES
COPY(RS)/COPY	YES	YES	YES	NO	YES	YES

Status of unaffected S-VOLs	Pair action					
	Create pairs	Split pairs	Resynchronize pairs (Normal Copy)	Resynchronize pairs (Reverse Copy)	Suspend pairs	Delete pairs
COPY(RS-R)/RCPY	NO	NO	NO	NO	YES	YES
PSUE	YES	YES	YES	YES	YES	YES

Monitoring SI pair and volume details

You can review the data related to L1 and L2 pairs and their volumes. This includes volume capacity, pair status, P-VOL and S-VOL, identifiers, and other details.

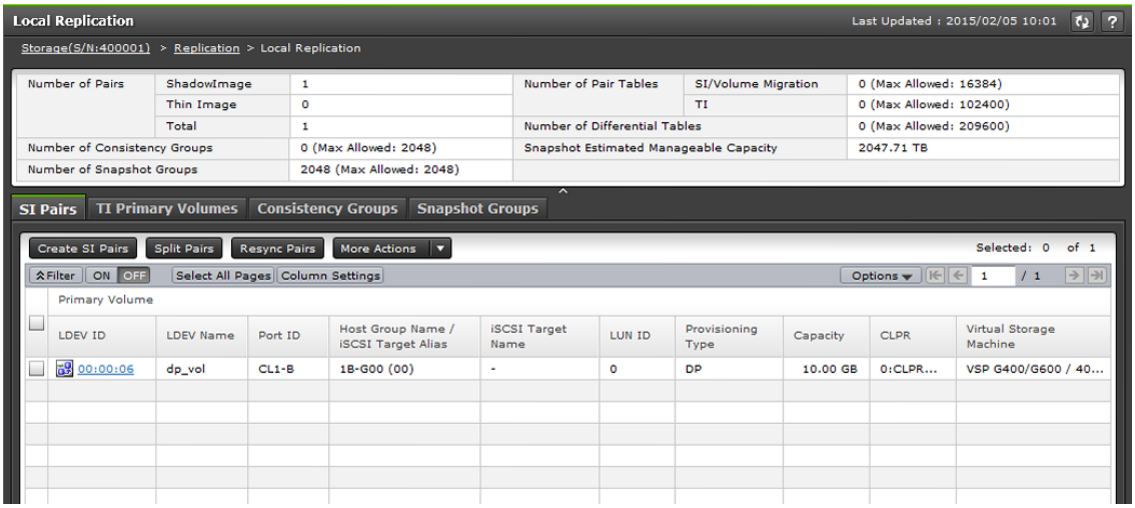
1. In Hitachi Command Suite:

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

2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, select the pair and then click **More Actions > View Pair Properties**.
4. In the **View Pair Properties** window, view the pair properties.

Related topics

- Monitoring SI pair status and available activity on page 5-3.
- View Pair Properties window on page B-13.
- Local Replication window on page B-4.

Monitoring SI pair synchronization rates

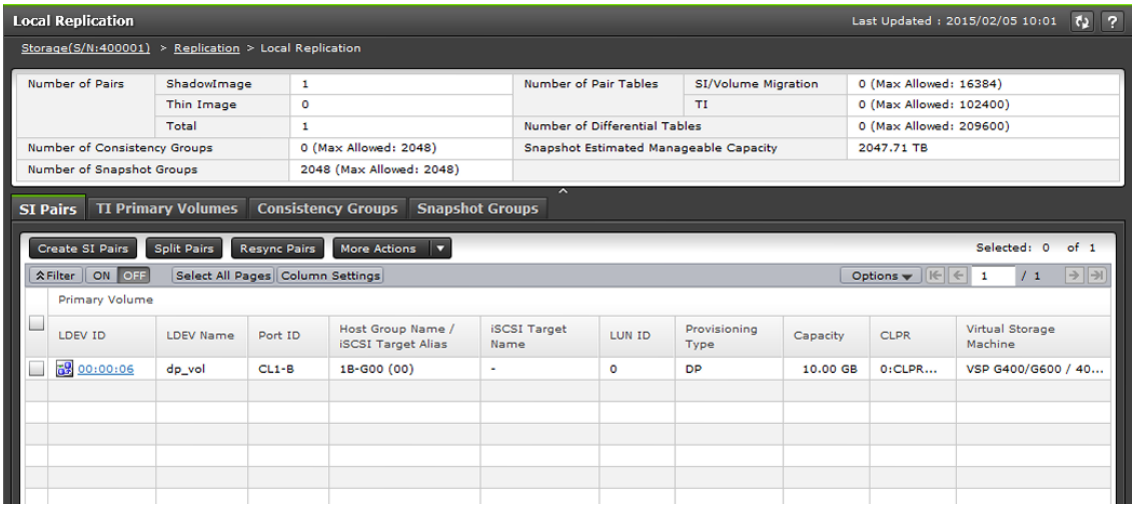
You can check the percentage of synchronized data between the P-VOL and S-VOL from the **View Pair Synchronization Rate** window.

1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

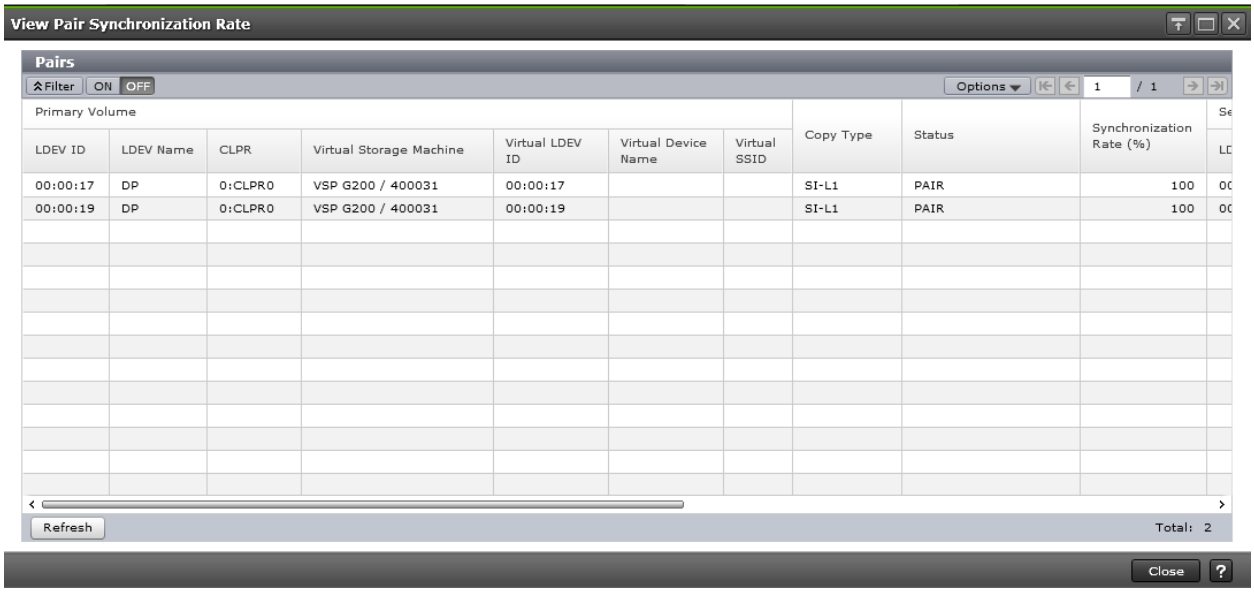
In Device Manager - Storage Navigator:

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

2. Select the **SI Pairs** tab.



3. In the **SI Pairs** tab, select the pair and then click **More Actions > View Pair Synchronization Rate**.



4. On the **View Pair Synchronization Rate** window, click **Refresh View** to show the latest synchronization rate.

Note: If you close the window, information in the **Local Replication** window may not be up to date. Click the **Refresh View** icon to refresh the information in the window.

Related topics

- View Pair Synchronization Rate window on page B-18

Monitoring consistency groups

You can check the number of CTGs and the details and individual properties for CTGs from the following section and tabs in the **Local Replication** window:

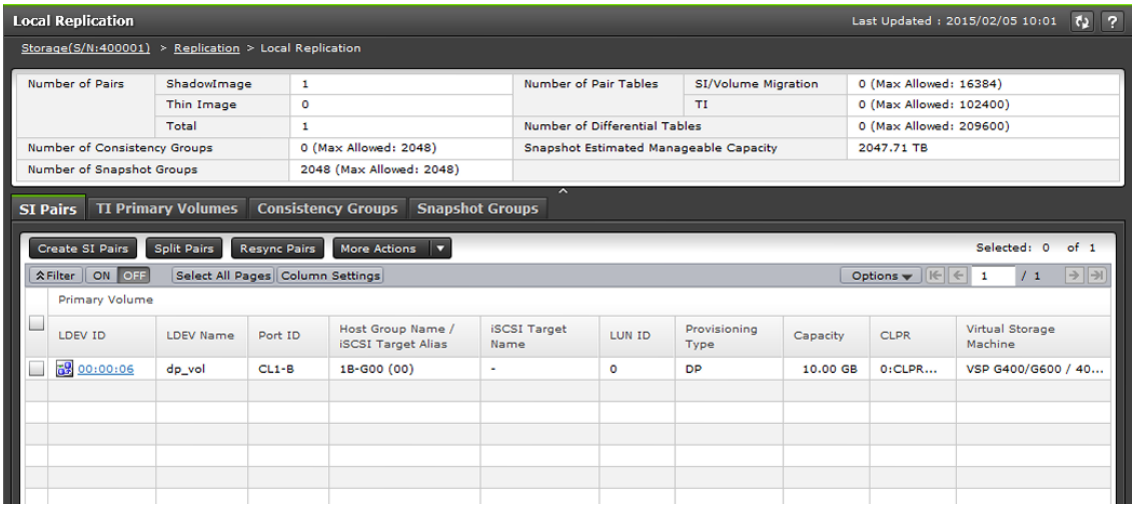
- The summary section. Use this section to view the number of CTGs and the number of pairs.
- The **SI Pairs** tab. Use this tab to:
  - View a list of SI pairs.
  - Monitor pair activity and status.

    For more information about monitoring SI pair activity and status, see Monitoring SI pair status and available activity on page 5-3
  - Monitor pair synchronization rates.

    For more information about monitoring pair synchronization rates, see Monitoring SI pair synchronization rates on page 5-11.
- The **TI Primary Volumes** tab. Use this tab to view a list of HTI pairs (see Viewing a list of Thin Image pairs on page 5-15).
- The **Consistency Groups** tab. Use this tab to:
  - View a list of CTGs.
  - View CTG properties.

    For more information about viewing a CTG's properties, see Viewing consistency group properties on page 5-13.

The following figure shows the **Local Replication** window, with the summary section and the **SI Pairs** tab in view.



Related topics

- Local Replication window on page B-4

Viewing consistency group properties

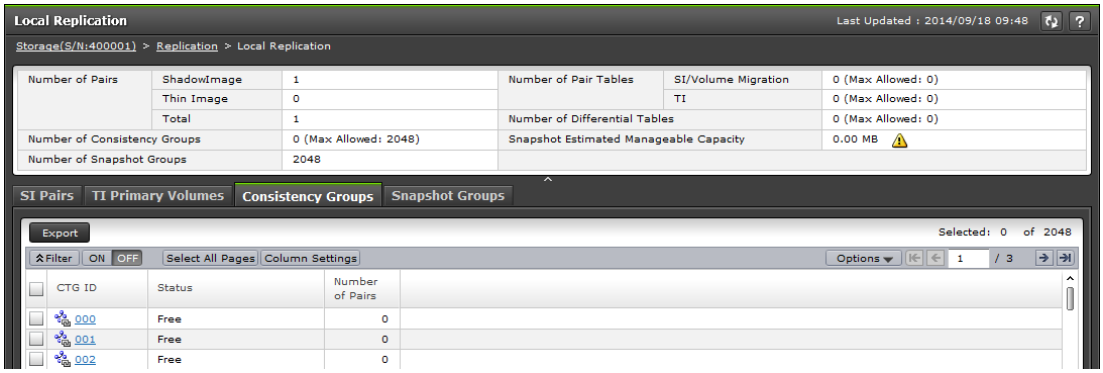
1. In Hitachi Command Suite:

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

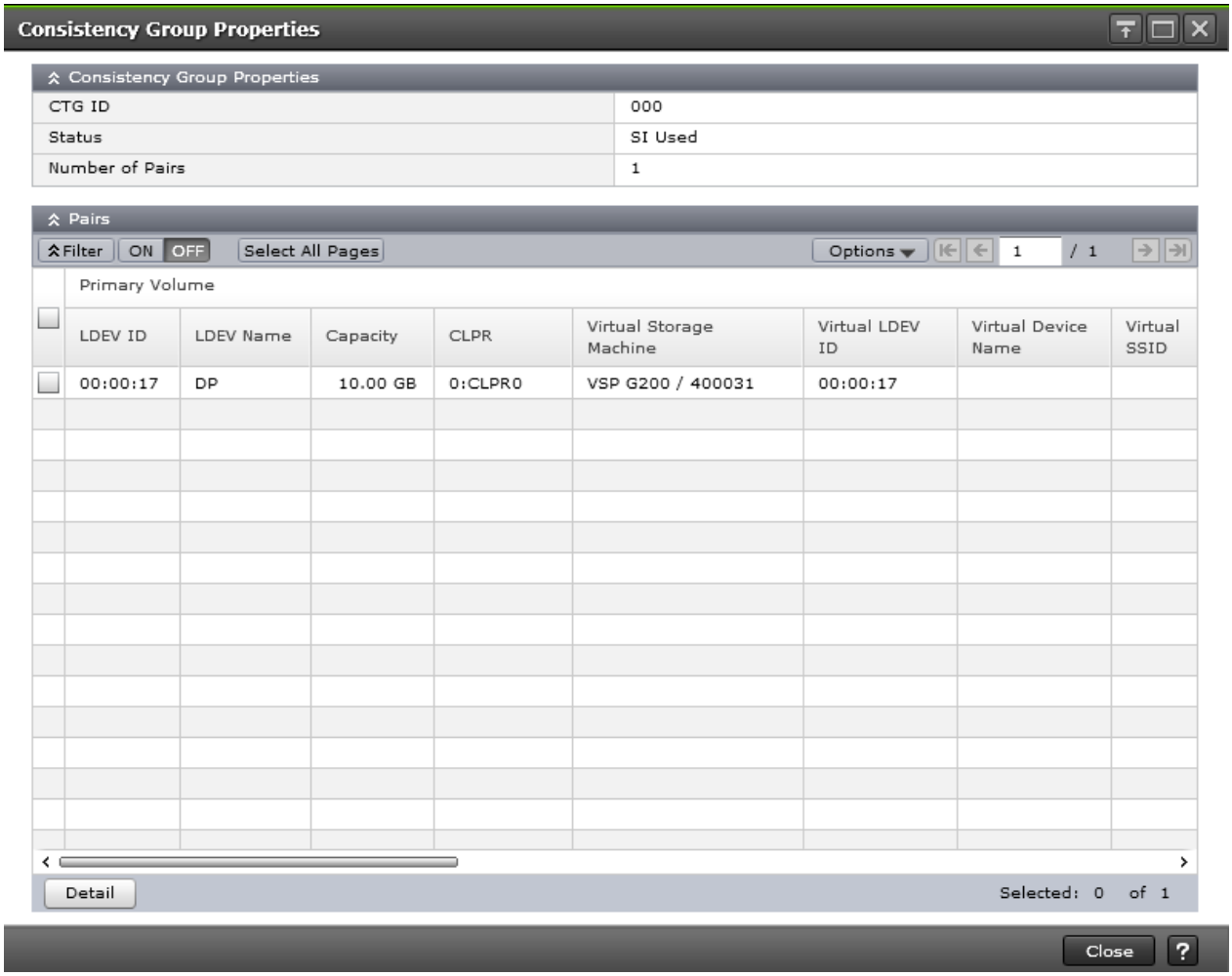
In Device Manager - Storage Navigator:

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

2. Select the **Consistency Groups** tab.



3. In the **Consistency Groups** tab of the **Local Replication** window, click the **CTG ID** for the CTG you want to view properties.



4. In the **Consistency Group Properties** window, view the CTG's properties, such as group information for local replication.

Viewing a list of Thin Image pairs

You can view a list of HTI pairs in the **TI Primary Volumes** tab of the **Local Replication** window.

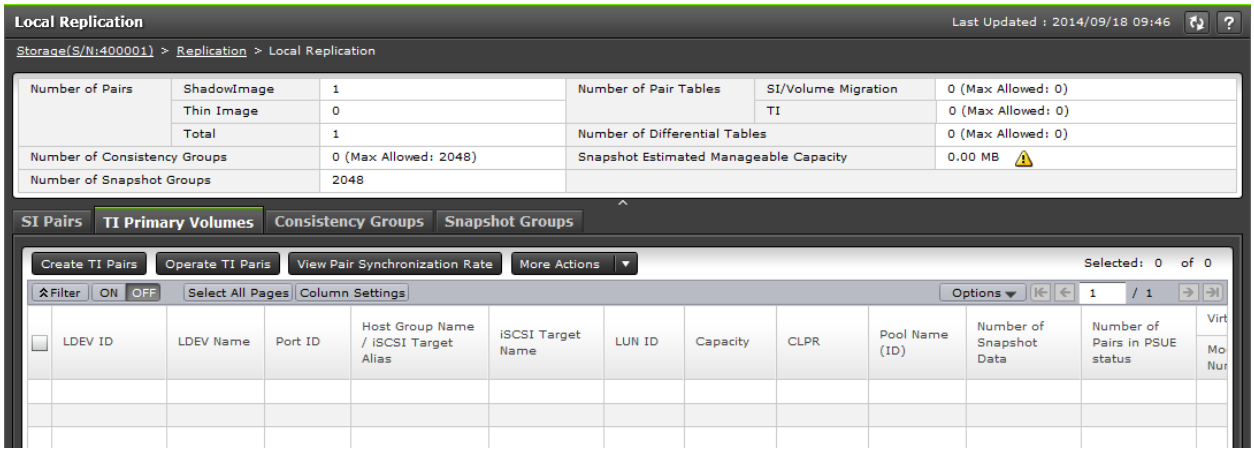
1. In Hitachi Command Suite:

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

2. Select the **TI Primary Volumes** tab.



3. In the **TI Primary Volumes** tab, view the list of HTI pairs.

Related topics

- Local Replication window on page B-4.

Monitoring pair user task history

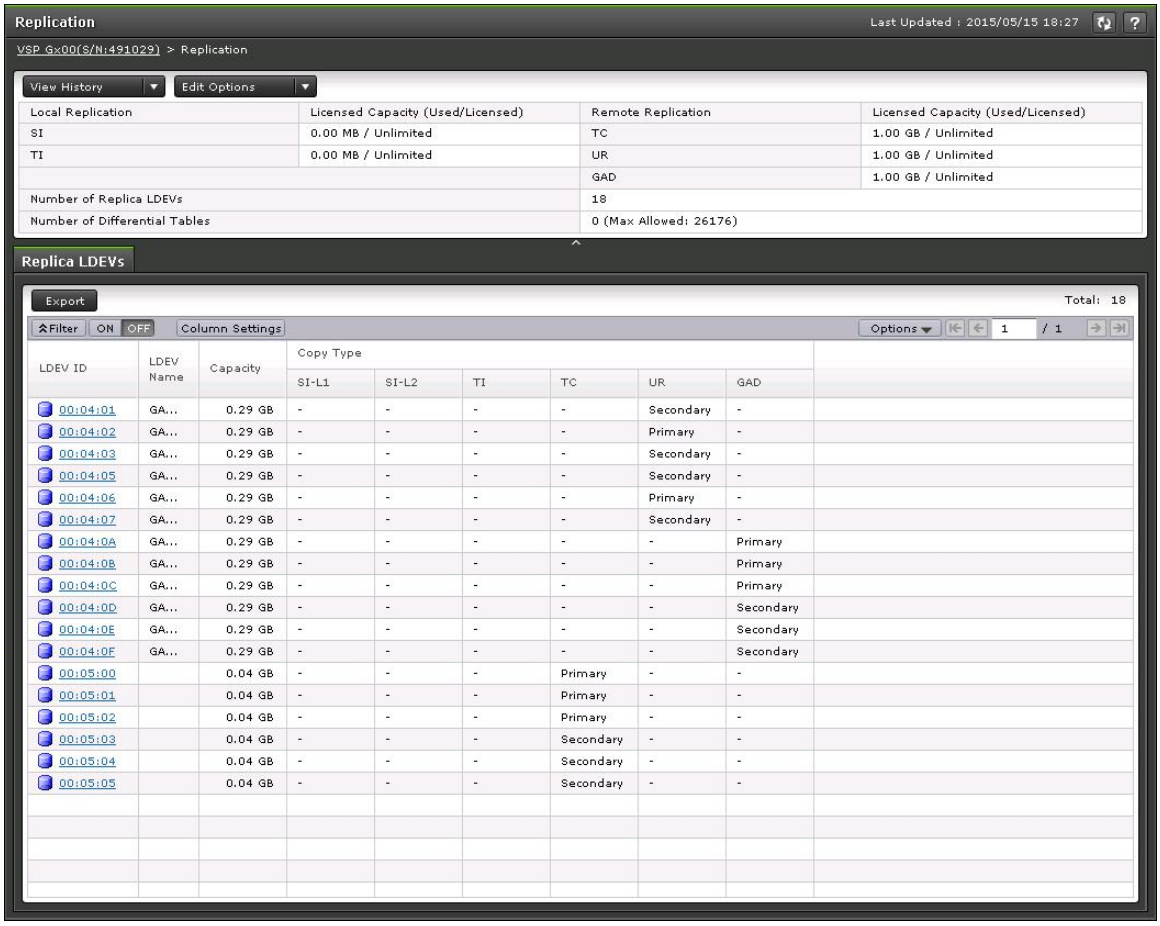
You can review a history of the user tasks you have completed on a pair from the **History** window. This window shows up to 8,192 of the latest user tasks.

1. In Hitachi Command Suite:

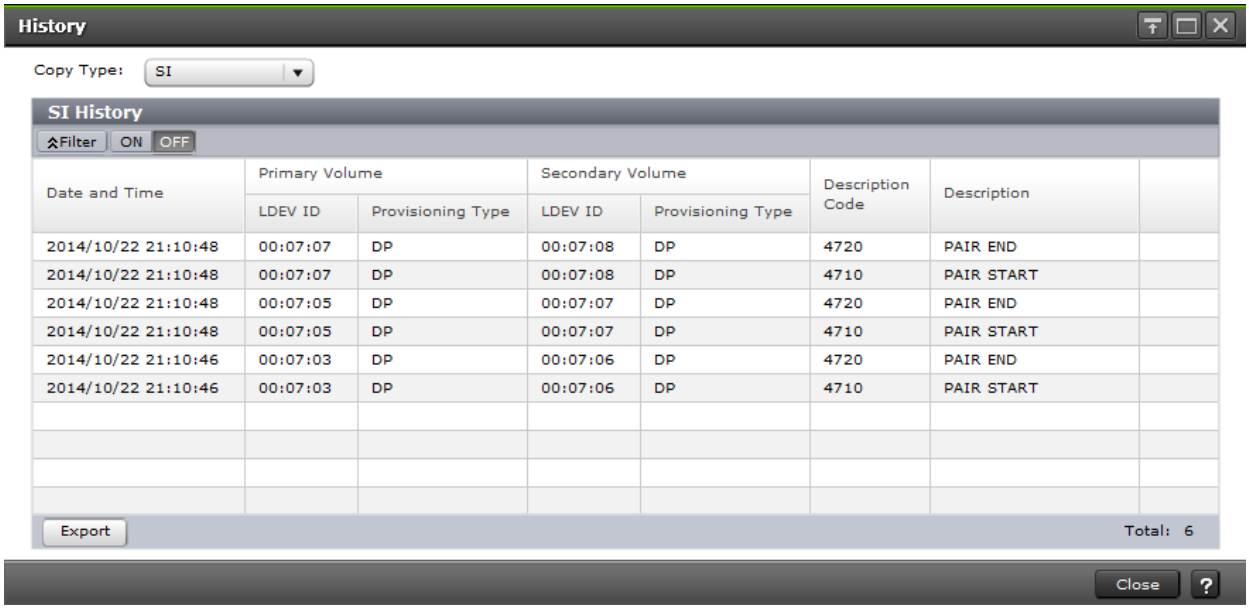
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Replication Dashboard**.

   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**.



3. In the **History** window, for **Copy Type**, select **SI**.

The **Description** column in the **History** table shows the user tasks that you have completed.

The following table shows the descriptions of the codes.

Code	Description	Explanation
4710	PAIR START	The initial copy has started.
4720	PAIR END	The initial copy has completed and the pair status is "PAIR".
4730	PSUS START	The pair is being split.
4740	PSUS END	The pair has been split and the pair status is "PSUS".
4750	COPY(RS)/COPY START COPY(RS-R)/RCPY START	The **pairresync** CCI command has started.
4760	COPY(RS)/COPY END COPY(RS-R)/RCPY END	The **pairresync** CCI command has completed and the volumes are paired ("PAIR" status).
4780	Unpaired	The pair is deleted and the volumes are unpaired.
4790	PSUE	The pair is suspended.
47D0	COPY ABNORMAL END	Copy processing has ended abnormally for reasons other than the ones stated above in this table.
47E9	INITIALIZE START	The initialization processing has started.
47EA	INITIALIZE END	The initialization processing completed.
47EB	INITIALIZE ENDED ABNORMAL	The initialization processing has ended abnormally.

Related topics

- History window on page B-21

Maintaining the system

Some maintenance tasks are a response to behavior discovered while monitoring the system. Other tasks are completed to keep the system in tune with your changing requirements.

Related topics

- Information about system and device maintenance on page 5-17
- Changing system options on page 5-18

Information about system and device maintenance

The following maintenance activities do not affect SI replication pairs.

- More than one SI pairs might suspend if cache maintenance is executed. Maintenance should be scheduled during times of low system activity.

- Performing maintenance of physical disk drives that provision LDEVs used by SI can be performed without impacting SI.
- If a physical device failure occurs, the pair status is not affected because of the RAID architecture.
- If a physical device failure requires the storage system to utilize dynamic sparing or automatic correction copy, the pair status is not be affected.
- If an LDEV failure occurs, the storage system suspends the pair.
- If an SI pair is using an LDEV, certain activities are not allowed. You can only block (for maintenance), format, or restore an LDEV that is in use by only a pair in PSUE status.

Related topics

- Performance planning and I/O performance effect for SI system on page 2-9

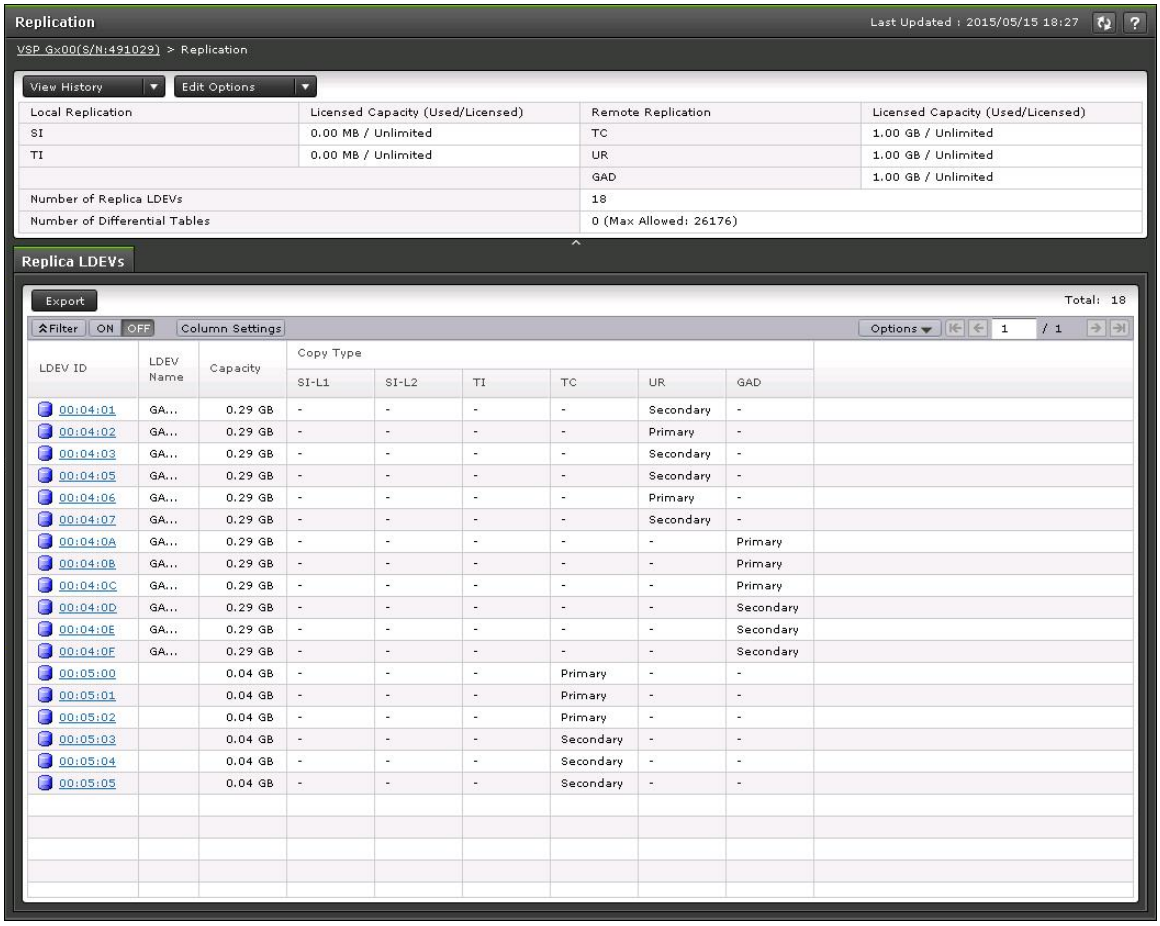
Changing system options

You can enable and disable the system options that affect performance.

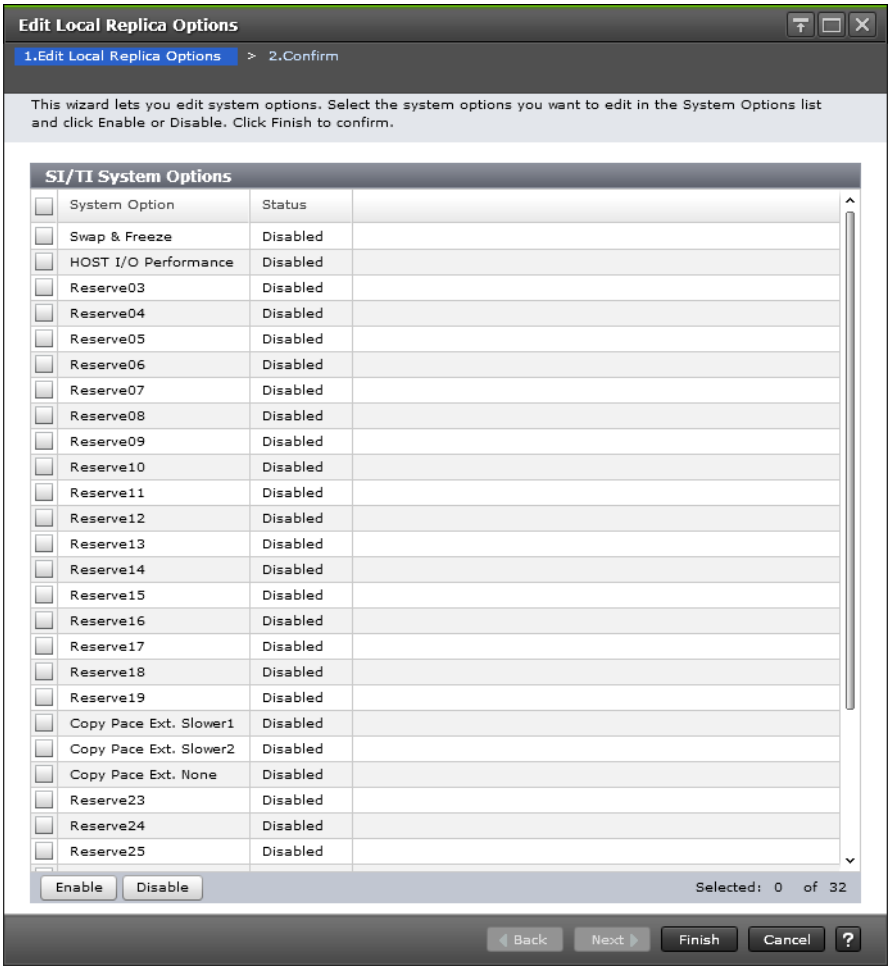
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Replication Dashboard**.

   In Device Manager - Storage Navigator:

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

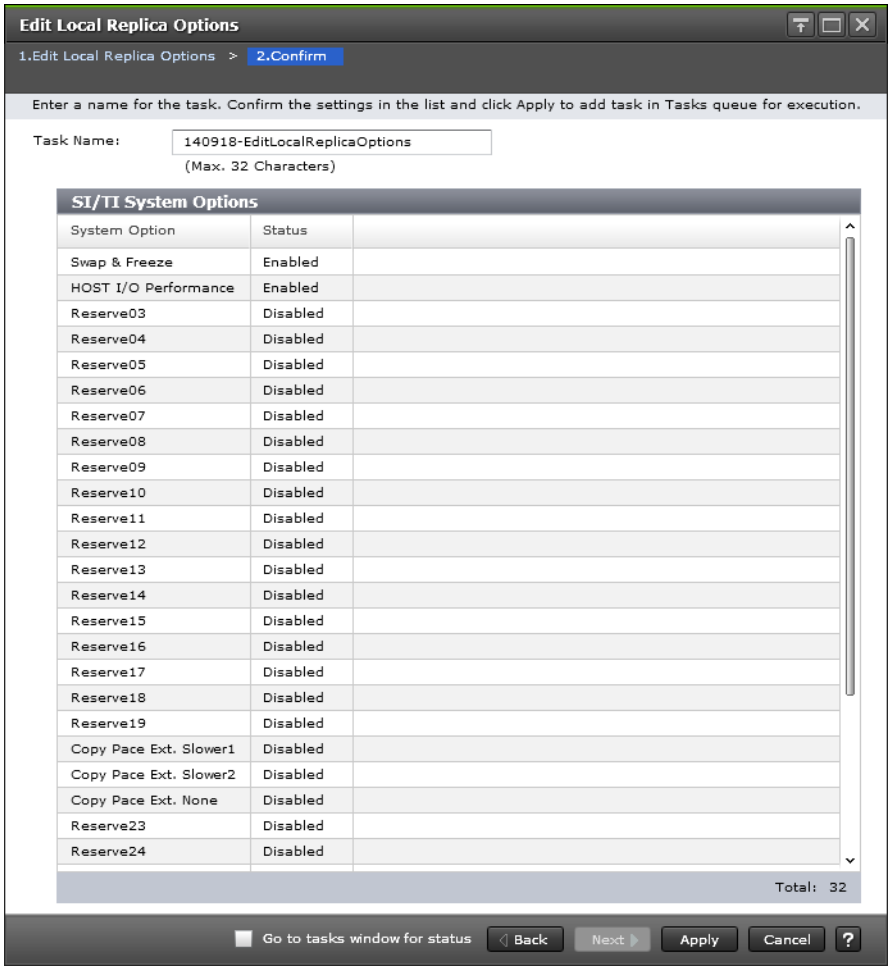


2. In the **Replication** window, click **Edit Options > Local Replication**.



3. In the **Edit Local Replica Options** window of the **Edit Local Replica Options** wizard, complete the following and then click **Finish**:

   - For **System Type**, ensure **Open** is selected.
     The default setting is **Open**.
   - From the **SI/TI System Options** table, select the system option you want to enable, click **Enable**, or select the system option you want to disable and click **Disable**.



4. In the **Confirm** window of the **Edit Local Replica Options** wizard, for **Task Name**, type a name for the task and then click **Apply**.

   The system options are set.

Guidelines for maximizing host server I/O performance

Creating, splitting, and resynchronizing pairs can affect host server I/O performance.

Use the following guidelines to minimize the impact of pair operations on host server I/O performance:

- If you are creating SI pairs, try one or both of the following:
  - Create the pair when the I/O load is light.

    For more information about checking I/O performance-related information, see the *Hitachi Command Suite User Guide*.
  - Limit the number of pairs that you simultaneously create.
- If you are creating, splitting, or resynchronizing SI pairs, select a slower copy pace. You can enable the system option for copy pace or you can select a specific copy pace while performing the task.

  For more information:

- About enabling the system option for copy pace, see Changing system options on page 5-18.
- About selecting a copy pace while creating SI pairs, see Creating SI pairs on page 4-6.
- About selecting a copy pace while splitting SI pairs, see Splitting SI pairs on page 4-19.
- About selecting a copy pace while resynchronizing SI pairs, see Resynchronizing or restoring SI pairs on page 4-32.

6

Troubleshooting ShadowImage

This topic provides SI troubleshooting information.

- SI actions and display troubleshooting
- Troubleshooting pinned tracks
- Troubleshooting extended copy times
- Locating and interpreting error codes and logs using the Command Control Interface
- Calling Hitachi Data Systems customer support

SI actions and display troubleshooting

The following table provides symptoms and suggested corrective actions for troubleshooting SI pairs.

Symptom	Corrective action
HDvM - SN hangs, or SI pair task are not properly performed.	• Make sure all SI requirements and restrictions are met. • Make sure the storage system is powered on and fully functional. • Check all input values and parameters to make sure that you entered the correct information on the SI windows (such as P-VOL and S-VOL IDs).
The volume pairs are not displaying correctly.	Select the correct volumes.
An SI error message is displayed in HDvM - SN during a task.	Check the error message for the failed task in HDvM - SN. **Note:** You can use HDvM - SN to set up email notifications of errors that occur during pair user tasks. For more information about managing your tasks and setting up email notifications, see the *Hitachi Command Suite User Guide*. For a list of error codes and corrective actions, see *Hitachi Device Manager - Storage Navigator Messages*.
Pair status is incorrect (or unexpected).	The pair may have been suspended or deleted from the UNIX/PC server host using a CCI command. If this did not happen, then the storage system detected an error condition during SI tasks. Check the HDvM - SN error log. If necessary, call the Support Center.

Troubleshooting pinned tracks

If a pinned track occurs on an SI P-VOL or S-VOL, the storage system suspends the pair. Contact your HDS representative for assistance in recovering pinned tracks.

Troubleshooting extended copy times

The following table describes some causes and possible responses in the case of extended copy times.

Cause	Response
A processor with an MP usage rate that exceeds 80% exists within the MP unit to which the P-VOL and S-VOL are allocated.	Examine the configuration.For information about checking the MP usage rate, see the *Hitachi Virtual Storage Platform Performance Guide*.

Cause	Response
The **HOST I/O Performance** option is enabled.	Disable the option. For more information about disabling, see System options that affect performance on page 2-8.
The S-VOL's HDD or external storage performance is lower than the P-VOL's.	Make the configuration of the S-VOL's HDD or external storage the same as the P-VOL's.
The P-VOL's HDD or external storage has an error.	Check the error and make the necessary correction.
The S-VOL's HDD or external storage has an error.	Check the error and make the necessary correction.

Locating and interpreting error codes and logs using the Command Control Interface

You can troubleshoot the tasks that you have performed using the CCI. The following task describes the CCI error codes and how to locate and interpret them.

You can use the SSB1/SSB2 error code combination to determine the cause of the error. The error codes are shown to the right of the equal symbol (=) in the log. The SSB1 code is the last four alphanumeric characters to the left of the comma (,). The SSB2 code is the last four alphanumeric characters to the right of the comma (,).

1. Open one of the following:
   - The CCI window.
   - The CCI operation log file.
2. In the log that is displayed, locate the log or error code you are investigating and the SSB1 and SSB2 codes:
   - (If you are using the CCI window)
     Example log:
     ```
     It was rejected due to SKEY=0x05,
     ASC=0x20,SSB=0xB9E1,0xB901 on Serial#(64015)
     ```
     SSB1 code: `B9E1`
     SSB2 code: `B901`
   - (If you are using the CCI operation log file)
     Example error code:
     ```
     11:06:03-37897-10413- SSB = 0xb9a0,2089
     ```
     SSB1 code: `b9a0`
     SSB2 code: `2089`
3. Locate the description of the SSB1/SSB2 error code combination in the following CCI error code table.

For more information about the errors that are not described in the table, call the Support Center.

For more information, see Calling Hitachi Data Systems customer support on page 6-13.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
-	An error occurred during an SI pair task.
200D	The pair task was rejected because the specified DP-VOL is not associated with a pool.
201B	The CTG pair-split was rejected because the UR pair is suspended ("PSUE" status), unpaired, or is not split ("PSUS" status). The UR S-VOL was the SI P-VOL included in the CTG on which the pair-split is being performed.
2026	The Quick Restore was rejected because the cache mode of the specified external P-VOL is different from the cache mode of the external S-VOL.
2043	The volume you specified as a P-VOL was a volume using two mirrors included in a 3-UR DC multi-target or cascade configuration. The operation was rejected because the volume was used as a UR pair volume.
202D	The pair task was rejected because one of the following conditions applies to the P-VOL: • It is used as a global-active device pair volume, and the volume status does not allow the pair task. • It is a volume for which the global-active device reserve attribute is set.
202E	The pair task was rejected because one of the following conditions applies to the S-VOL: • It is used as a global-active device pair volume. • It is a volume for which the global-active device reserve attribute is set.
2036	The pair task was rejected because the global-active device quorum disk was specified as the SI P-VOL.
2037	The pair task was rejected because the global-active device quorum disk was specified as the SI S-VOL.
2044	The volume you specified as an S-VOL was a volume using two mirrors included in a 3-UR DC multi-target or cascade configuration. The operation was rejected because the volume was used as a UR pair volume.
2047	The pair task was rejected because the current DKCMAIN firmware version does not support the specified P-VOL capacity.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
2048	The pair task was rejected because the current DKCMAIN firmware version does not support the specified S-VOL capacity.
205B	The pair was not created because the specified MU number is in use.
2060	The volume you specified as an SI P-VOL was a volume of a UR pair. The pair task was rejected because the status of the UR pair is not in the required status. For more information about the required status for each pair task, see Pair status and supported pair user tasks on page 5-7.
2061	The volume you specified as an SI S-VOL was a volume of a UR pair. The pair task was rejected because the status of the UR pair is not in the required status. For more information about the required status for each pair task, see Pair status and supported pair user tasks on page 5-7.
2067	Volumes of the specified pair are shared by TC and UR. The reverse resynchronization was rejected because the TC or UR pair is not split ("PSUS" status).
2072	The pair task was rejected because of one of the following reasons: • The P-VOL is also an HTI pool volume. • The P-VOL is also an HTI S-VOL. • The P-VOL is also an HTI P-VOL, and one of the following conditions is also true: - While restoring the HTI pair, you created, split, or resynchronized the SI pair. - You performed the SI Quick Restore. - You defined a CTG for SI. - After you specify the MU number an HTI pair is using, you created, split, or resynchronized the SI pair.
2073	The pair task was rejected because of one of the following reasons: • The S-VOL is also an HTI pool volume. • The S-VOL is also an HTI S-VOL or an HTI V-VOL. • The S-VOL is also an HTI P-VOL, and you created an SI pair or performed an SI Quick Restore operation. • The S-VOL is also an HTI P-VOL, and you split, resynchronized, or suspended an SI pair while restoring the HTI pair.
2078	Because the specified P-VOL was also a UR P-VOL for delta resync, one of the following errors occurred:

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
	• The Reverse Copy was rejected because the UR pair status is not "PSUS". • The Quick Restore was rejected.
2079	The pair task was rejected because the specified S-VOL was also a UR P-VOL for delta resync.
2086	The pair task was rejected because the initialization process is being performed.
2089	The Quick Restore was rejected because you are formatting the volume you specified as a P-VOL using Quick Format. For more information about formatting volumes using Quick Format, see the *Hitachi Virtual Storage Platform Provisioning Guide*.
208A	The Quick Restore was rejected because you are formatting the volume you specified as an S-VOL using Quick Format. For more information about formatting volumes using Quick Format, see the *Hitachi Virtual Storage Platform Provisioning Guide*.
2093	The pair task was rejected because T10PI settings for the P-VOL and the S-VOL are not the same.
2097	The Quick Restore was rejected because of one of the following: • The P-VOL is also an HDP V-VOL, but the S-VOL is a normal volume. • The P-VOL is a normal volume, but the S-VOL also an HDP V-VOL.
20A2	The create pair task was rejected because the P-VOL is a DP-VOL for which the capacity is increasing.
20A3	The pair was not created because the S-VOL is a DP-VOL for which capacity is increasing.
20A4	The pair operation was rejected because the volume you specified as the P-VOL is an external volume for which the Data Direct Mapping attribute is enabled.
20A7	The pair operation was rejected because the volume you specified as the S-VOL is an external volume for which the Data Direct Mapping attribute is enabled.
20A9	The pair task was rejected because HTI is using the specified CTG ID.
20AA	The pair operation was rejected because the volume you specified as the P-VOL was a DP-VOL and the Unmap command operation was in progress with system option mode 905 ON.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
20AB	The pair operation was rejected because the volume you specified as the S-VOL was a DP-VOL and the Unmap command operation was in progress with system option mode 905 ON.
20B0	The pair task was rejected because the volume you specified as the P-VOL is a DP-VOL and its capacity is increasing.
20B1	The pair task was rejected because the volume you specified as the S-VOL is a DP-VOL and its capacity is increasing.
20B4	The pair task was rejected because the volume you specified as the P-VOL is a DP-VOL, which is not associated with a pool.
20B5	The pair task was rejected because the volume you specified as the S-VOL is a DP-VOL, which is not associated with a pool.
20B7	The pair task was rejected because a LU path is not defined to the volume you specified as the P-VOL.
20B8	The pair task was rejected because a LU path is not defined to the volume you specified as S-VOL.
20C5	The command was rejected because you were in the process of turning off the storage system's power.
20D0	The create pair task was rejected because the volume you specified as the P-VOL is a DP-VOL and is in the process of initializing the pool.
20D1	The create pair task was rejected because the volume you specified as the S-VOL is a DP-VOL and is in the process of initializing the pool.
20E6	The CTG pair split function cannot be used from CCI for CTG reserved on Device Manager - Storage Navigator.
20E9	The pair task was rejected because the volume you specified as the P-VOL is a S-VOL for an existing pair, and the volume you specified as the S-VOL is the P-VOL for another existing pair.
2301	The pair task was rejected because there is not a sufficient amount of installed control memory or SI is not installed.
20F2	The pair task was rejected because the physical serial numbers of the corresponding storage systems do not match, even if the virtual serial numbers match, when the serial numbers of the virtual storage machines are specified for the P-VOL and S-VOL.
20F4	The pair task was rejected because either the device model and serial number or the virtual LDEV ID of the volume specified as the P-VOL is being changed.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
20F5	The pair task was rejected because either the device model and serial number or the virtual LDEV ID of the volume specified as the S-VOL is being changed.
2306	The pair task was rejected because the LBA size of the specified P-VOL is not the same as the size of the specified S-VOL.
2309	The pair was not created because the number of pairs exceeded the maximum number of pairs.
230A	The pair was not created because the volume you specified as the S-VOL is the P-VOL of the SI pair that has an MU number of 0.
230B	The pair task was rejected because the pair is being suspended or deleted.
2310	One of the following occurred: • Pair creation was rejected because the specified CTG ID had already been used for an L1 pair. • Pair creation was rejected because the specified CTG ID had already been used for an L2 pair. • Pair creation was rejected because the volume you specified as the P-VOL is the S-VOL of the pair which is in the process of being Quick Split. • The Quick Restore was rejected because the VLL setting of the P-VOL is different from that of the S-VOL. • The pair task was rejected because the specified P-VOL and S-VOLs were a Compatible FlashCopy® pair. • The reverse resynchronization was rejected because the pair of the specified P-VOL and S-VOLs is suspended ("PSUE" status). • The reverse resynchronization was rejected because the specified P-VOL and the S-VOL is the L2 pair. • The CTG pair-split was rejected because some of the pairs in the CTG were being resynchronized, split, or were already suspended. • The pair task was rejected because the pair status of the P-VOL, the S-VOL, or both showed that the pair could not receive the issued command.
2314	The pair was not created because the volume you specified as the S-VOL is the S-VOL of another pair that has been split ("PSUS" status).
2322	The pair task was rejected because there is not a sufficient amount of installed control memory or initialization is not completed.
2324	The pair task was rejected because the number of slots of the volume you specified as the P-VOL exceeded the upper limit.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
2325	The pair task was rejected because the number of slots of the volume you specified as the S-VOL exceeded the upper limit.
2326	The pair was not created because the volume you specified as the P-VOL had already had three S-VOLs.
2327	The pair was not created because the node volume specified as the P-VOL had already had two S-VOLs.
2328	The pair task was rejected because the pair configuration exceeded the number of the layers of the cascade configuration.
2329	The pair task was rejected because the volume you specified as the S-VOL is the S-VOL of an existing pair.
232A	The pair was not created because pairs that would exceed the license capacity were going to be created.
232F	The pair task was rejected because the volume you specified as the P-VOL is allocated as the destination of the Volume Migration.
2331	The pair task was rejected because the capacity of the specified P-VOL is not the same as the S-VOL's.
2332	The pair was not created because the volume you specified as the P-VOL had already had three S-VOLs.
2333	The pair task was rejected because the volume you specified as the P-VOL is not the P-VOL of the existing pair.
233A	The **pairresync** CCI command was rejected because the volume you specified as the P-VOL is not an SI P-VOL.
233B	The pair task was rejected because the volume you specified as the S-VOL is a root volume.
233C	The pair task was rejected because the volume you specified as the S-VOL is a node volume, and the volume you specified as the P-VOL is not the P-VOL for the specified S-VOL.
233D	The **pairsplit** CCI command was rejected because the specified P-VOL and S-VOLs were a L2 pair, and the L1 pair is not split ("PSUS" status).
233E	The pair task was rejected because the volume you specified as the P-VOL is being used as the TC P-VOL.
233F	The pair task was rejected because the volume you specified as the S-VOL is the TC P-VOL, and the pair is not split ("PSUS" status) or suspended ("PSUE" status).
2342	The pair task was rejected because the volume you specified as the S-VOL is the destination of the Volume Migration.

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
2343	The pair was not created because the volume you specified as the S-VOL had already been an S-VOL.
2344	The pair task was rejected because the volume you specified as the S-VOL for SI pair tasks is not an S-VOL.
2346	The volume you specified as an SI S-VOL is a TC P-VOL. The pair task was rejected because the TC pair is not in the required status. For more information about the required status for each pair task, see Pair status and supported pair user tasks on page 5-7.
2347	The volume you specified as an SI S-VOL was a TC S-VOL. The pair task was rejected because the TC pair is not in the required status. For more information about the required status for each pair task, see Pair status and supported pair user tasks on page 5-7.
234B	The pair task was rejected because the volume you specified as the S-VOL is the volume of the Volume Migration.
2350	The pair task was rejected because the specified P-VOL and the S-VOL for SI pair tasks is not a pair.
2351	The pair task was rejected because the volume you specified as the P-VOL and the volume you specified as the S-VOL are the same.
2353	The pair was not deleted because the specified P-VOL and S-VOLs are in the process of being Quick Split.
2354	The **`pairresync`** CCI command was rejected because the P-VOL and S-VOLs is in the process of being Steady Split.
2357	The pair creation was rejected because the volume you specified as the S-VOL is the P-VOL of the pair you are splitting or the P-VOL of the pair you are reverse resynchronizing.
2358	The **`pairresync`** CCI command was rejected because the volume you specified as the S-VOL is the P-VOL of the splitting pair.
235B	The volume you specified as a P-VOL is a TC P-VOL. The reverse resynchronization was rejected because the TC pair is not suspended ("PSUE" status) or split ("PSUS" status).
235C	The volume you specified as the P-VOL is a TC S-VOL. The reverse resynchronization was rejected because the TC pair is not suspended ("PSUE" status) or split ("PSUS" status).
235D	The volume you specified as an S-VOL was a TC P-VOL. The reverse resynchronization was rejected because the TC pair is not suspended ("PSUE" status) or split ("PSUS" status).

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
236C	The reverse resynchronization was rejected because the volume you specified as the P-VOL has the S-VOL Disable attribute assigned by the Data Retention Utility.
236D	The pair task was rejected because the volume you specified as the S-VOL has the S-VOL Disable attribute assigned by the Data Retention Utility.
2370	The pair task was rejected because the volume you specified as the P-VOL is not mounted.
2371	The pair task was rejected because the volume you specified as the P-VOL is blocked.
2372	The pair task was rejected because the volume you specified as the P-VOL is being formatted or shredded.
2373	The pair task was rejected because the volume you specified as the P-VOL is a command device.
2380	The pair task was rejected because of one of the following reasons: • The volume you specified as the S-VOL is not mounted. • The MU number is 3 or larger.
2381	The pair task was rejected because the volume you specified as the S-VOL is blocked.
2382	The pair task was rejected because the volume you specified as the S-VOL is being formatted or shredded.
2383	The pair task was rejected because the volume you specified as the S-VOL is a command device.
2387	The pair was not created because the volume you specified as the P-VOL is the volume for Volume Migration.
2394	The pair was not registered in the CTG because the number of the pairs assigned to the CTG has exceeded the defined maximum number of pairs.
2395	The pair task was rejected because you are reverse resynchronizing the pair sharing the specified volume as the P-VOL.
2396	The pair task was rejected because you are reverse resynchronizing the L1 pair sharing the specified P-VOL as the root volume.
2398	The reverse resynchronization was rejected because the pair is not split ("PSUS" status) or suspended ("PSUE" status).
2399	The reverse resynchronization was rejected because some of the pairs sharing the specified volume as the P-VOL are not in split ("PSUS" status) or suspended ("PSUE" status).

SSB2 code (SSB1 code: 2e31/ b9a0/ b9a1/ b9a2/ b9a5/ b9a6/ b9ae/b9af)	Description
23BB	The pair was not created because the volume you specified as the S-VOL could not be used as the S-VOL because of Volume Security settings.
23EF	The pair was not deleted because the P-VOL and S-VOL are in the process of being Quick Split.
23F1	The pair was not created because the CTG identifier you specified is not supported.
9100	You cannot run the command because the system did not authenticate your user information.
B911	The pair task was rejected because the specified volume did not exist.
B912	The pair was not created because the specified S-VOL does not exist.
B913	The pair task was rejected because the mirror ID is invalid.

Related topics

- Troubleshooting consistency group pair-split failures on page 6-12.

Troubleshooting consistency group pair-split failures

If a consistency group (CTG) pair-split fails, note the following:

- The pairs in the CTG are suspended ("PSUE" status).
- If the host server is down or has failed, you can assign a pair to a CTG that is not associated to another SI pair. If you are using the CCI to run commands under such a condition, do not run the following command with CTG pair-split:

  `paircreate`

  In this case, do the following:

  a. Locate a CTG ID that is not being used by a pair.
  b. Specify the CTG ID explicitly.
  c. You can now run the **`paircreate`** command on the host server.
- If you are using a UR S-VOL as an SI P-VOL and you are using the CCI to run commands and the status for some pairs that are assigned to a CTG are not changed, some pairs remain unsplit in the CTG and pair consistency is not guaranteed after you run the following command:

  `pairsplit`

The following are possible reasons why the status for some pairs that are assigned to a CTG are not changed:

- The UR pair is assigned to a CTG and the P-VOL and S-VOL have the same contents. The journal volumes for this pair are full.
- The SI license is invalid.
- The SI pair volumes are blocked.
- The SI pair is in a status that does not allow you to run the **pairsplit** CCI command.

  For more information about pair status, see Monitoring SI pair status and available activity on page 5-3.
- The SI pair is a part of cascaded pairs and the other pairs in the cascaded pairs are in a status that does not allow you to split the pairs.

  For more information about L1 and L2 pair status and the pair tasks that you can perform on cascaded pairs, see L1, L2 pair status and supported pair user tasks on page 5-7.
- You are using an SI pair volume in a TC or UR pair and the TC or UR pair is in a status that does not allow you to run the **pairsplit** CCI command.

If you cannot change the status, the **pairsplit** CCI command can end abnormally with the error code EX_EWSTOT, which indicates timeout occurrence. You cannot change the pair status during a timeout.

Remove these factors then complete the following:

1. Resynchronize the pairs.
2. Split the pairs.

Calling Hitachi Data Systems customer support

If you need to call Hitachi Data Systems customer support, provide as much information about the problem as possible, including the following:

- The circumstances surrounding the error or failure.
- The content of the error messages displayed on the host systems.
- The content of the error messages displayed inHDvM - SN.
- HDvM - SN configuration information (use the Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, that HDvM - SN displays.

The HDS customer support staff is available 24 hours a day, seven days a week. To contact technical support, log on to Hitachi Data Systems Support Connect for contact information: https://support.hds.com/en_us/contact-us.html.

A

Interface support for SI user tasks and options

This appendix lists SI actions and options, and the interfaces that support them.

- Supported Device Manager - Storage Navigator and CCI actions and options
- Supported ShadowImage consistency group actions and options

Supported Device Manager - Storage Navigator and CCI actions and options

The following table lists the SI pair actions and options that HDvM - SN and CCI support.

Action	System option	HDvM - SN	CCI	
			Command	Option
Change system options	No options	YES	Not applicable	Not applicable
Create pairs	No options	YES	paircreate	Not applicable
	MU number	YES	paircreate	Uses MU# in HORCM.conf file
	Copy pace	YES	paircreate	-c <size>
	Steady Split	YES	paircreate	-split -fq normal
	Quick Split	YES	paircreate	-split -fq quick
	MSGREQ	NO	NO	NO
	ONLINSEC	NO	NO	NO
Split pairs	No options	YES	pairsplit	Not applicable
	Copy pace	YES	pairsplit	-C <size>
	Steady Split	YES	pairsplit	-fq normal
	Quick Split	YES	pairsplit	-fq quick
	Prevent S-VOL read	NO	paircreate	-m noread
Resynchronize pairs	No options	YES	pairresync	Not applicable
	Copy pace	YES	pairresync	-c <size>
	Normal Copy	YES	pairresync	-fq normal
	Quick Resync	YES	pairresync	-fq quick
	Reverse Copy	YES	pairresync	-fq normal -restore
	Quick Restore	YES	pairresync	-fq quick -restore
Suspend pairs	No options	YES	pairsplit	-E
Delete pairs	No options	YES	pairsplit	-S

Supported ShadowImage consistency group actions and options

The following table shows the SI CTG actions and options that HDvM - SN or CCI support.

CTG action	System option	HDvM - SN	CCI	
			Command	Option
Reserve CTG	No options	YES	Not necessary	Not necessary
Cancel the CTG reservation	No options	YES	Not necessary	Not necessary
Assign pairs to a CTG	No options	NO	paircreate	-m grp [CTGID]
	MU number	NO	paircreate	Uses MU# in HORCM.conf file
	Copy pace	NO	paircreate	-m grp [CTGID] -c <size>
	User specifies the CTG ID	NO	paircreate	-m grp xx (xx = CTGID)
	System allocates the CTG ID	NO	paircreate	-m grp (CTGID is omitted)
CTG pair-split (undefined split time)	No options	NO	pairsplit	Not applicable
	Copy pace	NO	pairsplit	-C <size>
	Steady Split	NO	pairsplit	-fq normal
	Quick Split	NO	pairsplit	-fq quick
	UR-SI combination (Steady Split)	NO	pairsplit	-fq normal
	UR-SI combination (Quick Split)	NO	pairsplit	-fq quick
Resynchronize pairs	No options	NO	pairresync*	Not applicable
	Copy pace	NO	pairresync*	-c <size>
	Normal Copy	NO	pairresync*	-fq normal
	Quick Resync	NO	pairresync*	-fq quick
	Reverse Copy	NO	pairresync*	-fq normal -restore
	Quick Restore	NO	pairresync*	-fq quick -restore
	ONLINSEC	NO	NO	NO
Delete pairs	No options	NO	pairsplit*	-S
* You must use a CCI pair group to run the command on pairs in a CTG.				

B

ShadowImage GUI reference

This appendix describes SI windows and dialog boxes in HDvM - SN.

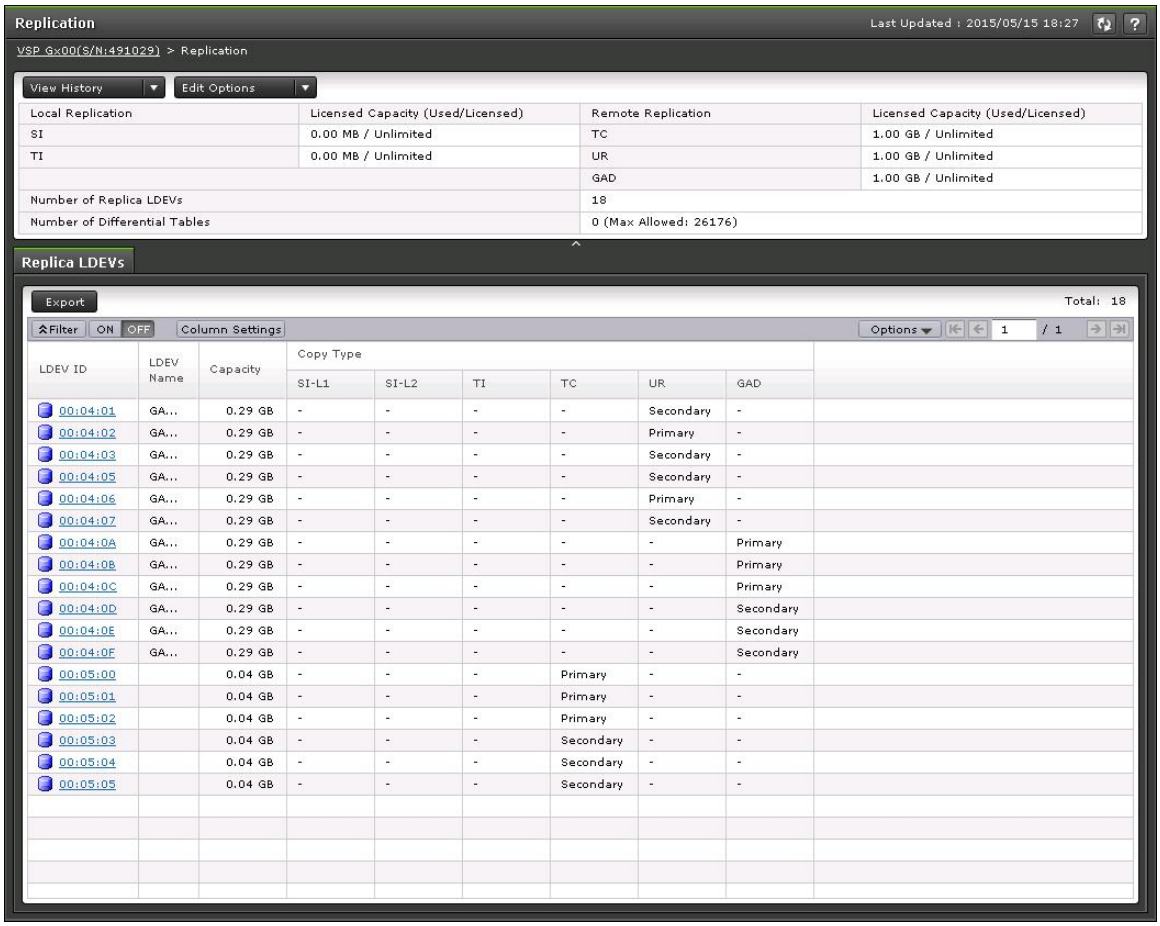
Replication window

Use this window to view pair information for local replication.

This window includes the following tabs:

- Summary section
- **Replication** tab
- **Replica LDEVs** tab

The following image shows this window, with the summary section and **Replica LDEVs** tab in view.



Summary section

The following table shows the items in this section of the **Replication** window.

Item	Description
Licensed Capacity	The amount of used and licensed capacity of each software application.
Number of Replica LDEVs	The number of LDEVs used for all local replication pairs.

Item	Description
Number of Differential Tables	SI only. The number of differential tables in use and the differential table limit. 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. • SI pair operations for a DP-VOL that exceeds 4 TB.
View History button (for Local Replication)	Click to open the **History** window for local replication.
View History button (for Remote Replication)	Click to open the **History** window for remote replication.
Edit Options button (for Local Replication)	Click to open the **Edit Local Replica Options** wizard.
Edit Options button (for Remote Replication)	Click to open the **Edit Remote Replica Options** wizard.

Replications tab

The **Replica LDEVs** tab shows a list of LDEVs. From this window, you can complete the following:

- Click the LDEV ID for a specific replica LDEV and open the **LDEV Properties** window, which contains additional information for the selected replica LDEV.
- View information for a list of replica LDEVs for the selected LDEV.

The following table shows the items on this tab in the **Replication** window.

Item	Description
Contents	Click to open the windows for: • Local Replication • Remote Replication • Journal • Remote Connections

Replica LDEVs tab

The following table shows the items on this tab in the **Replication** window.

Item	Description
LDEV ID	Selected LDEV's identifier. Click to open the **LDEV Properties** window, which contains additional information for the selected replica LDEV.

Item	Description
LDEV Name	The selected LDEV's name.
Capacity	The selected LDEV's capacity
Copy Type	The copy type. Values: • **SI-L1**: SI L1 P-VOL or S-VOL • **SI-L2**: SI L2 P-VOL or S-VOL • **TI**: HTI P-VOL or S-VOL • **TC**: TrueCopy P-VOL or S-VOL • **UR**: Universal Replicator P-VOL or S-VOL • **GAD**: global-active device P-VOL or S-VOL Volume types (SI, TI, TC, UR, GAD): • **Primary**: P-VOL • **Secondary**: S-VOL A hyphen [-] is displayed if the pair is not configured.
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 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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **SSID**: The virtual SSID of the volume. If no virtual SSID is specified, a blank is displayed.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.
* This item does not appear in the table by default. To display this item, click **Column Settings**.	

Local Replication window

Use this window to perform the following tasks:

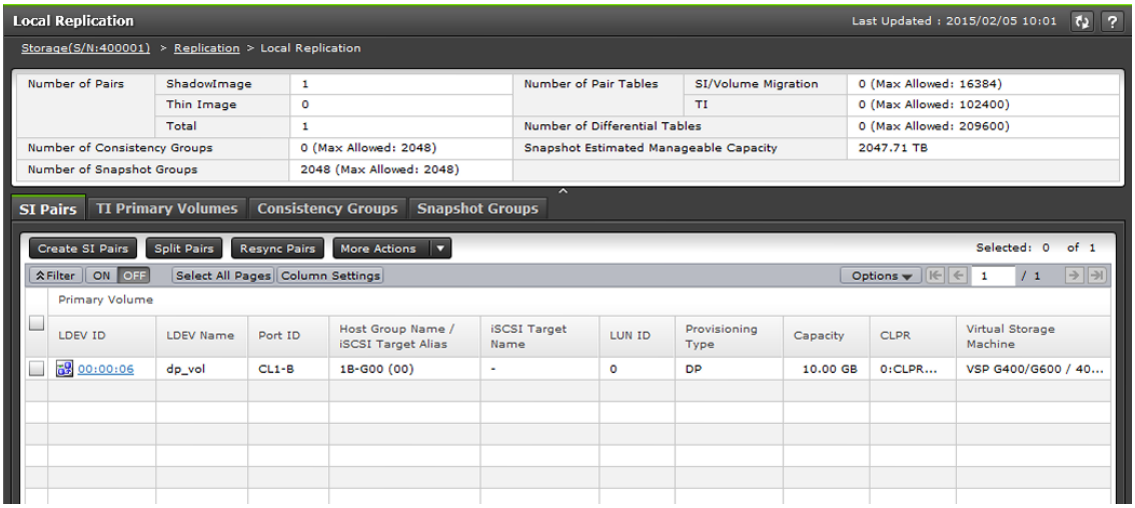
- Viewing SI pair, HTI pair, and CTG information for local replication.
- Creating SI pairs on page 4-6
- Splitting SI pairs on page 4-19
- Resynchronizing or restoring SI pairs on page 4-32

- Deleting SI pairs on page 4-36

This window includes the following section and tabs:

- Summary section
- **SI Pairs** tab
- **TI Primary Volumes** tab
- **Consistency Groups** tab
- **Snapshot Groups** tab

The following image shows the **SI Pairs** tab open in this window.



Summary section

The following table shows the items in this section of the **Local Replication** window.

Item	Description
Number of Pairs	The number of pairs for each local replication software type.
Number of Consistency Groups	The number of CTGs that have a status other than "Free".
Number of Snapshot Groups	The number of snapshot groups in use and the maximum number.
Number of Pair Tables	The number of pair tables in use. Values: • **SI/Volume Migration**: SI, Volume Migration • **TI**: HTI
Number of Differential Tables	The number of differential tables in use and the differential table limit. 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.

Item	Description
	• SI pair operations for a DP-VOL that exceeds 4 TB. This is not used by HTI.
Snapshot Estimated Manageable Capacity*	The estimated HTI pair capacity. The ⚠ icon is shown when the estimated capacity is below the following values: • VSP G200: 12 TB • VSP G400, G600, G800: 20 TB For more information about snapshot estimated manageable capacity, see the *Hitachi Thin Image User Guide*.
* Snapshot Estimated Manageable Capacity is a estimation of a Thin Image pair capacity which can be created from remaining control memory capacity after subtracting control memory used by Thin Image pool and Thin Image pair. Snapshot Estimated Manageable Capacity is just a reference and it doesn't guarantee that Snapshot Estimated Manageable Capacity worth of Thin Image pair will be created.	

SI Pairs tab

This tab on the **Local Replication** window shows the SI pairs for which the P-VOLs and/or S-VOLs are allocated to you.

The following table shows the items on this tab.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. Click to open the **LDEV Properties** window, which contains additional information for the selected replica LDEV. • **LDEV Name**: The P-VOL's LDEV name • **Port ID**: The name of the P-VOL LUN path. • **Host Group Name / iSCSI Target Alias**: The P-VOL's host group name (and ID) and iSCSI target alias (and ID). • **iSCSI Target Name**: The P-VOL's iSCSI target name. • **LUN ID**: The P-VOL's LUN identifier. • **Provisioning Type***: The P-VOL's provisioning type, which can be one of the following: ◦ **Basic**: Internal volume ◦ **DP**: DP-VOL ◦ **External**: External volume • **Attribute***: The P-VOL's attribute. • **Capacity***: The P-VOL's volume capacity. • **CLPR***: The P-VOL's CLPR ID. • **Encryption***: The P-VOL's encryption information.

Item	Description
	◦ **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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems. • **T10 PI***: The P-VOL's T10 PI attribute. ◦ **Enabled**: The T10 PI attribute is enabled. ◦ **Disabled**: The 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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID***: The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	The pair type. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2
Status	The status for the pair. For SI status descriptions, see HDvM - SN pair status names and descriptions on page 5-4. For SI status descriptions, see the *Hitachi ShadowImage® User Guide*.
Secondary Volume	The S-VOL information. Values:

Item	Description

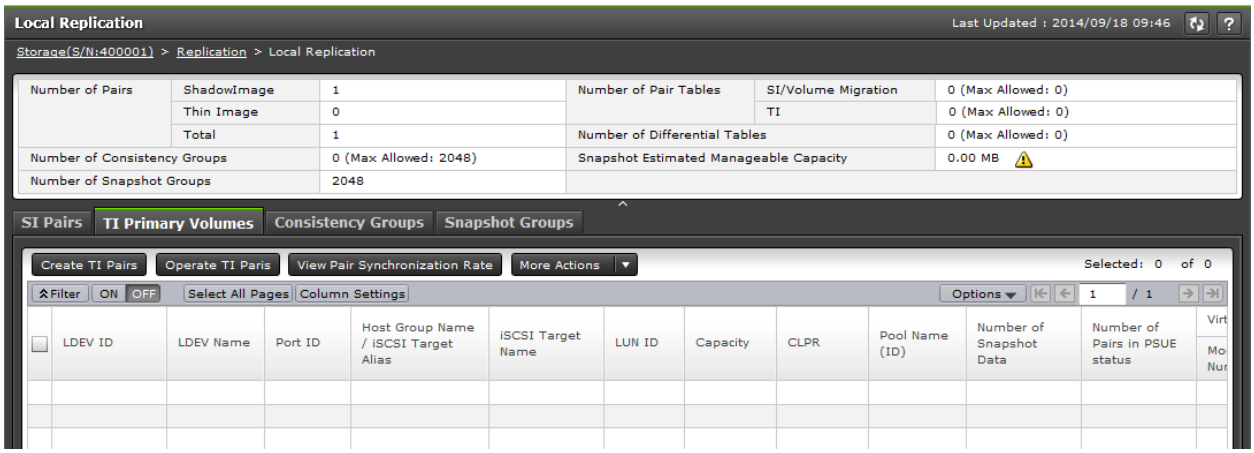
	• **LDEV ID**: The S-VOL's LDEV identifier. Click the LDEV ID to open the **LDEV Properties** window, which contains additional information for the selected LDEV.
	• **LDEV Name**: The S-VOL's LDEV name
	• **Port ID**: The name of the S-VOL LUN path.
	• **Host Group Name / iSCSI Target Alias**: The S-VOL's host group name (and ID) and iSCSI target alias (and ID).
	• **iSCSI Target Name**: The S-VOL's iSCSI target name.
	• **LUN ID**: The S-VOL's LUN identifier.
	• **Provisioning Type***: The S-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL
	  ◦ **External**: External volume
	• **Attribute***: 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.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
	• **T10 PI***: The S-VOL's T10 PI attribute.
	  ◦ **Enabled**: The T10 PI attribute is enabled.
	  ◦ **Disabled**: The 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. If no virtual LDEV ID is assigned, a blank is displayed.

Item	Description
	• **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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID***: The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Pace*	The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower**: Improved host I/O performance but slower processing speed. • **Medium**: Average processing speed and host I/O performance. • **Faster**: Faster processing speed but slower host server I/O performance. If you have not set a copy pace, this item is blank.
CTG ID*	The identifier of the consistency group to which the SI/SI pair is assigned.
Mirror Unit*	The mirror unit number.
Topology ID	The LDEV's topology identifier. This item shows the tier of a pair with the mirror unit, which is expressed in the following format: *The volume's LDEV ID* (*the mirror units*) Example: 00.00.00 (MU0-MU1)
Create SI Pairs button	Click to open the **Create SI Pairs** wizard.
Create TI Pairs button	Click to open the **Create TI Pairs** wizard.
Split Pairs button	Click to open the **Split Pairs** wizard.
Resync Pairs button	Click to open the **Resync Pairs** wizard.
More Actions	Click to show options. 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 a dialog for downloading table information to a tab-separated values (TSV) file.
* This item does not appear in the table by default. To display this item, click **Column Settings**.	

TI Primary Volumes tab

This tab on the **Local Replication** window shows the HTI pairs for which the P-VOLs are allocated to you.

The following image shows this tab.



The following table shows the items on this tab.

Item	Description
LDEV ID	The P-VOL's LDEV identifier. Click to open the **LDEV Properties** window.
LDEV Name	The P-VOL's LDEV name.
Port ID	The name of the P-VOL LUN path.
Host Group Name / iSCSI Target Alias	The P-VOL's host group name (and ID) and iSCSI target alias (and ID).
iSCSI Target Name	The P-VOL's iSCSI target name.
LUN ID	The P-VOL's LUN identifier.
Attribute*	The P-VOL's attribute.
Capacity*	The P-VOL's volume 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.

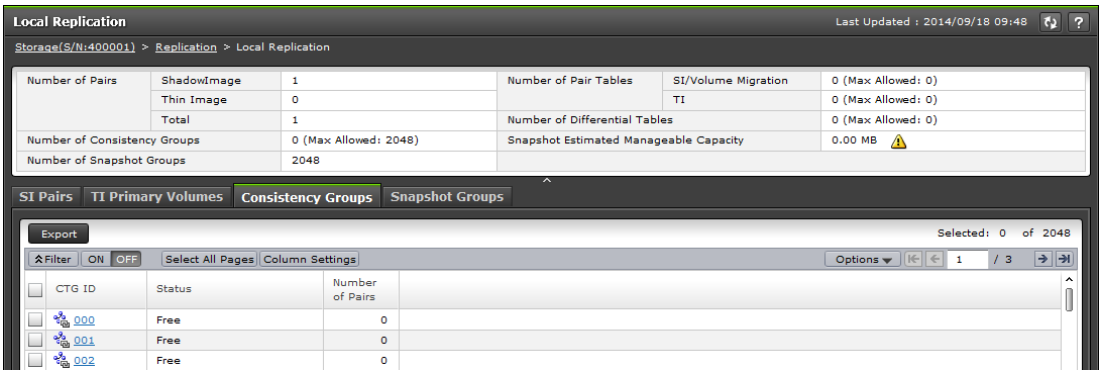
Item	Description
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
Pool Name (ID)*	Pool name and identifier.
Number of Snapshot Data	Number of Snapshot Data for P-VOL.
Number of Pairs in PSUE Status	The number of pairs that are in PSUE status.
T10 PI*	The P-VOL's T10 PI attribute. • **Enabled**: The T10 PI attribute is enabled. • **Disabled**: The T10 PI attribute is disabled.
Virtual Storage Machine*	• **Model / Serial Number**: The model type and serial number of the virtual storage machine to which the P-VOL belongs. • **LDEV ID**: The identification number of the P-VOL's virtual LDEV. • **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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **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** wizard.
Operate TI Pairs	Click to open the **TI Pairs** wizard.
View Pair Synchronization Rate	Click to open the **View Pair Synchronization Rate** window.
More Actions	Click to show options. Options: • **View Pair Properties**: Click to open the **View Pair Properties** window. • **View LDEV Properties**: Click to open the **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 a dialog for downloading table information to a tab-separated values (TSV) file.

Item	Description
* This item does not appear in the table by default. To display this item, click **Column Settings**.	

Consistency Groups tab

This tab on the **Local Replication** window shows your consistency groups.

The following image shows this tab.



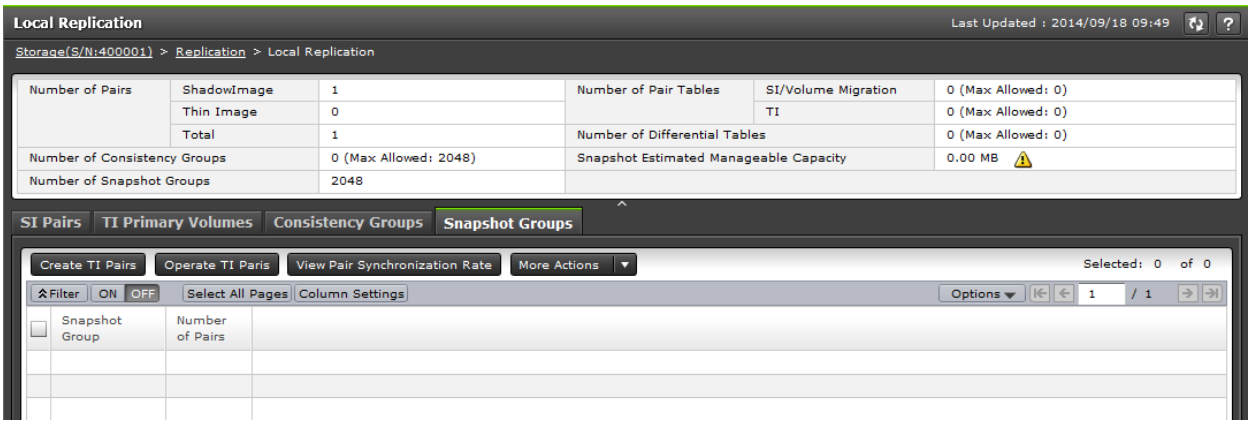
The following table shows the items on this tab on the **Local Replication** window.

Item	Description
CTG ID	The SI pair's CTG identification number. Click to open the **Consistency Group Properties** window.
Status	The status. Values: • **SI Used:** The CTG used by SI. • **TI Used:** HTI pairs is using the CTG. • **Free:** The CTG 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 CTG.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.

Snapshot Group tab

This tab on the **Local Replication** window shows your snapshot groups.

The following image shows this tab.



The following table shows the items on this tab on the **Local Replication** window.

Item	Description
Snapshot Group	Snapshot group name. HTI pairs window is displayed by clicking the snapshot group name.
Number of pairs	Number of pairs for snapshot group which is currently used.
Create TI Pairs	Click to open the **Create TI Pairs** window.
Operate TI Pairs	Click to open the **Operate TI Pairs** window.
View Pair Synchronization Rate	Click to open the **View Pair Synchronization Rate** window.
More Actions	Click to show options. 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 a dialog for downloading table information to a tab-separated values (TSV) file.

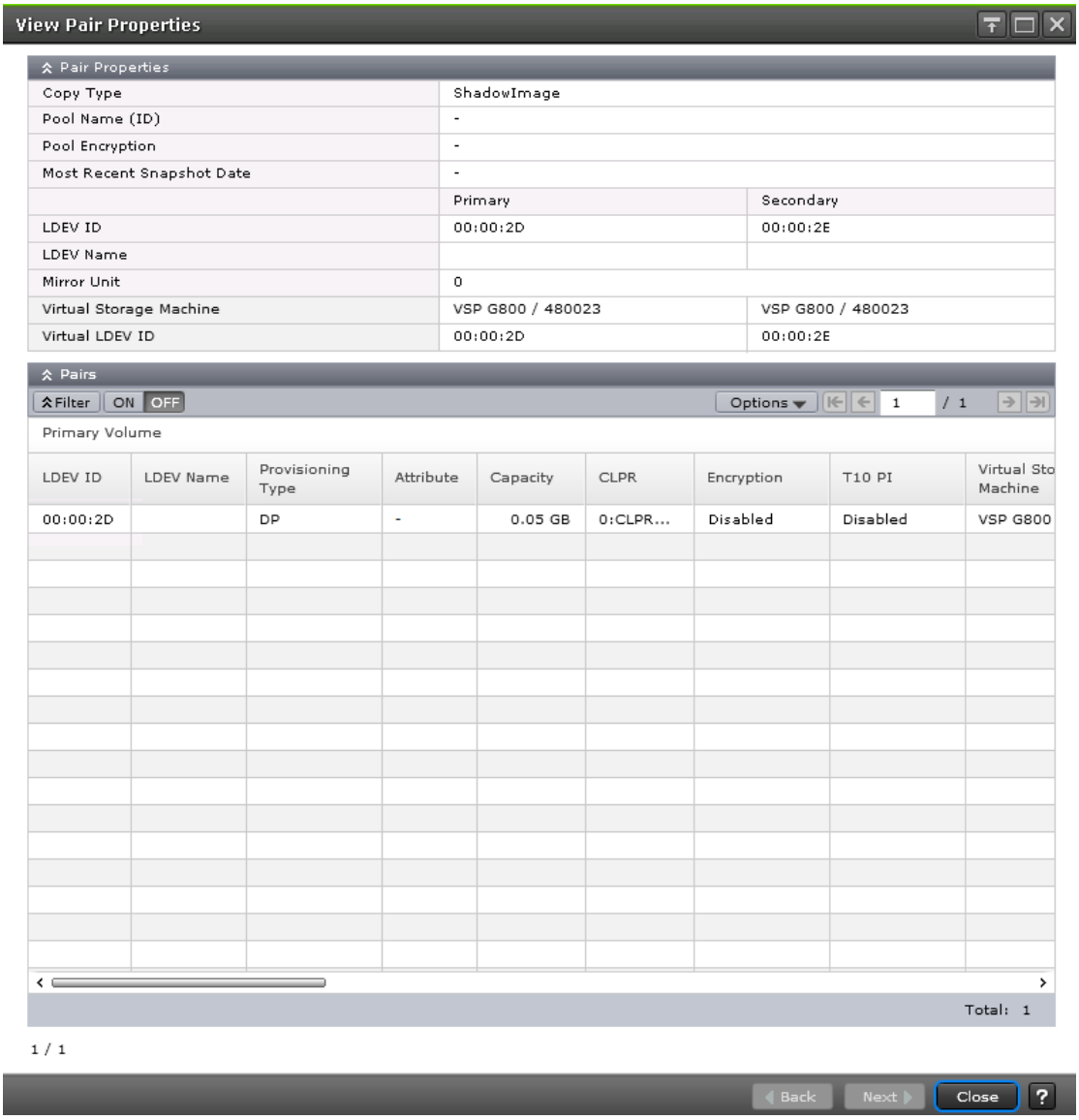
View Pair Properties window

Use this window to review pair and volume details for local replication.

This window includes the following section and table:

- **Pair Properties** section
- **Pairs** table

For more information about this window, see Monitoring SI pair and volume details on page 5-10.



Pair Properties section

The following table shows the items in this section of the **View Pair Properties** window.

Item	Description
Copy Type	The type of pair. Values: • **ShadowImage**: SI pair • **Thin Image**: HTI pair Default: **ShadowImage**
Pool Name (ID)	HTI only.

Item	Description
	The pool name and identification number. If you have not set a pool name for the pair, this item is blank.
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. This item does not appear for VSP G200 storage systems.
Most Recent Snapshot Date	HTI only. The date and time you acquired the most recent snapshot. If you have not acquired a snapshot, this item is blank.
LDEV ID	The identification number of the LDEVs for the P-VOL and S-VOLs.
LDEV Name	The name of the LDEVs 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

The following table shows the items in this table on the **View Pair Properties** window.

Item	Description

Primary Volume	The P-VOL information.
	Values:
	• **LDEV ID**: The P-VOL's LDEV identifier.
	• **LDEV Name**: The P-VOL's LDEV name.
	• **Provisioning type**: The P-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL

Item	Description
	◦ **External**: External volume • **Attribute**: The P-VOL's attribute. • **Capacity**: The P-VOL's volume 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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems. • **T10 PI**: The P-VOL's T10 PI attribute. ◦ **Enabled**: The T10 PI attribute is enabled. ◦ **Disabled**: The 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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair.

Item	Description
	For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.

Secondary Volume	The S-VOL information.
	Values:
	• **LDEV ID**: The S-VOL's LDEV identifier.
	• **LDEV name**: The S-VOL's LDEV name.
	• **Provisioning type**: The S-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL
	  ◦ **External**: External volume
	  ◦ **Snapshot**: HTI volume
	• **Attribute**: The S-VOL's attribute.
	• **Capacity**: The S-VOL's volume 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.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
	• **Mode**: Indicates whether the storage system has written to the S-VOL. For SI, this item also indicates whether the storage system can read the S-VOL.
	  ◦ For SI:
	  - W is shown when the storage system has written data to the S-VOL. W is also shown when the storage system has written data to the S-VOL and the S-VOL cannot be read when its pair status is "PSUS(SP)/PSUS" or "PSUS".
	  - N is shown when the S-VOL cannot be read because you specified "-m noread" using the CCI.
	  - A hyphen (-) indicates that the storage system has not written to the S-VOL.

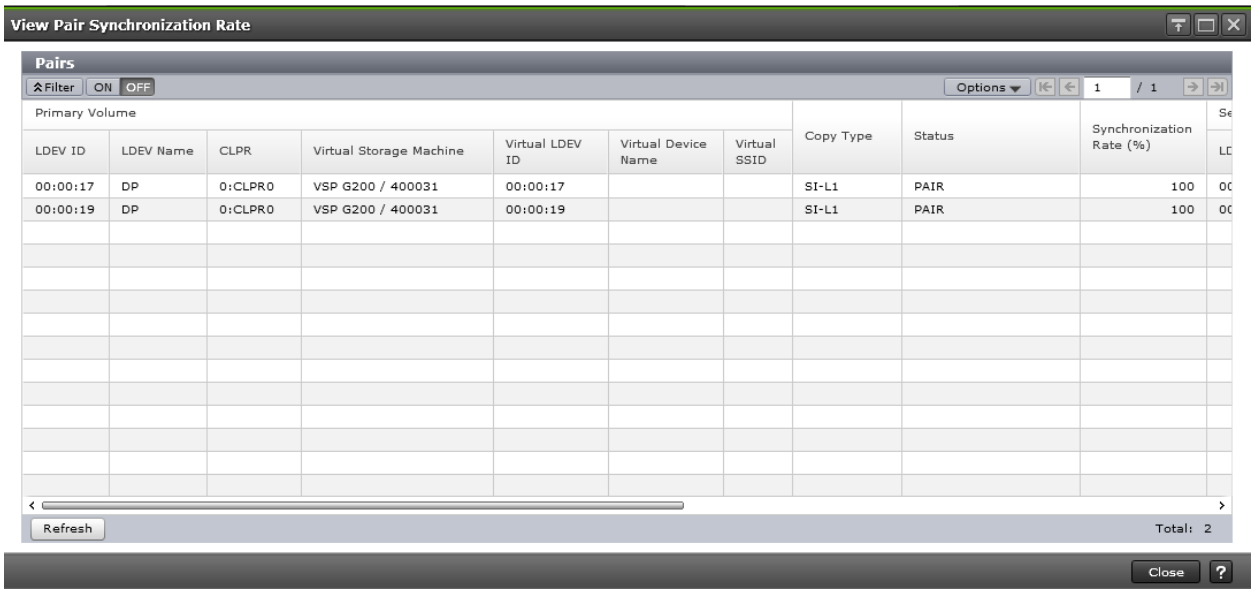
Item	Description
	◦ For HTI: - W is shown if the storage system has written data to the S-VOL when its pair status is "PSUS(SP)/ PSUS" or "PSUS". - A hyphen (-) indicates that the storage system has not written to the S-VOL.
Secondary Volume (continued)	Values (continued): • **T10 PI**: The S-VOL's T10 PI attribute. ◦ **Enabled**: The T10 PI attribute is enabled. ◦ **Disabled**: The 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. 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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Snapshot Date	HTI only. The date and time the snapshot was acquired.
CTG ID	The identification number for the CTG to which the pair is assigned.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data.
Mirror Unit	The mirror unit number.

View Pair Synchronization Rate window

Use this window to view the percentage of synchronized data between the P-VOL and S-VOL. This window includes the **Pairs** table.

For more information about using this window, see Monitoring SI pair synchronization rates on page 5-11.

The following image shows this window.



Pairs table

The following table shows the items in this table.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identifier. • **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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	SI only. The pair type. Values: • **SI-L1**: SI-L1 • **SI-L2**: SI L2

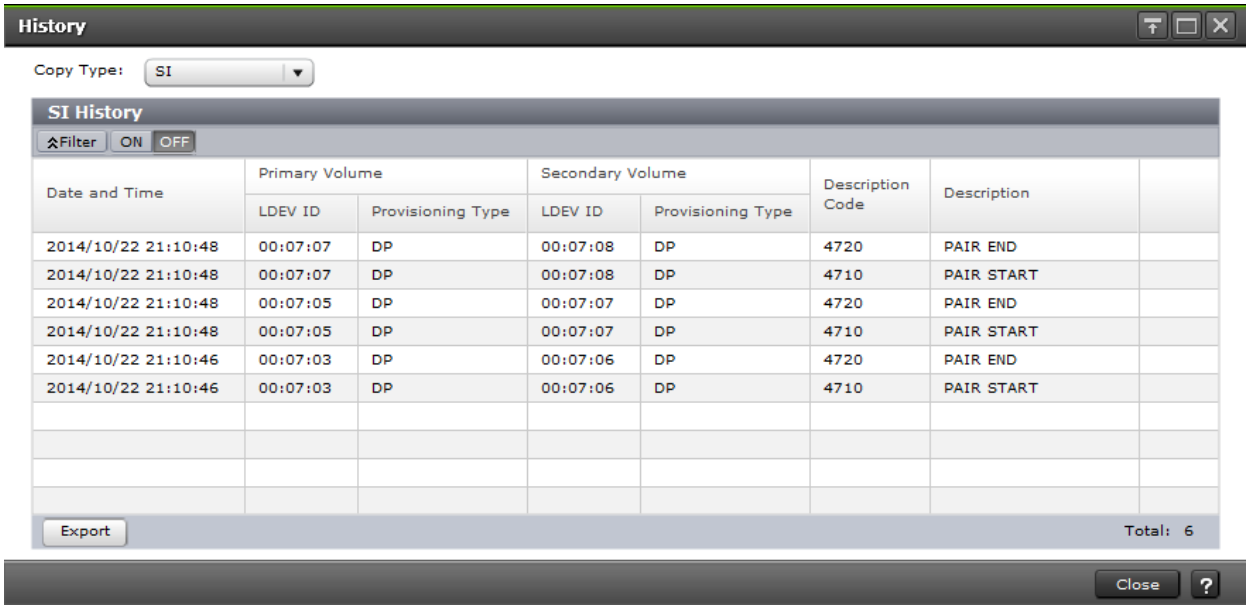
Item	Description
Snapshot Group	HTI only. The snapshot group name. A hyphen (-) is displayed when other than HTI pairs. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Synchronization Rate (%)	For SI: The synchronization rate (%) between P-VOL and S-VOL. For HTI: The rate at which the current 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 and the P-VOL.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Pace	SI only. The system option that determines at which you want the storage system to copy data. Values: • **Slower:** Improved host server I/O performance but slower processing speed. • **Medium:** Average processing speed and host server I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance.

Item	Description
Mirror Unit	The mirror unit number.
Refresh button	Click to update the information in the **Pairs** table.

History window

Use this window to monitor the pair tasks that you have performed.

For more information about monitoring pairs, see Monitoring pair user task history on page 5-15.



Setting fields

The following table shows the setting fields for this window.

Item	Description
Copy Type	The copy type. Values: • **SI:** SI • **TI:** HTI

History table for SI

The following table shows the items in the **SI History** window. Only tasks performed on the pairs consisting of the P-VOL or S-VOLs to which you are allocated are shown. This window shows up to 8,192 of the latest user tasks.

Item	Description
Date	The operation date and time.

Primary Volume	The P-VOL information.
	Values:
	• **LDEV ID**: The P-VOL's LDEV identifier.
	• **Provisioning type**: The P-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL
	  ◦ **External**: External volume

Secondary Volume	The S-VOL information.
	Values:
	• **LDEV ID**: The S-VOL's LDEV identifier.
	• **Provisioning type**: The S-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL
	  ◦ **External**: External volume

Description Code	The code for the type of operation performed.
Description	The description of the operation. For more information about description, see Monitoring pair user task history on page 5-15.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.

History table for HTI

This table is shown on the **HTI History** window. Only tasks performed on the pairs consisting of the P-VOL or S-VOLs to which you are allocated are shown. This window shows up to 8,192 of the latest user tasks.

Item	Description
Date and Time	The date and time the operation was performed.

Primary Volume	The P-VOL information.
	Values:
	• **LDEV ID**: The P-VOL's LDEV identifier.
	• The P-VOL's provisioning type, which can be one of the following:
	  ◦ **Basic**: Internal volume
	  ◦ **DP**: DP-VOL
	  ◦ **External**: External volume

Secondary Volume	The S-VOL information.
Mirror Unit	The S-VOL's mirror unit number.

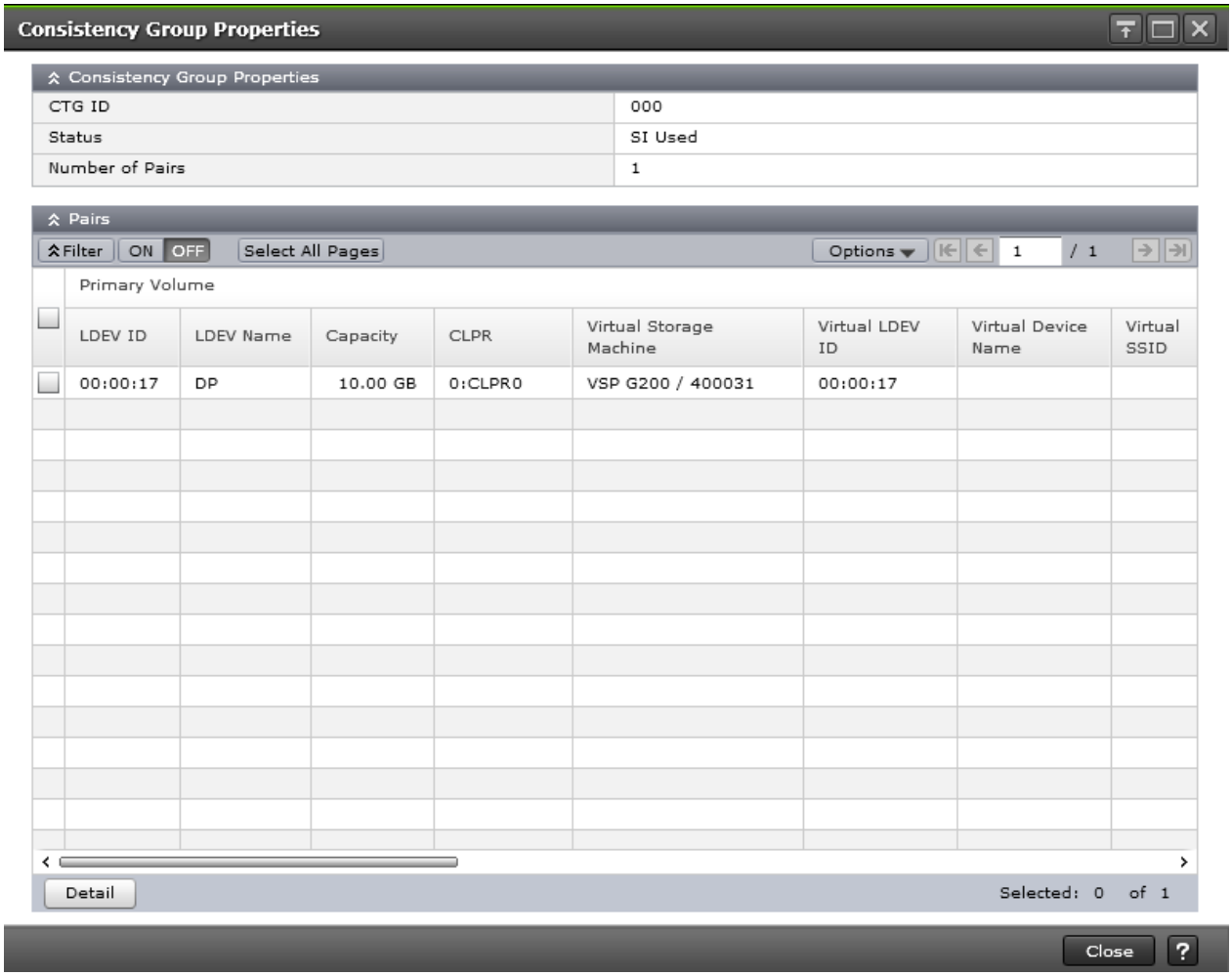
Item	Description
Pool ID	The pool identifier.
Description Code	The code for the type of operation performed.
Description	The description of the operation performed. For details on displayed words, refer to *Hitachi Thin Image User Guide*.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.

Consistency Group Properties window

Use this window to perform the following tasks:

- Viewing a list of CTGs, with status and number of pair information.
- Viewing a CTG's properties.

For more information about this window, see Monitoring consistency groups on page 5-13.



Consistency Group Properties table

The following table shows the items in this table.

Item	Description
CTG ID	The SI pair's CTG identification number.
Status	The CTG status. Values: • **SI Used:** The CTG is in use by SI. • **TI Used:** HTI is using the CTG. • **Free:** The CTG is not being used and is not reserved. • **(Changing...):** The status is the process of changing.
Number of Pairs	The number of pairs assigned to the CTG.

Pairs table

The **Pairs** table shows pairs with P-VOL and/or S-VOL allocated to you.

The following table shows the items in this table.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Capacity:** The P-VOL's volume 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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the P-VOL. If no virtual SSID is specified, a blank is displayed.
Copy Type	The pair type. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2

Item	Description
	• **TI**: HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Snapshot Date	HTI only. The date and time that a snapshot was acquired.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Capacity:** The S-VOL's volume capacity. • **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. "CVS" is displayed at the end of the device name, if the virtual CVS attribute is specified. • **Virtual SSID**: The virtual SSID of the S-VOL. If no virtual SSID is specified, a blank is displayed.
Pool Name (ID)	HTI only. The pool name and identification number.
Copy Pace	SI only. The system option that determines at which you want the storage system to copy data. Values: • **Slower:** Improved host I/O performance but slower processing speed. • **Medium:** Average processing speed and host I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance.
Mirror Unit	The mirror unit number.

Item	Description
Detail button	Click to open the **Pair Properties** window.

Create SI Pairs wizard

Use this wizard to create pairs and to specify new pair details.

This wizard includes the following windows:

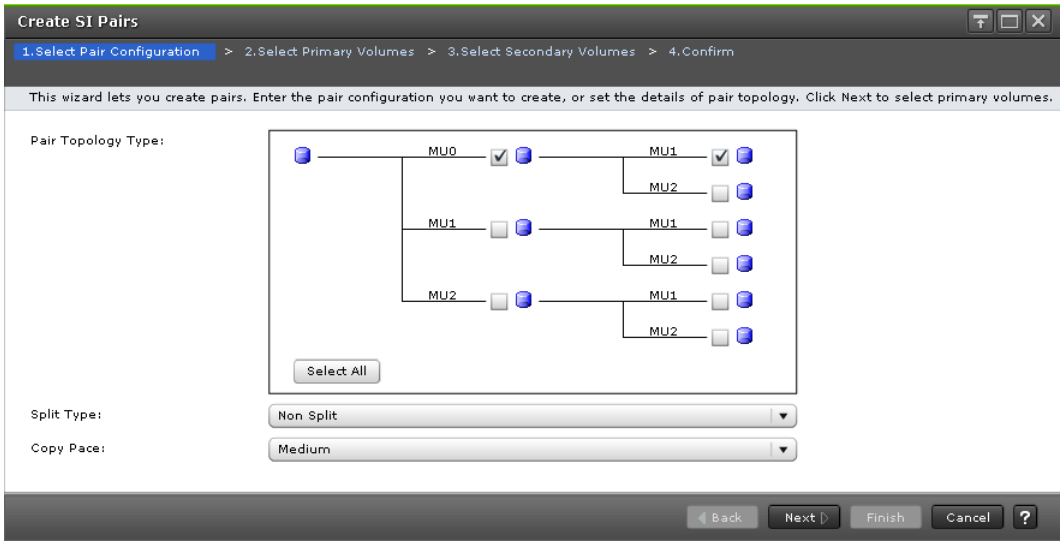
- Select Pair Configuration window on page B-26
- Select Primary Volumes window on page B-27
- Select Secondary Volumes window on page B-31
- Create SI Pairs confirmation window on page B-37

For more information about using this wizard, see Creating SI pairs on page 4-6.

Select Pair Configuration window

Use this window of the **Create SI Pairs** wizard to configure the pairs you plan create.

The following image shows this window of the **Create SI Pairs** wizard.



The following table shows the items in this window.

Item	Description
Pair Topology Type	SI only. The SI pair configuration. Values: • **Cleared but available**: You can configure the pair.

Item	Description
	• **Selected but not available**: The SI pair exists. • **Cleared but not available**: You cannot configure the pair. • **Select All**: Selects all configurations. This item is shown only if you specify **ShadowImage** as the **Copy Type**.
Split Type	SI only. The split type. Values: • **Non Split:** The pair is not split. • **Quick Split:** The pair is split and then the data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background. • **Steady Split:** Differential data is copied and then the pair is split. Default: **Non Split**
Copy Pace	SI only. The system option that determines at which you want the storage system to copy data. Values: • **Slower:** Improved host server I/O performance but slower processing speed. • **Medium:** Average processing speed and host server I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance. Default: **Medium**

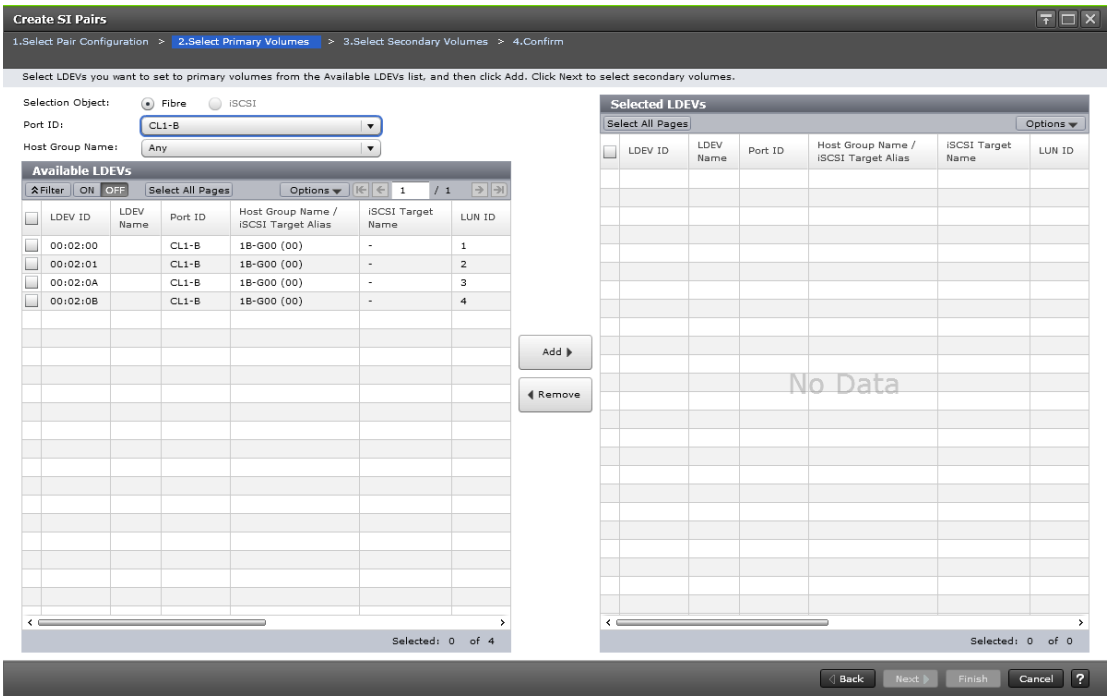
Select Primary Volumes window

Use this window of the **Create SI Pairs** wizard to select LDEVs that are P-VOLs.

This window includes the following tables:

- **Available LDEVs** table.
- **Selected LDEVs** table.

The following image shows this window of the **Create SI Pairs** wizard.



The following table shows items in this window.

Item	Description
Selection Object	Filters LDEVs in the **Available LDEVs** table according to port type. Values: • **Fibre** • **iSCSI**
Port ID	Filters LDEVs in the **Available LDEVs** table according to the port ID.
Host Group Name	Filters LDEVs in the **Available LDEVs** table according to host group name. This item is displayed when you select a Fibre Channel port for Port ID. Default: **Any**
iSCSI Target Alias	Filters LDEVs in the **Available LDEVs** table according to iSCSI target alias. This item is displayed when you select an iSCSI port for Port ID. Default: **Any**

Available LDEVs table

This table is shown on the **Select Primary Volumes** window.

The following table lists the items in this table.

Item	Description
LDEV ID	The LDEV's identifier.

Item	Description
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) and iSCSI target alias (and ID) of the LDEV's LUN path.
iSCSI Target Name	iSCSI target name.
LUN ID	The LUN identifier of the LDEV's LUN path.
Provisioning Type	The LDEV's provisioning type. Values: • **Basic**: Internal volume • **DP**: DP-VOL • **External**: External volume • **ALU**: Volume with ALU attribute.
Attribute	The LDEV's attribute. Values: • **ALU**: Volume with ALU attribute. • **SLU**: Volume with SLU attribute. • **Data Direct Mapping**: Volume with Data Direct Mapping attribute. If the attribute is not set, a hyphen (-) is displayed.
Capacity	The LDEV's capacity.
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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
T10 PI	The LDEV's T10 PI attribute. • **Enabled**: The T10 PI attribute is enabled. • **Disabled**: The T10 PI attribute is disabled.
Number of Secondary Volumes	The total number of S-VOLs assigned to the P-VOL. This value includes the volumes for pairs that you are creating,

Item	Description
	volumes in existing pairs. For an L1 pair, this value does not include the number of L2 S-VOLs.
Add button	Click to move the selected LDEVs from the **Available LDEVs** table to the **Selected LDEVs** table.
Remove button	Click to move the selected LDEVs from the **Selected LDEVs** table to the **Available LDEVs** table.

Selected LDEVs table

This table is shown on the **Select Primary Volumes** window.

The following table shows the items in this table.

Item	Description
LDEV ID	The selected P-VOL's LDEV identifier.
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) and iSCSI target alias (and ID) of the LDEV's LUN path.
iSCSI Target Name	iSCSI target name.
LUN ID	The LUN identifier of the LDEV's LUN path.
Provisioning Type	The LDEV's provisioning type. Values: • **Basic**: Internal volume • **DP**: DP-VOL • **External**: External volume • **ALU**: Volume with ALU attribute.
Attribute	The LDEV's attribute. Values: • **ALU**: Volume with ALU attribute. • **SLU**: Volume with SLU attribute. • **Data Direct Mapping**: Volume with Data Direct Mapping attribute. If the attribute is not set, a hyphen (-) is displayed.
Capacity	The LDEV's capacity.
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.

Item	Description
	• **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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
T10 PI	The LDEV's T10 PI attribute. • **Enabled**: The T10 PI attribute is enabled. • **Disabled**: The T10 PI attribute is disabled.
Number of Secondary Volumes	The total number of S-VOLs assigned to the P-VOL. This value includes the volumes for pairs that you are creating, volumes in existing pairs. For an L1 pair, this value does not include the number of L2 S-VOLs.

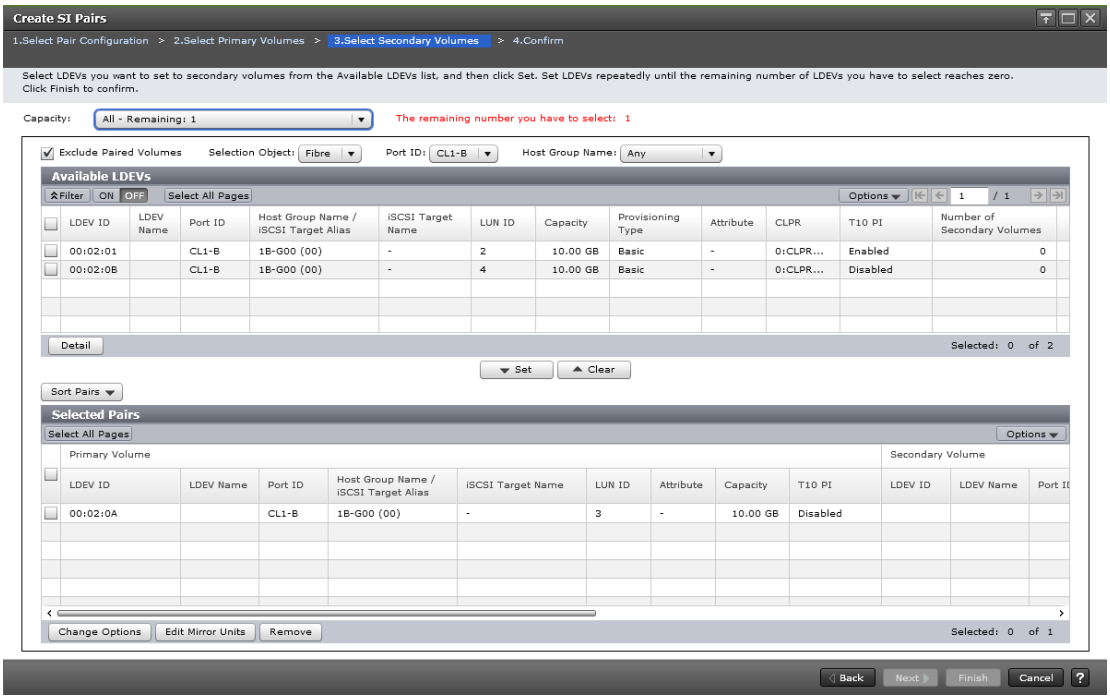
Select Secondary Volumes window

This window is the third window of the **Create SI Pairs** wizard. Use this window to select the LDEVs that are the S-VOL and to remove unwanted pairs or LDEVs.

This window includes the following tables:

- **Available LDEVs** table
- **Selected LDEVs** table

The following image shows this window.



The following table shows the items in this window.

Item	Description
Capacity list	Click to select the capacity by which to filter the available LDEVs.
The remaining number you have to select	This item refers to the P-VOLs in the **Selected Pairs** table that do not have an assigned S-VOL.
Exclude Paired Volumes	SI only. Select to hide volumes already in a pair. Values: • **Selected**: Paired volumes are not shown in the list. • **Cleared**: Paired volumes are shown in the list. Default: Selected
Selection Object	Filters LDEVs in the **Available LDEVs** table according to port type. Values: • **Fibre** • **iSCSI**
Port ID	Filters LDEVs in the **Available LDEVs** table according to the port ID.
Host Group Name	Filters LDEVs in the **Available LDEVs** table according to the host group name. Default: **Any**
iSCSI Target Alias	Filters LDEVs in the **Available LDEVs** table according to iSCSI target alias. Default: **Any**

Item	Description
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 return the selected S-VOL from the **Selected Pairs** table back to the **Available LDEVs** table.
Sort Pairs button	SI only. Click to sort the **Selected Pairs** table according to the following: • **Arrange in Mirror Unit**: Data is shown according to mirror units. • **Arrange in Topology**: Data is shown according to its topology. For example, L1 or L2 pairs.

Available LDEVs table

The following table shows the items in this table of the **Select Secondary Volumes** window of the **Create SI Pairs** wizard.

Item	Description
LDEV ID	The LDEV's identifier.
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) and iSCSI target alias (and ID) of the LDEV's LUN path.
iSCSI Target Name	iSCSI target name.
LUN ID	LUN identifier of the LDEV's LUN path.
Capacity	The LDEV's capacity.
Provisioning Type	SI only. The LDEV's provisioning type. Values: • **Basic**: Internal volume • **DP**: DP-VOL • **External**: External volume • **Snapshot**: HTI volume • **ALU**: Volume with ALU attribute.
Attribute	The LDEV's attribute. Values: • **ALU**: Volume with ALU attribute. • **SLU**: Volume with SLU attribute.

Item	Description
	• **Data Direct Mapping**: Volume with Data Direct Mapping attribute. If the attribute is not set, a hyphen (-) is displayed.
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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
T10 PI	The LDEV's T10 PI attribute. • **Enabled**: The T10 PI attribute is enabled. • **Disabled**: The T10 PI attribute is disabled.
Number of Secondary Volumes	SI only. The number of S-VOLs that the selected P-VOL has been assigned so far.
Detail button	Click to open the **LDEV Properties** window, which contains additional information for the selected LDEV.

Selected Pairs table

The following table shows the items in this table of the **Select Secondary Volumes** window of the **Create SI Pairs** wizard.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name**: The P-VOL's LDEV name. A hyphen (-) is displayed if no LDEV is assigned. • **Port ID**: The port name of the P-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias**: Host group name (and ID) and iSCSI target alias (and ID) of the P-VOL LDEV's LUN path.

Item	Description

	• **iSCSI Target Name**: The P-VOL's iSCSI target name.
	• **LUN ID**: The LUN identifier of the P-VOL LDEV's LUN path.
	• **Attribute**: The P-VOL's attribute.
	• **Capacity**: The P-VOL's volume capacity.
	• **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.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
	• **T10 PI**: The P-VOL's T10 PI attribute.
	  ◦ **Enabled**: The T10 PI attribute is enabled.
	  ◦ **Disabled**: The T10 PI attribute is disabled.

Secondary Volume	The S-VOL information. Values: • **LDEV ID**: The S-VOL's LDEV identifier. This item is blank if no LDEV is assigned. • **LDEV Name**: The S-VOL's LDEV name. A hyphen (-) is displayed if no LDEV is assigned. • **Port ID**: Port name of the S-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias**: Host group name (and ID) and 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**: LUN identifier of the S-VOL LDEV's LUN path. • **Attribute**: The S-VOL's attribute. • **Capacity**: The S-VOL's volume capacity. • **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.

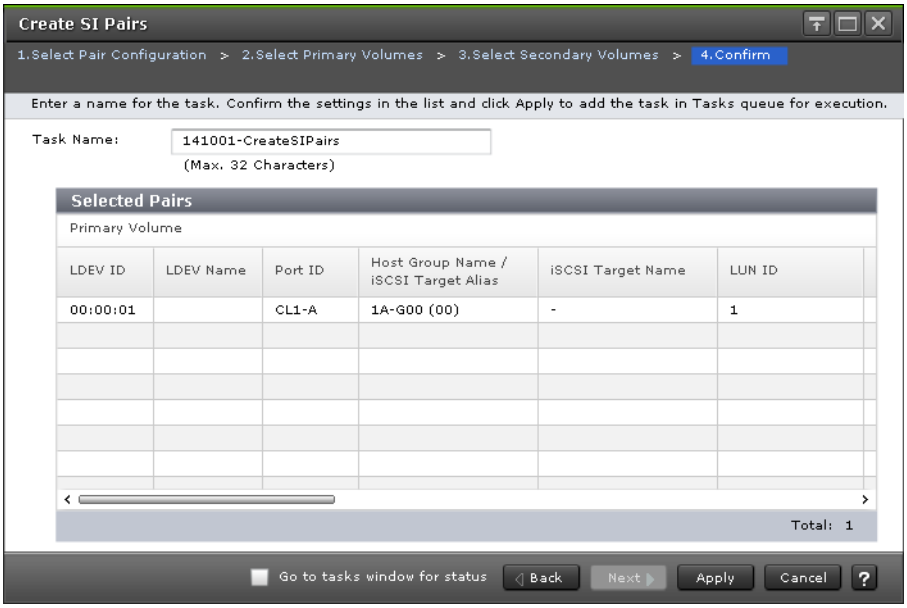
Item	Description
	◦ **Disabled**: Encryption is disabled for the parity group to which the S-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ◦ **Mixed**: The pool to which the S-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems. • **T10 PI**: The S-VOL's T10 PI attribute. ◦ **Enabled**: The T10 PI attribute is enabled. ◦ **Disabled**: The T10 PI attribute is disabled.
Copy Type	The types of pairs. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2
Mirror Unit	SI only. The mirror unit number.
Split Type	SI only. The split type. Values: • **Non Split**: The pair is not split. • **Quick Split**: The pair is split and then the data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background. • **Steady Split**: Differential data is copied, and then the pair is split.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower**: Improved host server I/O performance but slower processing speed. • **Medium**: Average processing speed and host server I/O performance. • **Faster**: Faster processing speed but slower host server I/O performance.
Change Options button	SI only.

Item	Description
	Click to open the **Change Options** dialog box. Options set in the **Change Options** dialog box will be applied to all the pairs newly created.
Edit Mirror Units button	SI only. Click to open the **Edit Mirror Units** dialog box. Use this dialog box to change the S-VOL's L1 and L2 mirror unit numbers, and thereby, pair topology. For more information about changing the MU number and pair topology, see Creating SI pairs on page 4-6 and Creating L1 and L2 pairs with different topologies on page 4-12.
Remove button	Click to remove the unwanted pairs or LDEV from the **Selected Pairs** table. **Note:** For SI, you cannot remove L1 pairs if the pairs have an L2 pair.

Create SI Pairs confirmation window

This window is the fourth and last window of the **Create SI Pairs** wizard. This window includes the **Selected Pairs** table.

The following image shows this window of the **Create SI Pairs** wizard.



Selected Pairs table

The following table shows the items in this table in the **Confirm** window of the **Create SI Pairs** wizard.

Item	Description
Primary Volume	The P-VOL information.

Item	Description
	Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name**: The P-VOL's LDEV name. • **Port ID**: Port name of the P-VOL LDEV's LUN path. • **Host Group Name / iSCSI Target Alias**: Host group name (and ID) and 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**: LUN identifier of the P-VOL LDEV's LUN path. • **Attribute**: The P-VOL's attribute. • **Capacity**: The P-VOL's volume 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. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems. • **T10 PI**: The P-VOL's T10 PI attribute. ◦ **Enabled**: The T10 PI attribute is enabled. ◦ **Disabled**: The T10 PI attribute is disabled.
Copy Type	The types of pairs. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2
Secondary Volume	The S-VOL information. Values: • **LDEV ID**: The S-VOL's LDEV identifier. • **LDEV Name**: The S-VOL's LDEV name. • **Port ID**: Port name of the S-VOL LDEV's LUN path.

Item	Description

	• **Host Group Name / iSCSI Target Alias**: Host group name (and ID) and 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**: LUN identifier of the S-VOL LDEV's LUN path.
	• **Attribute**: The S-VOL's attribute.
	• **Capacity**: The S-VOL's volume 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.
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked.
	For an external volume, a hyphen (-) is displayed. The encryption column does not appear for VSP G200 storage systems.
	• **T10 PI**: The S-VOL's T10 PI attribute.
	  ◦ **Enabled**: The T10 PI attribute is enabled.
	  ◦ **Disabled**: The T10 PI attribute is disabled.

Split Type	The type of split. Values: • **Non Split**: The pair is not split. • **Quick Split**: The pair is split and then the data is copied. • **Steady Split**: The pair is split after all of the differential data is copied.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower**: Improved host server I/O performance but slower processing speed. • **Medium**: Average processing speed and host server I/O performance.

Item	Description
	• **Faster**: Faster processing speed but slower host server I/O performance.
Mirror Unit	SI only. The mirror unit number.

Split Pairs wizard

Use this wizard to split pairs.

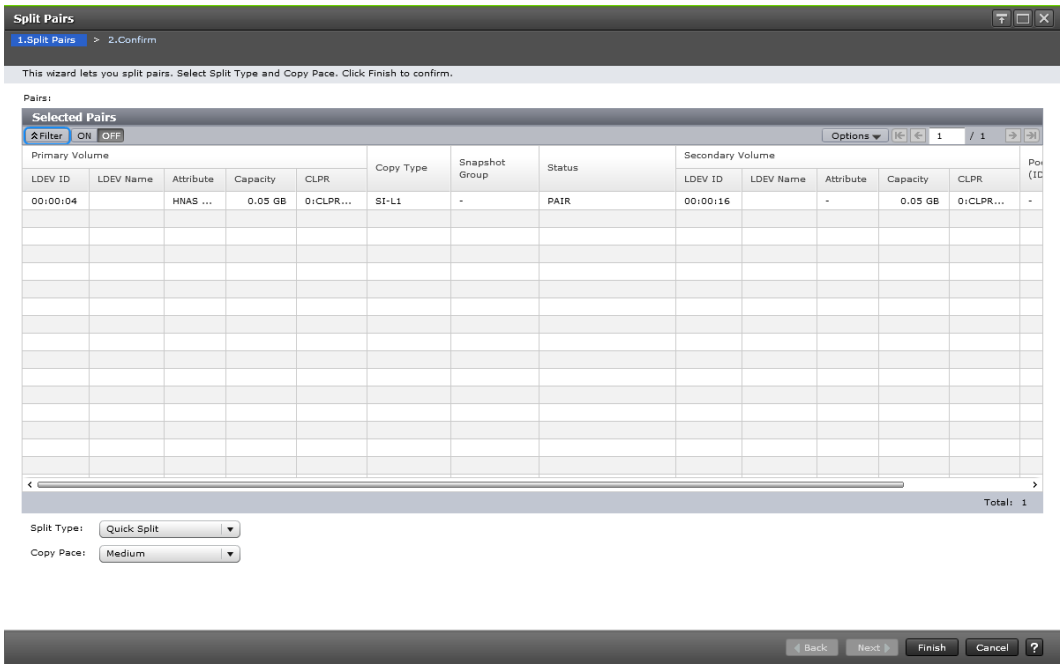
This wizard includes the following windows:

- Splitting SI pairs on page 4-18
- Split Pairs window on page B-40
- Split Pairs confirmation window on page B-42

Split Pairs window

Use this window of the **Split Pairs** wizard to split pairs. This window includes the **Selected Pairs** table.

For more information about using this window, see Splitting SI pairs on page 4-19.



Selected Pairs table

The following table shows the items in this table.

Note: The **Selected Pairs** table appears on the **Confirm** window and the **Split Pairs** window of the **Split Pairs** wizard. The table for the items on the **Confirm** window is shown with that window.

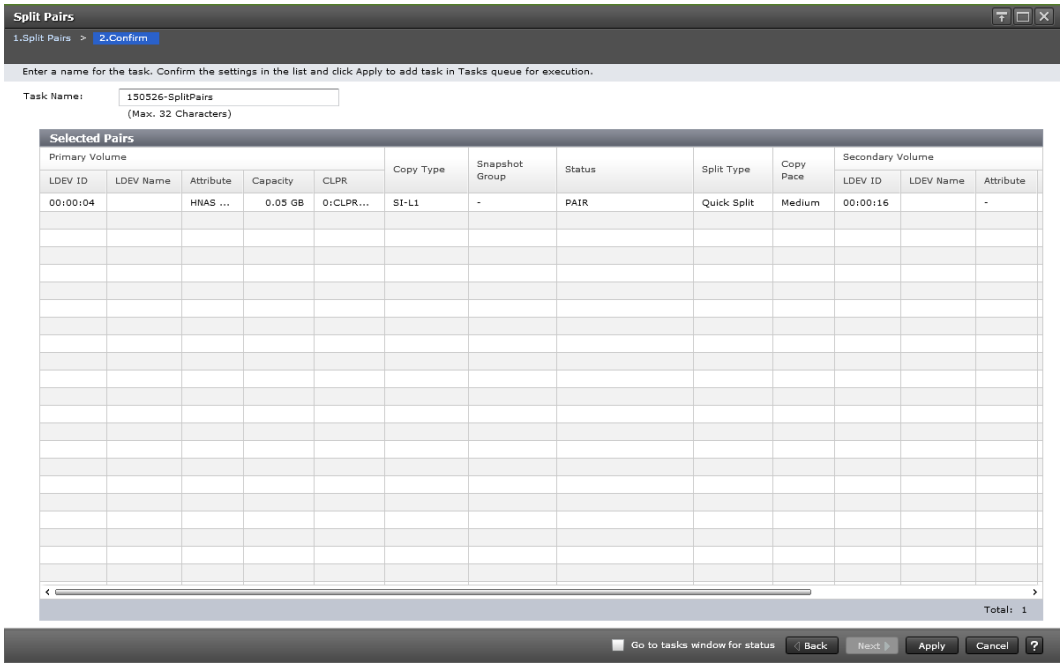
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name**: The P-VOL's LDEV name. • **Attribute**: The P-VOL's attribute. • **Capacity**: The P-VOL's volume capacity. • **CLPR**: The P-VOL's CLPR ID.
Copy Type	The types of pairs. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2 • **TI**: HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Secondary Volume	The S-VOL information. Values: • **LDEV ID**: The S-VOL's LDEV identifier. • **LDEV Name**: The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity**: The S-VOL's volume capacity. • **CLPR**: The S-VOL's CLPR ID.
Pool Name (ID)	HTI only. The pool name and ID number.
Mirror Unit	The mirror unit number.
Split Type list	The split type. Values: • **Quick Split**: The pair is split and then the data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background. For HTI, this value is not shown. • **Steady Split**: Splits the pair after all of the differential data is copied.

Item	Description
Copy Pace list	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower**: Improved host server I/O performance but slower processing speed. • **Medium**: Average processing speed and host server I/O performance. • **Faster**: Faster processing speed but slower host server I/O performance.

Split Pairs confirmation window

This window of the **Split Pairs** wizard includes the **Selected Pairs** table.

The following image shows this window.



Selected Pairs table

The following table shows the items in this table in the **Confirm** window of the **Split Pairs** wizard.

Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name**: The P-VOL's LDEV name.

Item	Description
	• **Attribute**: The P-VOL's attribute. • **Capacity**: The P-VOL's volume capacity. • **CLPR**: The P-VOL's CLPR ID.
Copy Type	The pair type. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2 • **TI:** HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Split Type	The split type. Values: • **Quick Split**: The pair is split and then the data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background. • **Steady Split**: Differential data is copied and then the pair is split.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower**: Improved host server I/O performance but slower processing speed. • **Medium**: Average processing speed and host server I/O performance. • **Faster**: Faster processing speed but slower host server I/O performance.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR ID.
Mirror Unit	The mirror unit number.

Resync Pairs wizard

Use this wizard to resynchronize pairs.

This wizard includes the following windows:

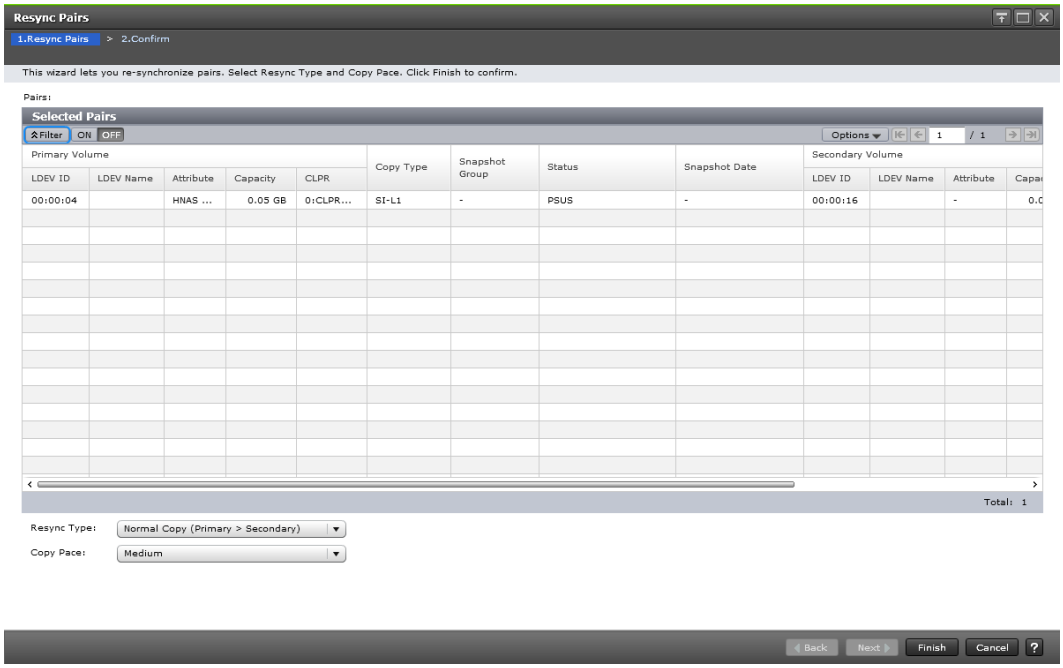
- SI pair resynchronization on page 4-28
- Resync Pairs window on page B-44
- Resync Pairs confirmation window on page B-46

Resync Pairs window

Use this window of the **Resync Pairs** wizard to resynchronize a pair.

For more information about using this wizard, see Resynchronizing or restoring SI pairs on page 4-32.

The following image shows this window.



Selected Pairs table

The following table shows the items in this table in the **Resync Pairs** window of the **Resync Pairs** wizard.

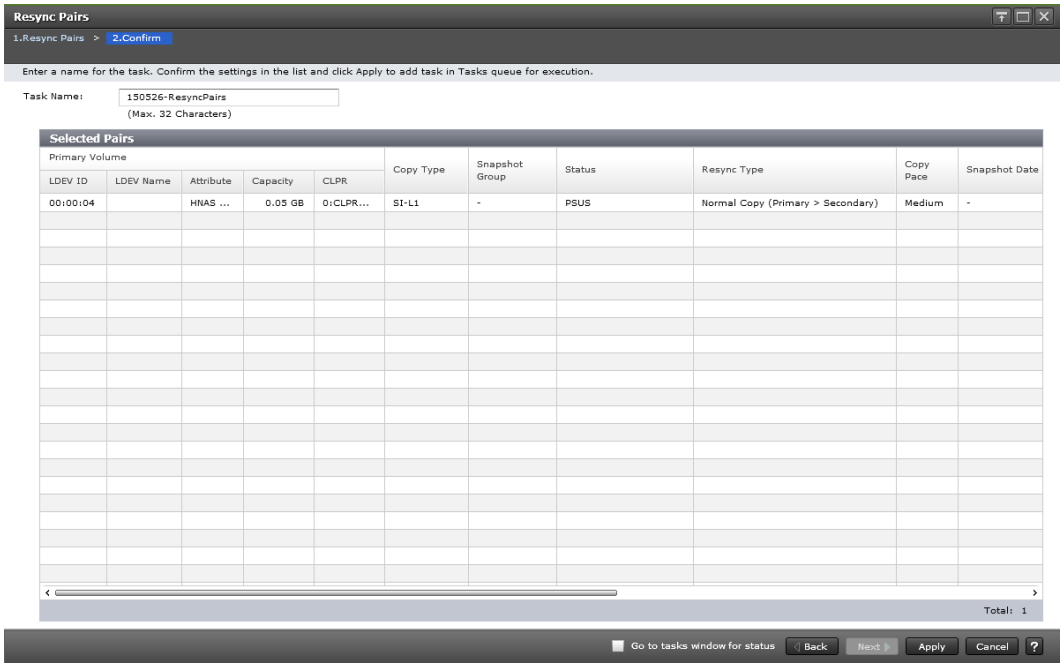
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID**: The P-VOL's LDEV identifier. • **LDEV Name**: The P-VOL's LDEV name. • **Attribute**: The P-VOL's attribute. • **Capacity**: The P-VOL's volume capacity.

Item	Description
	• **CLPR**: The P-VOL's CLPR ID.
Copy Type	The pair type. Values: • **SI-L1**: SI L1 • **SI-L2**: SI L2 • **TI**: HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Snapshot Date	HTI only. The date and time that you acquired the snapshot.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	HTI only. The pool name and identification number.
Mirror Unit	The mirror unit number.
Resync Type	The type of resynchronization. Values: • **Normal Copy (Primary > Secondary)** A full forward resynchronization from the P-VOL to the S-VOL. The differential data is updated to the S-VOL. • **Reverse Copy (Secondary > Primary)** Resyncs the pairs from S-VOL to P-VOL. The differential data is updated to the P-VOL. You cannot use Reverse Copy with the following pair: ◦ An SI L2 pair. • **Quick Resync (Primary > Secondary)** A forward resynchronization from the P-VOL to the S-VOL where data is not copied or resynchronized. The volumes are paired ("PAIR" status). The update copy operation copies the differential data to the S-VOL.You can use Quick Resync with the SI pairs only. • **Quick Restore (Secondary > Primary)**

Item	Description
	Swaps the P-VOL and S-VOLs. The update copy operation copies the differential data to the S-VOL. Only SI pairs can be selected. You cannot use Quick Restore with the following pairs: ○ SI L2 pairs ○ Only one of the P-VOL or S-VOL is DP-VOL pair ○ SI pairs which has HTI pairs in P-VOL or/and S-VOL pairs Default: **Normal Copy (Primary > Secondary)** For more information about the methods you can use to resynchronize pairs, see Types of pair resynchronization on page 4-29.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower:** Improved host server I/O performance but slower processing speed. • **Medium:** Average processing speed and host server I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance.

Resync Pairs confirmation window

The following image shows this window of the **Resync Pairs** wizard.



Selected Pairs table

The following table shows the items in this table in the **Confirm** window of the **Resync Pairs** wizard.

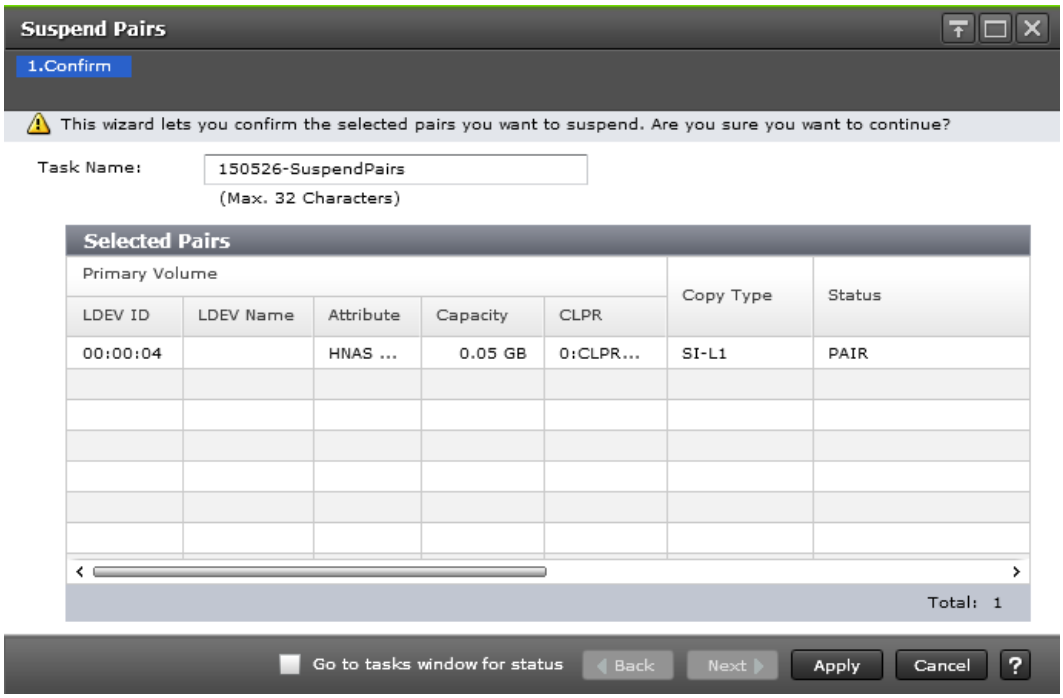
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Attribute**: The P-VOL's attribute. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The types of pairs. Values: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Resync Type	The type of resynchronization. Values: • **Normal Copy (Primary > Secondary)** Resync pair from P-VOL to S-VOL. • **Reverse Copy (Secondary > Primary)** Resync pair from S-VOL to P-VOL. • **Quick Resync (Primary > Secondary)** Resync pair from P-VOL to S-VOL and immediately change the status to PAIR. • **Quick Restore (Secondary > Primary)** Swaps the P-VOL and S-VOL. Default: **Normal Copy (Primary > Secondary)** For more information about the types of resynchronization, see Types of pair resynchronization on page 4-29.
Copy Pace	SI only. The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower:** Improved host server I/O performance but slower processing speed.

Item	Description
	• **Medium:** Average processing speed and host server I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance.
Snapshot Date	HTI only. The date and time that a snapshot was acquired.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	HTI only. The pool name and identification number.
Mirror Unit	The mirror unit number.

Suspend Pairs window

Use this window to suspend creating the pair. This window includes the **Selected Pairs** table.

For more information about using this window, see Suspending SI pair creation on page 4-15.



Selected Pairs table

The following table shows the items in this table in the **Suspend Pairs** window.

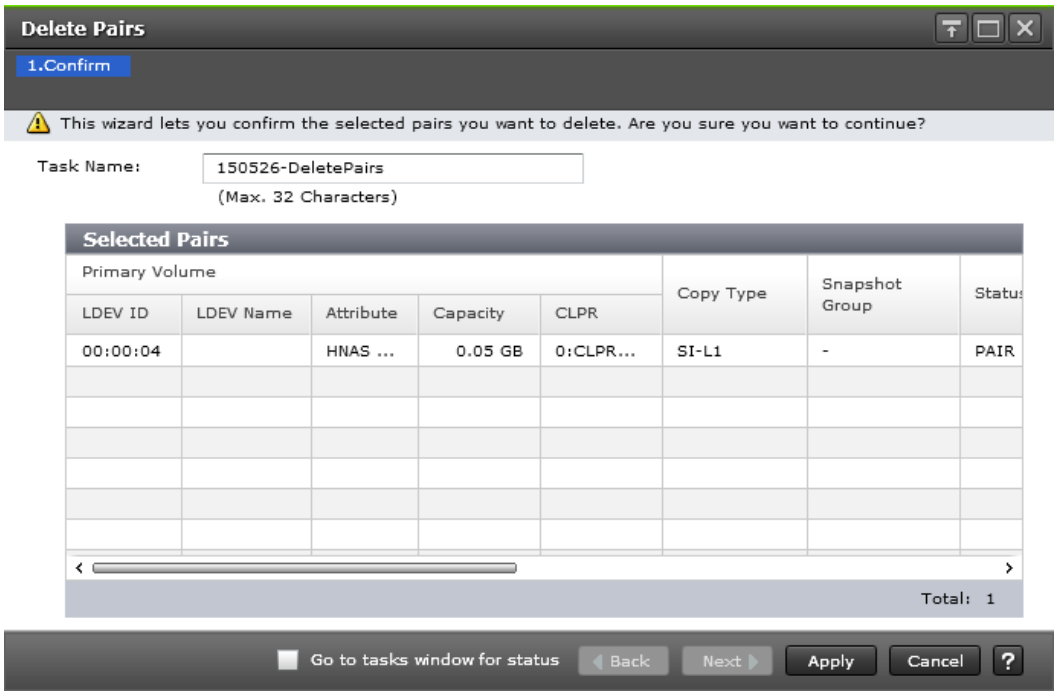
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Attribute**: The P-VOL's attribute. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The types of pairs. Values: • **SI-L1:** SI L1 • **SI-L2:** SI L2
Status	The status for the pair. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR ID.
Mirror Unit	The mirror unit number.

Delete Pairs window

Use this window to delete pairs. This window includes the **Selected Pairs** table.

For more information about deleting pairs, see Deleting SI pairs on page 4-36.

The following image shows this window.



Selected Pairs table

The following table shows the items in this table in the **Delete Pairs** window.

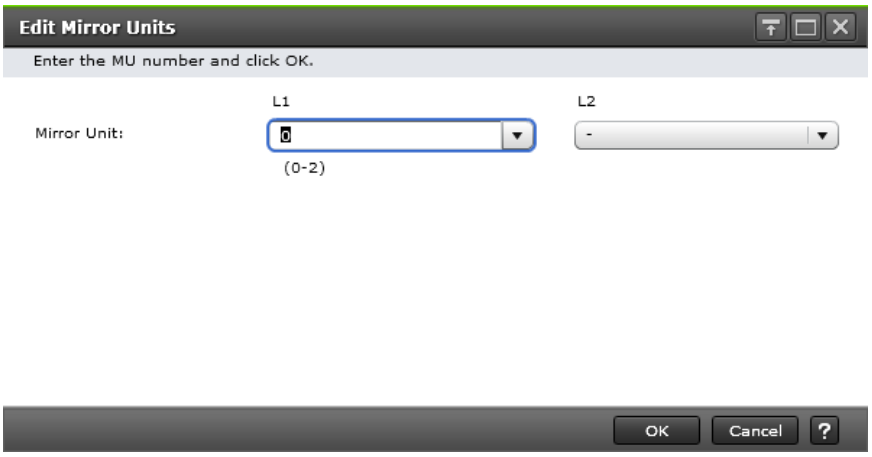
Item	Description
Primary Volume	The P-VOL information. Values: • **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Attribute**: The P-VOL's attribute. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR ID.
Copy Type	The types of pairs. Values: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, this item is blank.
Status	The pair status. For more information about pair status, see HDvM - SN pair status names and descriptions on page 5-4.
Snapshot Date	HTI only.

Item	Description
	The date and time that a snapshot was acquired.
Secondary Volume	The S-VOL information. Values: • **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Attribute**: The S-VOL's attribute. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR ID.
Pool Name (ID)	HTI only. The pool name and identification number.
Mirror Unit	The mirror unit number.

Edit Mirror Units dialog box

Use this dialog box to change the S-VOL's L1 and L2 mirror unit numbers. To open this dialog box, on the **Select Secondary Volumes** window of the **Create SI Pairs** wizard, click **Edit Mirror Units**.

The following image shows this dialog box.



The following table shows the items in this dialog box.

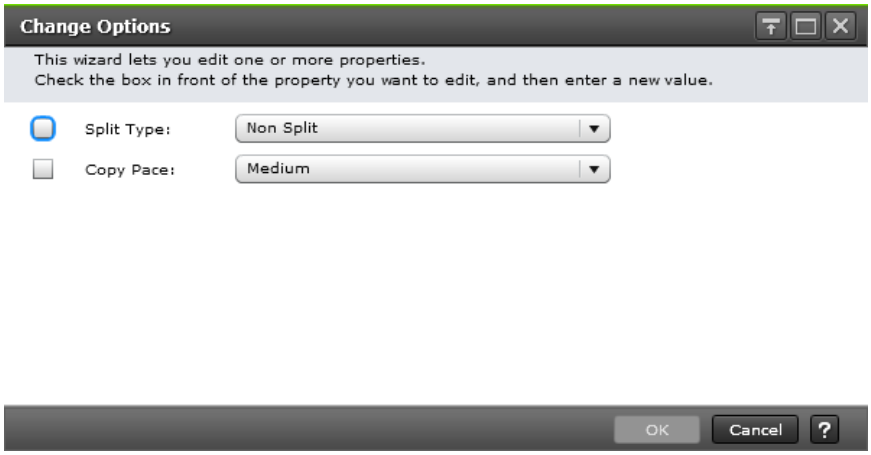
Item	Description
Mirror Unit	The mirror unit number. For SI, the mirror unit assigned to L1 and L2 volumes. For more information about the values you can set for the mirror unit number, see Creating SI pairs on page 4-6.

Change Options dialog box

Use this dialog box to change the split type and copy pace for all new pairs that you create.

For more information about how to navigate to this dialog box, see Changing SI pair options on page 4-16.

The following image shows this dialog box.



Item	Description
Split Type	The split type. Values: • **Non Split:** The pair is not split. • **Quick Split:** The pair is split and then the data is copied so that the S-VOL is immediately available for read and write I/O. Any remaining differential data is copied to the S-VOL in the background. • **Steady Split:** Differential data is copied and then the pair is split. Default: **Non Split**
Copy Pace	The system option that determines the rate at which you want the storage system to copy data. Values: • **Slower:** Improved host server I/O performance but slower processing speed. • **Medium:** Average processing speed and host server I/O performance. • **Faster:** Faster processing speed but slower host server I/O performance. Default: **Medium**

Edit Local Replica Options wizard

Use this wizard to enable or disable options that affect host server I/O performance.

This wizard includes the following windows:

- Edit Local Replica Options window on page B-53
- Edit Local Replica Options confirmation window on page B-54

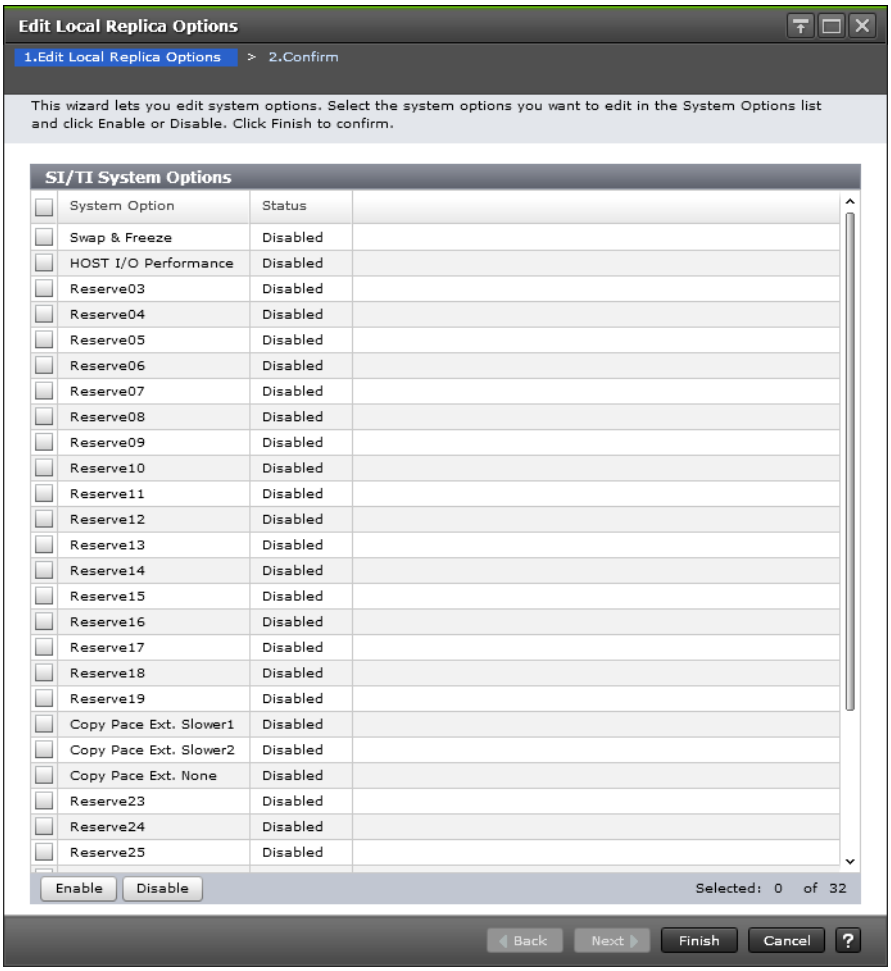
For more information about using this wizard, see System options that affect performance on page 2-8.

Edit Local Replica Options window

Use this window to specify options that affect host server I/O performance. This is the first window of the **Edit Local Replica Options** wizard.

For full information, see System options that affect performance on page 2-8.

The following image shows this window.



SI/TI System Options table

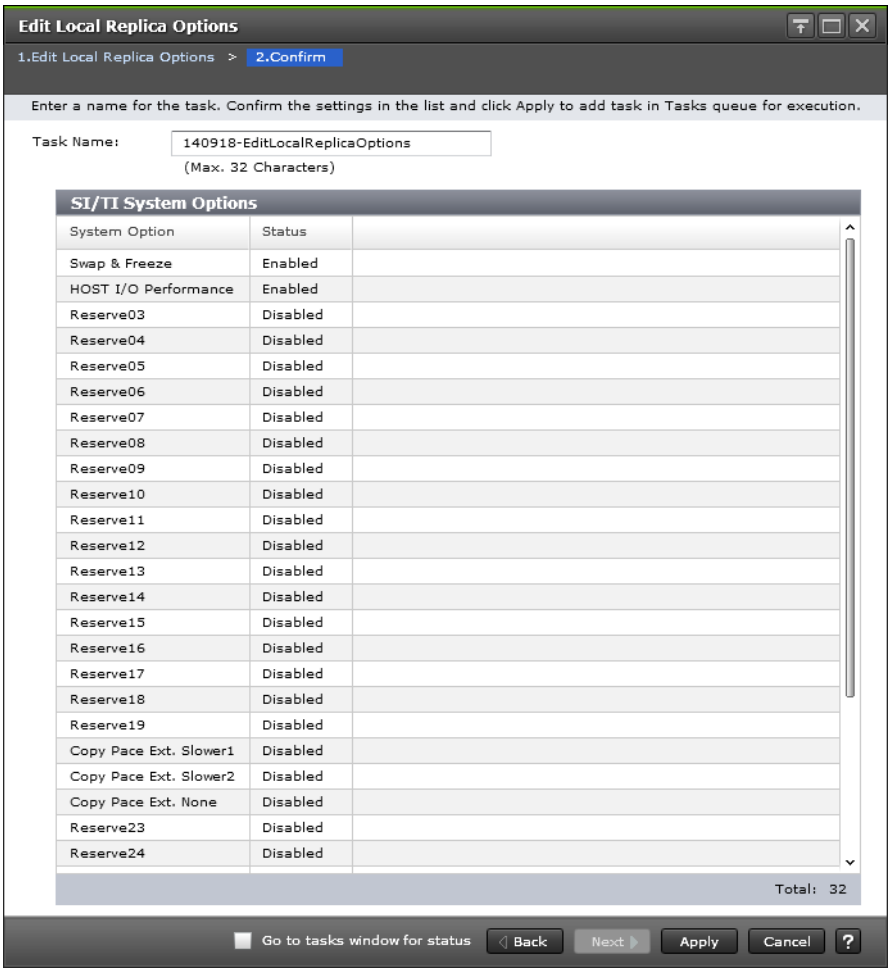
The following table shows the items in this table.

Item	Description
System Option	System options that you can enable or disable.

Item	Description
	Values: • **Swap & Freeze**: Use this option to suppress the storage system's update copy operations after a Quick Restore and the pair is in PAIR status (for SI or HTI). The S-VOL remains unchanged, and differential data is not copied to the new S-VOL. Default status: **Disabled** • **HOST I/O Performance**: Suppresses copy operations at all times regardless of the workload. This system option increases I/O performance. Default status: **Disabled** • **Copy Pace**: Maximizes host server I/O performance by suppressing copy processing only if the pair status is PAIR (for SI or HTI). Processing-suppression/performance-improvement levels: ◦ **Copy Pace Ext. Slower1** Default status: **Disabled** ◦ **Copy Pace Ext. Slower2** Default status: **Disabled** ◦ **Copy Pace Ext. None** Default status: **Disabled** The I/O performance of the host server is improved most effectively with Copy Pace Ext. None, followed by Copy Pace Ext. Slower2, and then Copy Pace Ext. Slower1. For more information about the system options, see System options that affect performance on page 2-8.
Status	Shows whether the option is currently enabled or disabled.
Enable button	Click to enable the option.
Disable button	Click to disable the option.

Edit Local Replica Options confirmation window

The following image shows this window of the **Edit Local Replica Options** wizard.



SI/TI System Options table

The following table shows the items in this table.

Item	Description
System Option	Options that you can change.
Status	Shows whether the option is currently enabled or disabled.

Glossary

This glossary defines the special terms used in this document. Click the letter links below to navigate.

#

2DC
two-data-center. Refers to the local and remote sites, or data centers, in which TrueCopy (TC) and Universal Replicator (UR) combine to form a remote replication configuration.
In a 2DC configuration, data is copied from a TC P-VOL at the primary site to the UR master journal volume at an intermediate site, then is replicated to the UR S-VOL at the remote site. Since this configuration side-steps the TC S-VOL at the intermediate site, the intermediate site is not considered a data center.

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)*.

alternate path
A secondary path (port, target ID, LUN) to a logical volume, in addition to the primary path, that is used as a backup in case the primary path fails.

ALU
See *administrative logical unit (ALU)*.

| # | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

array
Another name for a RAID storage system.

array group
See *RAID group*.

async
asynchronous

ATTIME Suspend
A CTG task in which you run a BCM command to split the pairs simultaneously at a pre-determined time.

audit log
Files that store a history of the operations performed from Device Manager - Storage Navigator and the service processor (SVP) and commands that the storage system received from hosts.

B

base emulation type
Emulation type that is set when drives are installed. Determines the device emulation types that can be set in the RAID group.

blade
A computer module, generally a single circuit board, used mostly in servers.

BLK, blk
block

bmp
bitmap

C

C/T
See *consistency time (C/T)*.

ca
cache

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 (for example MB, GB, and TB).

cascade function
An SI function for open systems where a P-VOL can have up to nine S-VOLs in a layered configuration. The first cascade layer (L1) is the original SI pair with one P-VOL and up to three S-VOLs. The second cascade layer (L2) contains SI pairs in which the L1 S-VOLs are functioning as the P-VOLs of layer-2 SI pairs that can have up to two S-VOLs for each P-VOL.
See also *root volume*, *node volume*, *leaf volume*, *level-1 pair*, and *level-2 pair*.

cascaded pair
An SI pair in a cascade configuration. See *cascade configuration*.

CCI
Command Control Interface

CFL
Configuration File Loader. An HDvM - SN function for validating and running scripted spreadsheets.

CFW
cache fast write

CTG
See *consistency group (CTG)*.

CH
channel

channel path
The communication path between a channel and a control unit. A channel path consists of the physical channel path and the logical path.

CHAP
challenge handshake authentication protocol

CL
cluster

CLI
command line interface

CLPR
cache logical partition

cluster
Multiple-storage servers working together to respond to multiple read and write requests.

command device
A dedicated logical volume used only by CCI to interface with the storage system. Several hosts can share the logical volume.

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 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. See also *extended consistency group (EXCTG)*.

consistency group pair-split
Generic name for a CTG task in which you run a CCI, BCM, or PPRC command to split the pairs simultaneously.

consistency time (C/T)
Shows a time stamp to indicate how close the target volume is to the source volume. C/T also shows the time stamp of a journal and extended CTG.

controller
The component in a storage system that manages all storage functions. It is analogous to a computer and contains a processors, I/O devices, RAM, power supplies, cooling fans, and other sub-components as needed to support the task of the storage system.

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 a pair. A pair created by Compatible FlashCopy® is called a relationship.

CTG
See *consistency group (CTG)*.

CTL
controller

CU
control unit

currency of data
The synchronization of the volumes in a copy pair. When the data on the S-VOL is identical to the data on the P-VOL (P-VOL), the data on the S-VOL is current. When the data on the S-VOL is not identical to the data on the P-VOL, the data on the S-VOL is not current.

CYL, cyl
cylinder

cylinder bitmap
Indicates the differential data (updated by write I/Os) in a volume of a split or suspended copy pair. The P-VOL and S-VOLs each have their own cylinder bitmap. When you resynchronize the pair, the cylinder bitmaps are merged and the differential data is copied to the S-VOL.

D

DASD
direct-access storage device

data consistency
When the data on the S-VOL is identical to the data on the P-VOL.

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 P-VOL, the data pool is used if a data block in the P-VOL is to be updated. The original snapshot of the volume is maintained by storing the to-be-changed data blocks in the data pool.

DB
database

DBMS
database management system

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. 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.

DEVN
device number

DFW
DASD fast write

DHCP
dynamic host configuration protocol

differential data
Changed data in the P-VOL not yet reflected in the copy volume.

disaster recovery
Procedures to recover critical application data and processing after a disaster or other failure.

disk array
Disk array, or just array, is another name for a RAID storage system.

disk controller (DKC)
The hardware component that manages front-end and back-end storage operations. The term DKC can refer to the entire RAID storage system.

DKC
disk controller. The term DKC can refer to the RAID storage system or the controller components.

DKCMAIN
disk controller main. Refers to the microcode for the VSP G200, G400, G600, G800 storage system.

DKP
disk processor. Refers to the microprocessors on the back-end director features of the Universal Storage Platform V.

DKU
disk unit. Refers to the cabinet (floor model) or rack-mounted hardware component that contains data drives but does not have controller components.

DMP
Dynamic Multi Pathing

DRU
Hitachi Data Retention Utility

DP-VOL
Dynamic Provisioning-virtual volume. A virtual volume that does not have memory space used by Dynamic Provisioning, Dynamic Tiering, or active flash. Hitachi Thin Image uses V-VOLs as secondary volumes.

dynamic provisioning
An approach to managing storage. Dynamic Provisioning removes capacity from the available pool when data is actually written to disk. Also called thin provisioning.

E

EC
error code

emulation
A storage system operation that emulates the characteristics of a different storage system. For device emulation the mainframe host recognizes the logical devices on the RAID storage system as 3390-x devices. For controller emulation the mainframe host recognizes the control units (CUs) on the RAID storage system as 2107 controllers. The storage system operates the same as the storage system it emulates.

emulation group
Device emulation types that can be intermixed within a RAID group and treated as a group.

env.
environment

ERC
error reporting communications

ESCON
Enterprise System Connection

EXCTG
See *extended consistency group (ECTG)*.

EXG
external volume group

ext.
external

external application
A software module that is used by a storage system but runs on a separate platform.

external port
A fibre-channel port that is configured to be connected to an external storage system for Universal Volume Manager tasks.

external volume
A logical volume whose data resides on drives that are physically located outside the storage system.

F

failback
The process of switching operations from the secondary path or host back to the primary path or host, after the primary path or host has recovered from failure. See also *failover*.

failover
The process of switching operations from the primary path or host to a secondary path or host when the primary path or host fails.

FBA
fixed-block architecture

FC
fibre channel; FlashCopy

FCA
fibre-channel adapter

FC-AL
fibre-channel arbitrated loop

FCIP
fibre-channel internet protocol

FCP
fibre-channel protocol

FCSP
fibre-channel security protocol

FIBARC
Fibre Connection Architecture

FICON
Fibre Connectivity

FIFO
first in, first out

free capacity
The amount of storage space (in bytes) that is available for use by the host systems.

FSW
fibre switch

FTP
file-transfer protocol

FV
fixed-size volume

FWD
fast-wide differential

G

GID
group ID

GUI
graphical user interface

H

HA
high availability

HACMP
High Availability Cluster Multi-Processing

HDLM
Hitachi Dynamic Link Manager

HDP
Hitachi Dynamic Provisioning

HDS
Hitachi Data Systems

HDT
Hitachi Dynamic Tiering

HDvM
Hitachi Device Manager

HGLAM
Hitachi Global Link Availability Manager

H-LUN
host logical unit

HOMRCF
Hitachi Open Multi-RAID Coupling Feature. Another name for Hitachi ShadowImage.

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.

host mode
Operational modes that provide enhanced compatibility with supported host platforms. Used with fibre-channel ports on RAID storage systems.

host mode option
Additional options for fibre-channel ports on RAID storage systems. Provide enhanced functionality for host software and middleware.

HRC
Hitachi Remote Copy. Another name for Hitachi TrueCopy for IBM z/OS.

HRpM
Hitachi Replication Manager

HSCS
Hitachi Storage Command Suite. For this release, the suite of software applications is called the Hitachi Command Suite.

HUR
Hitachi Universal Replicator

HXRC
Hitachi Extended Remote Copy. Another name for Hitachi Compatible Replication for IBM XRC.

I

iFCP
internet fibre-channel protocol

IML
initial microcode load; initial microprogram load

IMPL
initial microprogram load

initial copy
An initial copy operation is performed when you create a copy pair. Data on the P-VOL is copied to the S-VOL.

in-system replication
The original data volume and its copy are located in the same storage system. SI 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*.

internal volume
A logical volume whose data resides on drives that are physically located within the storage system. See also *external volume*.

IO, I/O
input/output

I/O mode
I/O actions on the P-VOL and S-VOL of the global-active device pair.

IOPS
I/Os per second

IP
internet protocol

IPL
initial program load

J

JNL
journal

JNLG
journal group

journal group (JNLG)
In a Universal Replicator system, journal groups manage data consistency between multiple P-VOLs and S-VOLs. 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.

JRE
Java Runtime Environment

L

L1 pair
See *layer-1 (L1) pair*.

L2 pair
See *layer-2 (L2) pair*.

LAN
local-area network

layer-1 (L1) pair
In an SI cascade configuration, a layer-1 pair consists of a P-VOL and S-VOL in the first cascade layer. You can pair L1 P-VOL with up to three L1 S-VOLs. See also *cascade configuration*.

layer-2 (L2) pair
In an SI cascade configuration, a layer-2 (L2) pair consists of a P-VOL and S-VOL in the second cascade layer. An L2 P-VOL can be paired with up to two L2 S-VOLs. See also *cascade configuration*.

LBA
logical block address

LCP
local control port; link control processor

LCU
logical control unit

LDEV
logical device

LDKC
See *logical disk controller (LDKC)*.

leaf volume
A level-2 S-VOL in an SI cascade configuration. The P-VOL of a layer-2 pair is called a node volume. See also *cascade configuration*.

LED
light-emitting diode

license key
A specific set of characters that unlocks a software application so that you can use it.

local copy
See *in-system replication*.

local site
See *primary site*.

logical device (LDEV)
An individual logical data volume (on multiple drives in a RAID configuration) in the storage system. An LDEV may or may not contain any data and may or may not be defined to any hosts. Each LDEV has a unique identifier or "address" within the storage system 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 open-system hosts is called a logical unit (LU).

logical disk controller (LDKC)
A group of 255 control unit (CU) images in a RAID storage system that is controlled by a virtual (logical) storage system within the single physical storage system. For

example, the Universal Storage Platform V storage system supports two LDKCs, LDKC 00 and LDKC 01.

logical unit (LU)
A logical volume that is configured for use by open-systems hosts (for example, OPEN-V).

logical unit (LU) path
The path between an open-systems host and a logical unit.

logical volume
See *volume*.

LU
logical unit

LUN
logical unit number

LUNM
Hitachi LUN Manager

LUSE
Hitachi LUN Expansion; Hitachi 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 stored on the Hitachi storage system using fewer LU numbers.

LV
logical volume

M

main site
See *primary site*.

management area
The area in which the control information of software products that use a pool is stored.

master journal (M-JNL)
Holds differential data on the primary Universal Replicator system until it is copied to the restore journal (R-JNL) on the secondary system. See also *restore journal (R-JNL)*.

max.
maximum

MB
megabyte

Mb/sec, Mbps
megabits per second

MB/sec, MBps
megabytes per second

MCU
See *main control unit (MCU)*.

MF, M/F
mainframe

MIH
missing interrupt handler

mirror
In Universal Replicator, each pair relationship in and between journals is called a "mirror". Each pair is assigned a mirror ID when it is created. The mirror ID identifies individual pair relationships between journals.

M-JNL
main journal

modify mode
A mode of operation in Device Manager - Storage Navigator that allows changes to the storage system configuration. See also *view mode*.

MP
microprocessor

MP unit
A unit containing an I/O processor. Tune performance in the storage system by allocating a specific MP unit to each I/O-related resource (LDEV, external volume, or journal). Specific MP units are allocated or the storage system can automatically select an MP unit.

MSCS
Microsoft Cluster Server

mto, MTO
mainframe-to-open

MU
mirror unit

multi-pathing
A performance and fault-tolerant technique that uses more than one physical connection between the storage system and host system. Also called multipath I/O.

M-VOL
main volume

N

node volume
A level-2 P-VOL in an SI cascade configuration. The S-VOL of a layer-2 pair is called a leaf volume. See also *cascade configuration*.

NUM
number

NVS
nonvolatile storage

O

OPEN-V
A logical unit (LU) of user-defined size that is formatted for use by open-systems hosts.

OPEN-*x*
A logical unit (LU) of fixed size (for example, OPEN-3 or OPEN-9) that is used primarily for sharing data between mainframe and open-systems hosts using Hitachi Cross-OS File Exchange.

OS
operating system

P

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 tasks. When an task completes, the status of the pair changes to the new status.

parity group
See *RAID group*.

path failover
The ability of a host to switch from using the primary path to a logical volume to the secondary path to the volume when the primary path fails. Path failover ensures continuous host access to the volume in the event the primary path fails.
See also *alternate path* and *failback*.

PG
parity group. See *RAID group*.

physical device
See *device*.

PiT
point-in-time

point-in-time (PiT) copy
A copy or snapshot of a volume or set of volumes at a specific point in time. A point-in-time copy can be used for backup or mirroring application to run concurrently with the system.

pool
A set of volumes that are reserved for storing pool volumes (pool-VOLs), and used by Hitachi Thin Image, Dynamic Provisioning, Dynamic Tiering, or active flash.

pool volume (pool-VOL)
A logical volume registered in a pool that is reserved for storing snapshot data for Hitachi Thin Image operations, or write data for Dynamic Provisioning, Dynamic Tiering, and active flash.

port block
A group of four fibre-channel ports that have the same port mode.

port mode
The operational mode of a fibre-channel port. The three port modes are standard, high-speed, and initiator/external MIX.

PPRC
An IBM Peer-to-Peer Remote Copy host software function.

Preview list
The list of requested tasks in HDvM - SN.

| # | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

primary site
The physical location of a storage system that contains the original data to be replicated and that is connected to one or more storage systems at the 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 host computer where the production applications are running, and the secondary site is where the backup applications run when the applications at the primary site fail, or where the primary site itself fails.

primary volume
The volume in a copy pair that contains the original data to be replicated. The data in the P-VOL is duplicated synchronously or asynchronously on the secondary pairs.
The following Hitachi software applications use this term: HDvM - SN, HTI, SI, TC, and UR.
See also *secondary volume*.

P-site
primary site

P-VOL
See *primary volume*.

Q

quick format
A Virtual LUN feature 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.

quick restore
A reverse resynchronization in which data is not actually copied: the P-VOL and S-VOLs are swapped.

quick split
A split task in which the pair is split and then the differential data is copied to the S-VOL. Any remaining differential data is copied to the S-VOL in the background. The benefit is that the S-VOL is 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 disk is installed in an external storage system.

R

R/W, 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 group's RAID level 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 parity data for RAID1 RAID groups does not exist.
A RAID group can also be called an array group or a parity group.

RAID level
The type of RAID implementation. RAID levels include RAID0, RAID1, RAID2, RAID3, RAID4, RAID5 and RAID6.

RCP
remote control port

RCU
See *remote control unit (RCU)*.

RD
read

remote console PC
A previous term for the personal computer (PC) system that is LAN-connected to a RAID storage system. The current term is HDvM - SN PC.

remote control port (RCP)
A serial-channel (ESCON) port on a TrueCopy main control unit (MCU) that is configured to send remote I/Os to a TrueCopy remote control unit (RCU).

remote control unit (RCU)
A storage system at a secondary or remote site that is configured to receive remote I/Os from one or more storage systems at the primary site.

remote copy
See *remote replication*.

remote copy connections
The physical paths that connect a storage system at the primary site to a storage system at the secondary site. Also called data path.

remote replication
Data replication configuration in which the storage system that contains the original data is at a primary site and the storage system that contains the copy of the original data is at a remote site. TrueCopy and Universal Replicator provide remote replication. See also *in-system replication*.

remote site
See *secondary site*.

restore journal (R-JNL)
Holds differential data on the secondary Universal Replicator system until it is copied to the S-VOL.

resync
resynchronize

RF
record format

RIO
remote I/O

R-JNL
restore journal

RL
record length

RMI
Remote Method Invocation

rnd
random

root volume
A level-1 P-VOL in an SI cascade configuration. The S-VOL of a layer-1 pair is called a node volume. See also *cascade configuration*.

RPO
recovery point objective

R-SIM
remote service information message

R-site
remote site (used for Universal Replicator)

RTC
real-time clock

RTO
recovery time objective

R-VOL
See *remote volume (R-VOL)*.

R/W
read/write

S

S#
serial number

S/N
serial number

s/w
software

SAID
system adapter ID

SAN
storage-area network

SATA
serial Advanced Technology Attachment

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 tasks.

SCSI
small computer system interface

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
The volume in a copy pair that is the copy of the original data on the primary volume (P-VOL).
See also *primary volume*.

seq.
sequential

service information message (SIM)
SIMs are generated by a 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 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

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 (SLU)*.

SMTP
simple mail transfer protocol

SN
serial number shown in HDvM - SN

snapshot
A point-in-time virtual copy of a Thin Image P-VOL. The snapshot is maintained when you update the P-VOL by storing pre-updated data (snapshot data) in a data pool.

SNMP
simple network management protocol

SOM
system option mode

source volume (S-VOL)
The volume in a copy pair containing the original data. The term is used only in the earlier version of HDvM - SN (still in use).

space
Generally refers to the data storage capacity of a disk drive or flash drive.

SRM
Storage Replication Manager

SSB
sense byte

SSID
storage subsystem identifier

SSL
secure socket layer

steady split
In SI, a typical pair split task in which any remaining differential data from the P-VOL is copied to the S-VOL and then the pair is split.

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 also *administrative logical unit (ALU)*.

S-VOL
See *secondary volume* or *source volume (S-VOL)*.

SVP
See *service processor (SVP)*.

sync
synchronous

system option mode (SOM)
Additional operational parameters for the VSP G200, G400, G600, G800 storage systems that enable the storage system to be tailored to unique customer operating requirements. Set SOMs on the service processor.

system pool volume
A pool volume that contains a management area and is set automatically by the system when a pool is created. The capacity allocated to the management area cannot be used by the system pool volume. If a system pool volume is deleted, another volume is set automatically as the new system pool volume.

T

target volume (T-VOL)
The volume in a mainframe copy pair that is the copy. The term is used only in the earlier version of HDvM - SN (still in use).
See also *source volume (S-VOL)*.

TB
terabyte

TC
Hitachi TrueCopy

TDEVN
target device number

THD
threshold

TID
target ID

total capacity
The aggregate amount of storage space in a data storage system.

T-VOL
See *target volume (T-VOL)*.

U

update copy
An operation that copies differential data on the P-VOL of a copy pair to the S-VOL. Update copy operations are performed in response to write I/Os on the P-VOL after the initial copy operation is completed.

UR
Hitachi Universal Replicator

USP
Hitachi TagmaStore® Universal Storage Platform

USP V
Hitachi Universal Storage Platform V

USP VM
Hitachi Universal Storage Platform VM

UT
Universal Time

UTC
Universal Time-coordinated

V

V
version; variable length and de-blocking (mainframe record format)

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. The two Device Manager - Storage Navigator modes are view mode and 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 LUN volume
A custom-size volume whose size is defined by the user using Virtual 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 Dynamic Provisioning, Dynamic Tiering, or active flash, V-VOLs are referred to as DP-VOLs.

VLL
Hitachi Virtual LUN

VM
volume migration; volume manager

VOL, vol
volume

VOLID
volume ID

volser
volume serial number

volume
A logical device (LDEV), or 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).

volume pair
See *copy pair*.

V-VOL
virtual volume

V-VOL management area

Contains the pool management block and pool association information for Dynamic Provisioning, Dynamic Tiering, and Thin Image operations. The V-VOL management area is created automatically when additional control memory is installed.

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