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Hitachi ShadowImage®

User Guide

Hitachi Virtual Storage Platform G1000 and G1500

Hitachi Virtual Storage Platform F1500

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Systems

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Preface

This document describes and provides instructions for performing Hitachi ShadowImage® operations. Please read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

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

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The *Product Overview*.
- The Device Manager - Storage Navigator software, and the *Hitachi Command Suite User Guide*.

Product version

This document revision applies to the following microcode or firmware:

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

Changes in this revision

- Added the Hitachi Virtual Storage Platform G1500 and Hitachi Virtual Storage Platform F1500 storage systems.

Release notes

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

Referenced documents

The following documents are referenced in this guide:

- *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/FlashCopy SE User Guide*, MK-92RD8010
- *Performance Guide*, MK-92RD8012
- *Provisioning Guide for Open Systems*, MK-92RD8014
- *Hitachi Device Manager - Storage Navigator Messages*, MK-92RD8017

- *Hitachi TrueCopy® User Guide*, MK-92RD8019
- *Hitachi Universal Replicator User Guide*, MK-92RD8023

Document conventions

This document uses the following terminology conventions:

Convention	Description
FCSE	Hitachi Compatible Software for IBM® FlashCopy® SE
FCv2	Compatible FlashCopy® V2
GAD	Global-active device
HDP	Hitachi Dynamic Provisioning
SI	ShadowImage
SIz	ShadowImage for Mainframe
TC	TrueCopy
TCz	TrueCopy for Mainframe
HTI	Hitachi Thin Image
UR	Universal Replicator
URz	Universal Replicator for Mainframe

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.

Convention	Description
| 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.

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

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

Conventions for storage capacity values

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

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

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

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems:

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

Getting help

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

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Comments

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Thank you!

1

ShadowImage overview

Hitachi ShadowImage® (SI) uses local mirroring technology to create and maintain full copies of data volumes within a storage system. Using SI volume copies (for example: backups, secondary host applications, data mining, testing) allows you to continue working without stopping host application input/output (I/O) in the production volume. For information about Hitachi Virtual Storage Platform F1500 availability, contact your HDS representative.

- ☐ How ShadowImage works
- ☐ Hardware and software components
- ☐ Initial and update copy operations

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.

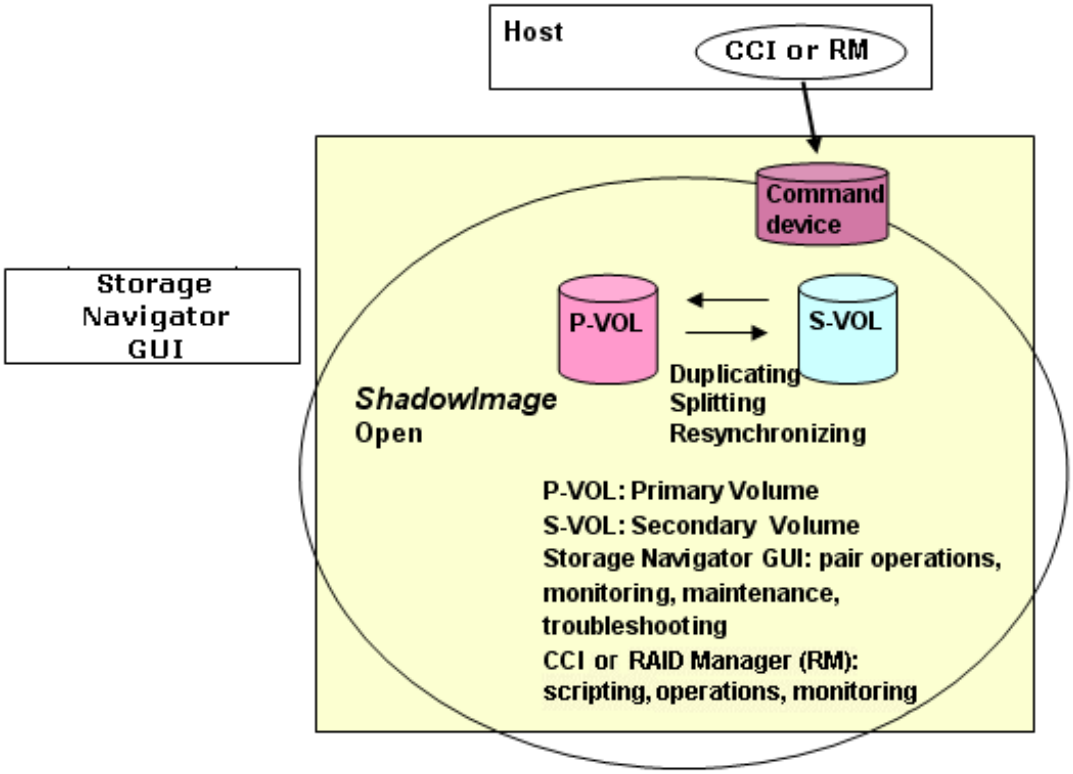
- S-VOL data is consistent and usable. It is available for read/write access by secondary host applications.
- Changes to the P-VOLs and S-VOLs are managed by differential bitmaps.
- You can pair the volumes again by resynchronizing the update data from P-VOL to S-VOL, or from S-VOL to P-VOL.

Note: In Device Manager - Storage Navigator (HDvM - SN), the source volume is called P-VOL and the destination volume is called S-VOL.

Hardware and software components

A typical configuration consists of a storage system, a host connected to the storage system, the SI software, a primary or source volume (P-VOL), and secondary or target volumes (S-VOLs), and interface tools for operating SI.

The following image shows a typical configuration.



Interface tools

Interface tools used to operate ShadowImage include the following:

- HDvM - SN graphical user interface (GUI)
- Command Control Interface (CCI)

Device Manager - Storage Navigator

Use HDvM - SN to perform the following tasks:

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

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

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

Command Control Interface

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 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 CTG pair-split tasks. Using a CTG to perform tasks ensures the consistency of the pair status for all pairs in the group.

Related references

- Supported ShadowImage consistency group actions and options on page 128

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 might 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.

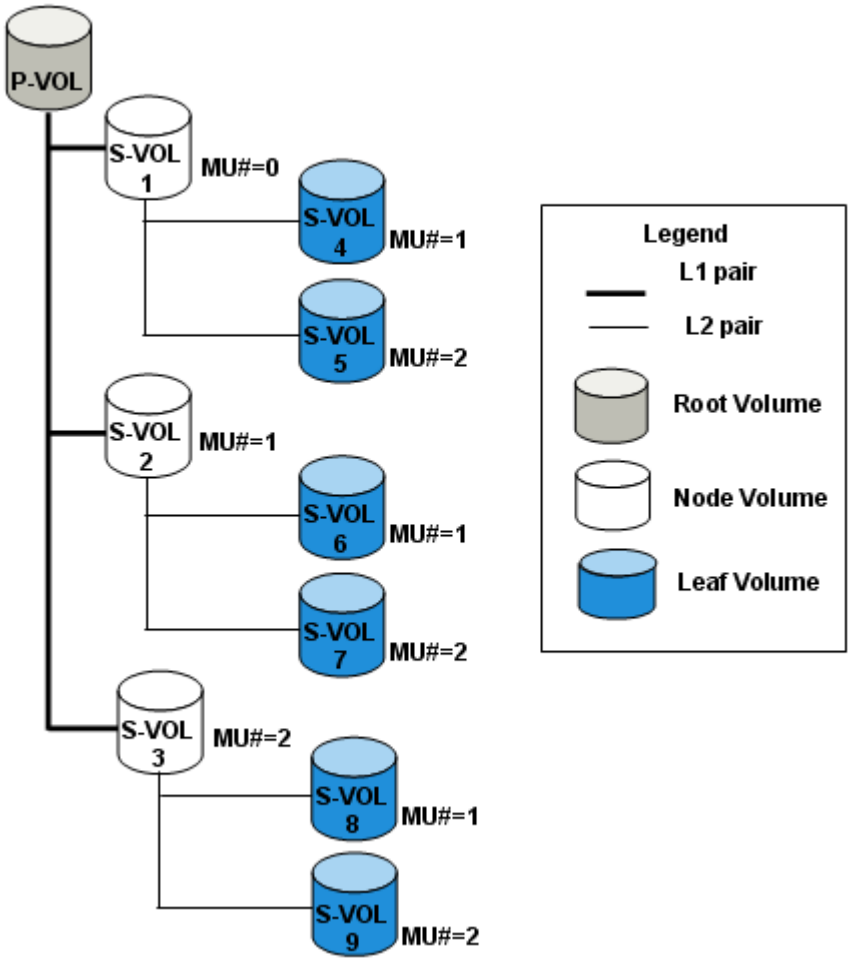
Related concepts

- ShadowImage pair creation on page 57
- ShadowImage pair splitting on page 71
- ShadowImage pair resynchronization on page 82
- ShadowImage pair deletion on page 90

Cascaded pairs

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

- Sharing volumes with Universal Replicator on page 43
- Sharing volumes with TrueCopy on page 42

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 performed when you create a copy pair. Data on the P-VOL is copied to the S-VOL for the initial copy using the following workflow.

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

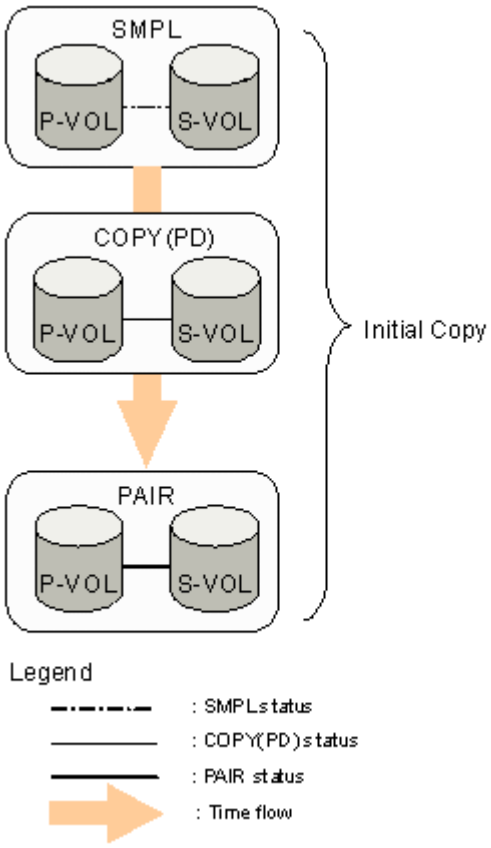
1. The S-VOLs are not paired. You create the copy pair.

   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.

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



Related concepts

- ShadowImage pair creation on page 57

Update copy workflow

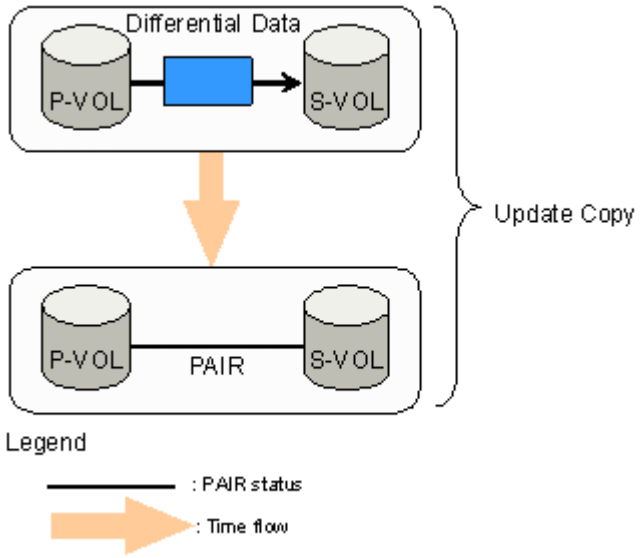
Update copy is performed to asynchronously copy new data (differential data) from the P-VOL of a copy volume to the S-VOL.

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 concepts

- ShadowImage pair splitting on page 71

2

ShadowImage system requirements and planning

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

- System requirements
- ShadowImage licensed capacity requirements
- Workflow for determining the maximum number of ShadowImage pairs
- Quick Split and Steady Split performance planning
- Performance planning for ShadowImage

System requirements

The following table describes 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 ShadowImage licensed capacity requirements on page 23.
License key	Must be installed.
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, CCI is not required. For more information about 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: 1 • Number of S-VOLs per P-VOL: L1 pairs: 1 to 3 L2 pairs: 1 or 2 For more information about cascading pairs, see Cascaded pairs on page 16. • 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, select Options > Capacity Unit > block in the Logical Devices window. • Supported volume types: ○ Internal volumes ○ External volumes **Note:** Universal Volume Manager license is required. ○ Custom-sized volumes (VSP G1000, G1500, and VSP F1500) **Note:** VLL is required. Pair volumes must have the same capacity and emulation type. • Mirror Unit number (MU number): Values: ○ L1 pairs: 0, 1, or 2 ○ L2 pairs: 1 or 2 You can share volumes with other software applications (see Sharing ShadowImage volumes on page 35). • You cannot use the following volumes as pair volumes: ○ UR journal volumes ○ Virtual volumes except Dynamic Provisioning (HDP) volumes ○ Pool volumes

Item	Requirement
	○ Volumes that belong to parity groups for which accelerated compression is enabled ○ Deduplication system data volume ○ The value of the T10 PI attribute must be the same for the P-VOL and S-VOL.
Maximum number of pairs	Pairs per storage system (if you pair one S-VOL per P-VOL): • VSP G1000 and G1500, and VSP F1500: 32,768 • VSP Gx00 models or VSP Fx00 models: 8,192 **Note:** The maximum is dependent on the amount of installed shared memory. For more information about installed shared memory, see Maximum number of tables based on installed shared memory on page 25. For more information about the number of pairs your VSP G1000, G1500, and VSP F1500 configuration supports, see Workflow for determining the maximum number of ShadowImage pairs on page 24.
Consistency groups	Maximum per storage system: 256 (including SI, SIz, and Thin Image (HTI)) **Note:** You cannot place SI, SIz, and HTI pairs in the same CTG. Maximum SI pairs per CTG: 8,192 You can only use CTGs that you created using CCI in CCI. CTG IDs are numbers between 0 and FF. CTG IDs 00 to 7F (or 0 to 127) are used for SI, SIz, and HTI. CTG IDs 80 to FF (or 128 to 255) are used for HTI only.

ShadowImage licensed capacity requirements

The capacity of 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 volume capacity is counted, but for a DP-VOL (a virtual volume used in Dynamic Provisioning for Mainframe, Dynamic Tiering for Mainframe, or active flash for mainframe), the pool capacity being used by the volume is counted.

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. For the volume with the capacity saving enabled, the licensed capacity is the data capacity before saving.

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

You can continue using ShadowImage volumes in pairs for 30 days after licensed capacity is exceeded. After 30 days, the only allowed operation is pair deletion.

For more information about licenses, see the *Hitachi Command Suite User Guide*.

Workflow for determining the maximum number of ShadowImage pairs

Complete the following steps 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 that have an emulation type other than OPEN-V.
   - Calculate the number of tables for volumes that have OPEN-V emulation types.
   - Query the number of differential tables required to create ShadowImage (SI) pairs.

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

2. Determine the maximum number of SI pairs that you can create on your storage system.

Related tasks

- Calculating the number of tables for ShadowImage when sharing tables (VSP G1000, G1500, and VSP F1500) on page 26
- Calculating the number of tables for emulation types that are not OPEN-V (VSP G1000, G1500, and VSP F1500) on page 27
- Calculating the number of tables for OPEN-V emulation type (VSP G1000, G1500, and VSP F1500) on page 27
- Calculating the maximum number of ShadowImage pairs (VSP G1000, G1500, and VSP F1500) on page 28

Related references

- Differential tables and pair tables on page 25
- Maximum number of tables based on installed shared memory on page 25

Differential tables and pair tables

Differential tables and pair tables are required to create SI pairs. Differential tables are tables that manage the differential bitmaps, and 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:
- ShadowImage (VSP G1000, G1500, and VSP F1500)
- Volume Migration

The following software applications use pair tables:
- ShadowImage (VSP G1000, G1500, and VSP F1500)
- Volume Migration (using migration plans)

Maximum number of tables based on installed shared memory

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

The maximum number of differential tables, pair tables, and system volumes you can create are based on the amount of installed shared memory.

The maximum number of pairs is 32,768 if the 64KLDEV shared memory extension is installed.

Table and volume limits (VSP G1000, G1500, and VSP F1500)

Shared memory	Differential table limit	Pair table limit	System volume limit
Base (no additional shared memory)	57,600	8,192	16,384
64KLDEV Extension	419,200	32,768	65,536

The maximum number of SI pairs you can create is half the number of system volumes in the table if the P-VOLs and S-VOLs are in a one-to-one relationship.

For example, if you have only the base shared memory installed and the maximum amount of system volumes you can create is 16,384, then you can only create 8,192 SI pairs. If there are more S-VOLs than P-VOLs, then the number of allowed SI pairs decreases.

The maximum number of pair tables when shared memory is extended is always 32,768, regardless of the system volumes limit.

Table and volume limits VSP Gx00 models or VSP Fx00 models

	VSP G200		VSP G400, G600, G800	
Shared memory	**Differential table limit**	**Pair table limit**	**Differential table limit**	**Pair table limit**
Base (no additional shared 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 shared memory, the number of differential tables is 26,176 and the number of pair tables is 8,192. If you have shared memory extension 1 or 2, the number of differential tables is 209,600 and the number of pair tables is 16,384.

Calculating the number of tables for ShadowImage when sharing tables (VSP G1000, G1500, and VSP F1500)

You can calculate the number of differential tables and pair tables your storage system needs to create SI pairs.

Procedure

Use the following formula:

```
Maximum number of pairs which the storage system has
available is approximately =<
(the total number of differential and pair tables in the
storage system -
the number of tables other software applications are using,
such as Compatible
                FlashCopy®)
```

Note: You can use CCI **inqraid** command to query the number of the differential tables required when you create SI pairs, though not for creating SIz 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 emulation types that are not OPEN-V (VSP G1000, G1500, and VSP F1500)

You can calculate the number of differential tables and pair tables you will need for a volume that has an emulation type other than OPEN-V.

Procedure

1. Use the following formula:

   ```
   Total number of differential tables per pair =
   (volume capacity KB ÷ 48) +
   (management area capacity as number of cylinders)* × 15) ÷
   (20,448**)
   ```

   * See the table that describes the control cylinders per emulation type in the *Provisioning Guide for Open Systems*.

   ** 20,488 is the maximum 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 2,403,360 KB, the calculation is as follows:

   ```
   (2,403,360 ÷ 48 + 8 × 15) ÷ 20,448 = 2.4545...
   ```

   Round up 2.4545 to the nearest whole number, 3. In this example, you will need three differential tables for the pair and one pair table.

Calculating the number of tables for OPEN-V emulation type (VSP G1000, G1500, and VSP F1500)

You can calculate the number of differential tables and pair tables that you will need for a volume that has an OPEN-V emulation type.

Note: Differential tables are not used if a DP-VOL exceeds 4 TB. Only the OPEN-V emulation type can use more than one pair table per pair.

Procedure

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, the calculation is as follows:

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

You can calculate the number of differential and pair tables you will need. Round up 576.9014 to the nearest whole number, 577. In this example, you will need 577 differential tables.

Calculating the maximum number of ShadowImage pairs (VSP G1000, G1500, and VSP F1500)

You can calculate the maximum number of pairs your storage system can support. In the calculation, you use the results of calculating the number of differential and pair tables.

Procedure

Use the following formula:

$\Sigma \{(\alpha) \times (\text{the number of SI pairs})\} \leq (\beta)$ and $\Sigma \{(\gamma) \times (\text{the number of SI pairs})\} \leq (\delta)$

where:

- (α): The required number of differential tables per pair (per previous calculation).
- (β): The number of differential tables available in the system.
  For more information about differential tables, see Maximum number of tables based on installed shared memory on page 25.
- (γ): The required number of pair tables per pair.
  For more information about determining the number of differential and pair tables your storage system needs to create SI pairs, see Workflow for determining the maximum number of ShadowImage pairs on page 24.
- (δ): The number of pair tables available in the system.
  For more information about pair tables, see Maximum number of tables based on installed shared memory on page 25.

Note: The values for (β) and (δ) in the calculation are dependent on the amount of installed shared memory.

For more information about installed shared memory, see Maximum number of tables based on installed shared memory on page 25.

For example, if you plan to create 10 SI pairs of OPEN-3 volumes and 20 SI pairs of OPEN-V volumes in a storage system that has 57,600 differential tables, use the following formula:

$(3 \times 10) + (577 \times 20) = 11{,}570$, which is ≤ 57,600

If the emulation type is OPEN-3 and the capacity of the volume is 2,403,360 KB, you will need three differential tables and one pair table.

If the emulation type is OPEN-V and 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:

```
(3 x 10) + (577 x 20) = 11,570 ≤ 57,600
```

and

```
(1 x 10) + (17 x 20) = 350 ≤ 8,192
```

Thus, you can create 10 SI pairs of OPEN-3 volumes and 20 SI pairs of OPEN-V volumes.

Calculating the number of tables for each pair (VSP Gx00 models and VSP Fx00 models)

You can calculate the number of differential tables and pair tables that 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.

Procedure

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, the calculation is as follows:

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

   Round up 576.9014 to the nearest whole number, 577.
3. 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.

Calculating the number of SI pairs that can be created VSP Gx00 models or VSP Fx00 models

After you determine the necessary number of differential and pair tables, determine whether the planned number of pairs can be created.

The number of differential and pair tables for a pair depends on the volume capacity.

Procedure

1. Calculate how many differential tables are required for the planned number of pairs:

   number-of-differential-tables-per-pair × planned-number-of-pairs
2. Calculate how many pair tables are required for the planned number of pairs:

   number-of-pair-tables-per-pair × planned-number-of-pairs
3. Verify that the storage system has enough differential tables and pair tables available.
   - The number of differential tables calculated in step 1 must not exceed the number of available differential tables
   - The number of pair tables calculated in step 2 must not exceed the number of available pair tables



Note: The number of available differential tables and pair tables depends on the amount of installed shared memory.

Example

if you plan to create 20 pairs in a storage system that has 57,600 differential tables, use the following calculation:

577 × 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 × 20 = 11,570 ≤ 57,600

and

17 × 20 = 340 ≤ 8,192

Therefore, you can create 20 pairs.

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):

- Whether 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 lists the affects 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 destaging to the external storage system has completed. The pair is split (PSUS status).
* If the S-VOL is a DP-VOL, this column indicates whether the top pool volume allocated to the S-VOL is internal or external.		

Related concepts

- Pair splitting methods on page 72

Related tasks

- Splitting ShadowImage pairs on page 73

Performance planning for ShadowImage

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 and 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.

    - 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. Ensure the configuration is appropriate for the internal and host workload. Items that can help are additional parity groups, cache adapters, cache, BEDs, and MPBs.
    - 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.
- If use AIX® host servers, for best performance, place the P-VOLs on one 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 Port VLAN ID when you create or resynchronize the SI pairs. If the Port VLAN IDs of the P-VOLs and S-VOLs 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 33).

For more information about the guidelines for maximizing host server I/O performance while performing pair operations, see How to maximize host server I/O performance on page 32.

Related references

- Sharing volumes with Cache Residency Manager on page 36

How to maximize host server I/O performance

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

Use the following suggestions 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.

Related tasks

- Enabling system options on page 49
- Creating ShadowImage pairs on page 58
- Splitting ShadowImage pairs on page 73
- Resynchronizing or restoring ShadowImage pairs on page 86

Workflow for maximizing Quick Restore performance

Complete the following steps to maximize performance when restoring pairs with Quick Restore:

1. Use the same RAID level and hard disk drive (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 steps:
   - If the P-VOL and S-VOLs are in different partitions, place them into the same cache partition.
   - 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 *Performance Guide* for your storage system.
3. Restore the pairs using Quick Restore.
4. Resume the original RAID levels if they were changed by a reverse resynchronization action.

Related tasks

- Setting the RAID level on page 90

Related references

- Reverse resynchronization on page 84

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
- Sharing volumes and Data Retention Utility access attributes
- Sharing volumes with Dynamic Provisioning
- Sharing volumes with LUN Manager
- Sharing volumes with Resource Partition Manager
- Sharing volumes with Thin Image
- Sharing volumes with TrueCopy
- Sharing volumes with Universal Replicator
- Sharing volumes with Universal Volume Manager
- Sharing volumes with Hitachi Volume Migration
- Sharing volumes with global-active device

Sharing volumes with Cache Residency Manager

You can use volumes with Cache Residency Manager settings as SI P-VOLs and S-VOLs. The Cache Residency Manager settings can affect performance when restoring pairs with Quick Restore.

For more information on avoiding negative performance when restoring pairs using Quick Restore, see Workflow for maximizing Quick Restore performance on page 33.

Related references

- Reverse resynchronization on page 84

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 vary, depending on whether you set Data Retention Utility access attributes using HDvM - SN or CCI.

The following table lists 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

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, S-VOL Disable	Read Only, Protect, S-VOL Disable	NO	NO	YES

The following table lists 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 might not be able to set access attributes for SI P-VOLs and S-VOLs for Data Retention Utility. Access attribute settings also depend on whether you set Data Retention Utility access attributes when using HDvM - SN or CCI.

The following table lists 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(PD)/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

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

The following table lists 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(PD)/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

Volumes created using Dynamic Provisioning 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. A volume with the capacity saving enabled can be used as a P-VOL or S-VOL.

The term Dynamic Provisioning in this manual includes Dynamic Provisioning, Dynamic Tiering, or active flash.

Restrictions

The following restrictions apply:

- Data compressed or deduplicated by the capacity saving function is copied to a volume after compression and deduplication are released. The capacity saving function is not performed immediately for copied data. Before creating or resynchronizing an SI pair, make sure that the available capacity in the copy destination volume is greater than the used capacity in the copy origination volume before capacity saving. For details, see the *Provisioning Guide* for your storage system.
- If you create an SI pair using a volume for which the capacity saving function is used, compressed or deduplicated data is copied. Because of this, copy or I/O performance may be degraded.
- When the capacity saving function is used, management information is stored in a pool. As a result, there may be difference between a P-VOL and an S-VOL in the number of used pages or licensed capacity.
- Because the S-VOL uses the same pool capacity as the P-VOL, best practice is to avoid the following volume combinations:
  - 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 using 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 DP-VOL or the capacity saving of the P-VOL or S-VOL is enabled. For Quick Restore, you must use DP-VOLs for both the P-VOL and S-VOL.
- The deduplication system data volume cannot be used as a P-VOL or S-VOL.
- You can use a maximum size Dynamic Provisioning volume as an SI P-VOL or S-VOL. For information about the maximum size for Dynamic Provisioning volumes, see the *Provisioning Guide* for your storage system.
- You must use the block specification for SI volumes shared with DP-VOLs. You cannot use TB, GB, or MB. For example, 4 TB = 8,589,934,592 blocks.
- 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.
- (VSP G1000, G1500, and VSP F1500) If you downgrade to a microcode version that does not support pair creation with a DP-VOL greater than 4,194,304 MB, release the differential data (pages) managed in a pool.
- If you perform an SI paircreate or pairresync operation while zero pages are being reclaimed (including operations by WriteSame, Unmap, and Rebalance), it results in zero-page reclamation interruption.
- If you create an SI pair during WriteSame or Unmap command processing, the pair creation may fail. In this case, create the pair again after the WriteSame or Unmap command processing finishes.

- SI pair creation may be rejected if the Unmap command operation is in progress with system option mode 905 ON. Wait a while, and then retry. If the operation still fails, set system option mode 905 to OFF and retry.

Related tasks

- Releasing differential data for ShadowImage pairs on page 67

Sharing volumes with LUN Manager

LUN Manager tasks do not affect SI tasks. You can assign volumes that are under secure ports 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 *Provisioning Guide* for your storage system.

Before you begin

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, but not to the same CTG. For the node or leaf volume of a Thin Image pair, see the V-VOL description in the following table.

The following table describes how you can share HTI volumes.

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

HTI volume	SI volume	
	P-VOL	S-VOL

Notes:
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 supported SI tasks.

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

The following table lists 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	PAIR, PFUL	PSUS, PFUS	SMPL(PD)	RCPY	PSUE
Create a pair (paircreate)	YES	YES	YES	YES	NO	YES
Create and split a pair (paircreate -split)	YES	YES	YES	YES	NO	YES
Split a pair (pairsplit)	YES	YES	YES	YES	NO	YES
Resynchronize a pair (pairresync)	YES	YES	YES	YES	NO	YES
Reverse Copy a pair (pairresync -restore)	YES	YES*	YES	YES	NO	YES
Quick Restore 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

Notes:

*The snapshot data must be consistent with P-VOL data and ready to use in the SI task.

After issuing the pairsplit command for a pair for which a consistency group is configured, verify that the status of all pairs in the consistency group is PSUS or unpaired, and then execute the SI task. If you do not, the snapshot data and P-VOL data when the storage system accepted the pairsplit command will not be consistent. For details, see the *Hitachi Thin Image User Guide*.

For more information about ensuring the snapshot data is consistent with P-VOL data, see Ensuring snapshot data is consistent with P-VOL data on page 82.

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

The following table lists 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	PAIR, PFUL	PSUS, PFUS	SMPL(PD)	RCPY	PSUE
Create a pair (paircreate)	NO	NO	NO	NO	NO	NO
Create and split a pair (paircreate -split)	NO	NO	NO	NO	NO	NO
Split a pair (pairsplit)	YES	YES[1]	YES	YES	NO	YES
Resynchronize a pair (pairresync)	YES	YES[1]	YES	YES	NO	YES
Reverse Copy a pair (pairresync -restore)	YES	YES[1]	YES	YES	NO	YES
Quick Restore a pair[2] (pairresync -restore)	NO	NO	NO	NO	NO	NO
Suspend a pair task (pairsplit -E)	YES	YES	YES	YES	NO	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES

Notes:

1. The snapshot data must be consistent with P-VOL data and ready to use in the SI task.
   After issuing the pairsplit command for a pair for which a consistency group is configured, verify that the status of all pairs in the consistency group is PSUS or unpaired, and then execute the SI task. If you do not, the snapshot data and P-VOL data when the storage system accepted the pairsplit command will not be consistent. For details, see the *Hitachi Thin Image User Guide*.
   For more information about ensuring the snapshot data is consistent with P-VOL data, see Ensuring snapshot data is consistent with P-VOL data on page 82.
2. 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-VOLs.

Sharing volumes with TrueCopy

You can share 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.

For more information about splitting pairs, see Pair splitting methods on page 72.

Restrictions

The following restrictions apply:

- 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 16.
- 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 76.

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 16.
- 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 84.
- 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 76.

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 migrate the following types of SI pair volumes as Volume Migration source volumes:

- L1 P-VOL with up to two S-VOLs.
- L2 P-VOL with at least one S-VOL.

To assign another type of SI pair volume as a Volume Migration source volume, you must delete the SI pair first.

SI pair volumes cannot be migrated as Volume Migration target volumes.

Volume Migration volumes cannot be used in SI pair tasks; you must release a volume in Volume Migration before you can use it as an SI volume.

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 (CCI command)	ShadowImage volume	
	P-VOL	S-VOL
GAD P-VOL	YES	NO
GAD S-VOL	YES	NO
GAD S-VOL Reserve attribute volume	NO	NO
GAD quorum disk volume	NO	NO

If sharing GAD pair volume and P-VOL of ShadowImage pair, GAD pair status and relationship of ShadowImage operation will be as seen in the following two tables.

Note:

- If a pair that cannot be split is in a consistency group (CTG), pairs in the CTG are suspended (PSUE status) when executing a CTG pair split function for ShadowImage.
- To split a ShadowImage pair that links with a GAD pair and obtain a backup, stop I/O for the target backup volume, and then split the ShadowImage pair.

ShadowImage tasks when sharing GAD P-VOL and ShadowImage P-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	YES	YES	YES	YES	YES	YES

ShadowImage task (CCI command)	GAD pair status and I/O mode					
	COPY	PAIR	PSUS		PSUE	
	Mirror (RL)	Mirror (RL)	Local	Block	Local	Block
(pairresync)						
Reverse Copy a pair (pairresync -restore)	NO	NO	YES	NO	YES	NO
Quick restore 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

ShadowImage tasks when sharing GAD S-VOL and ShadowImage P-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
Reverse Copy a pair (pairresync -restore)	NO	NO	NO	NO	YES
Quick restore 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

Configuring ShadowImage

This chapter provides information related to configuring SI.

- Workflow for setting up ShadowImage
- Preparing volumes for ShadowImage
- Enabling system options
- Setting HOST I/O Performance options (VSP Gx00 models and VSP Fx00 models)
- System options

Workflow for setting up ShadowImage

Set up SI before you create the copy pair. You must have Storage Administrator (Local Copy) role to perform SI operations.

Complete the following steps to set up SI:

1. Prepare the volumes for SI (see Preparing volumes for ShadowImage on page 48).
2. (Optional) Enable the system options (see Enabling system options on page 49).

Preparing volumes for ShadowImage

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

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

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	N/A	N/A	N/A
0	1A	0:01	L1 P-VOL	1B-0:01, 2A-0:01, 2B-0:01	N/A	N/A	N/A
0	1B	0:00	L1 S-VOL L2 P-VOL	N/A	1A-0:00	3A-0:00, 3A-0:01	N/A
0	1B	0:01	L1 S-VOL L2 P-VOL	N/A	1A-0:00	3B-0:00, 3B-0:01	N/A
0	2A	0:00	L1 S-VOL L2 P-VOL	N/A	1A-0:00	4A-0:00, 3B-0:01	N/A
0	2A	0:01	L1 S-VOL L2 P-VOL	N/A	1A-0:00	4B-0:00, 3B-0:01	N/A
0	3A	0:00	L2 S-VOL	N/A	N/A	N/A	1B-0:00
0	3A	0:01	L2 S-VOL	N/A	N/A	N/A	1B-0:00

Enabling system options

You can enable and disable the system options that affect performance. For details about how to change system options using Command Control Interface, see the *Command Control Interface User and Reference Guide.*

Procedure

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, complete the following steps:
   a. For **System Type**, verify that **Open** is selected.

      The default setting is **Open**.
   b. From the **SI/TI System Options** table, select the system option you want to enable, and then click **Enable**.
4. Click **Finish**, and then confirm the settings.
5. Accept the default task name or enter a unique name.

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

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

Setting HOST I/O Performance options (VSP Gx00 models and VSP Fx00 models)

This section describes how to change system options using Device Manager - Storage Navigator. For details about how to set Host I/O Performance options using Command Control Interface, see the *Command Control Interface User and Reference Guide*.

Procedure

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 then 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.

System options

Some ShadowImage options can be set by using Device Manager - Storage Navigator or Command Control Interface, and some ShadowImage options can only be set by your service representative.

Options set by service representatives

The copy threshold option can only be set by your service representative. When you want to change the copy threshold option, please contact your service representative.

Option	Description
Copy Threshold	Temporarily stops copy operations when the workload of the storage system is heavy, and minimizes degradation of host I/O performance. This option is enabled only when the workload is heavy. When this option is set, the function is enabled for the following products: • ShadowImage • ShadowImage for Mainframe • Compatible FlashCopy® V2 (VSP G1000, G1500, and VSP F1500) • Thin Image • Volume Migration

Options set by using Device Manager - Storage Navigator or Command Control Interface

You can set the following ShadowImage options by using Device Manager - Storage Navigator or Command Control Interface (CCI). For details about how to change system options using CCI, see the *Command Control Interface User and Reference Guide*.

No.	Option	Description
1	Swap & Freeze	Saves ShadowImage data as is immediately after Quick Restore. Used with the Quick Restore, inhibits the update copy operation after Quick Restore, and the paired S-VOL in PAIR status is not updated and remains unchanged.
2	Host I/O Performance	Gives weight to host I/O responses rather than the copy time of a volume. This option controls SI copy operations and improves host I/O responses. This option suppresses copy operations at any time regardless of workload.
20 21 22	Copy Pace Ext. Slower1 Copy Pace Ext. Slower2 Copy Pace Ext. None	Reducing the copy volume in the PAIR status curbs the influence to the I/O performance of the host server. This option is available to all SI pairs in the PAIR status. The I/O performance of the host server is improved most effectively with Copy Pace Ext. None, followed by Copy Pace Ext. Slower2, and Copy Pace Ext. Slower1. Copy Pace Ext. None takes precedence over Copy Pace Ext. Slower2, and Copy Pace Ext. Slower2 takes precedence over Copy Pace Ext. Slower1. This function is enabled only when the pair status is PAIR. If the pair status is COPY(PD)/COPY, COPY(SP)/COPY, PSUS(SP)/PSUS, COPY(RS)/COPY and COPY(RS-R)/RCPY, this function cannot reduce the impact on the host server's I/O performance.
24	Quick/Steady Split Multiplexing (ShadowImage/ ShadowImage for Mainframe)	Accelerates SI pair split. The number of jobs used for concurrent copy processing for each pair is changed from 1 to 24.
25	Reverse Copy Multiplexing (ShadowImage/ ShadowImage for Mainframe)	Accelerates resynchronization of SI pairs. The number of jobs used for concurrent copy processing for each pair is changed from 1 to 24.

Caution: The Host I/O Performance option suppresses copy processing, and prolongs the copy time. Also, if there is an SIz pair, host I/O responses might not be improved. In this case, enable this option for both SI and SIz.

For details about how to set I/O Performance options using Command Control Interface, see the *Command Control Interface User and Reference Guide.*

Caution: Note the following when you use the Quick/Steady Split Multiplexing (ShadowImage/ShadowImage for Mainframe) and Reverse Copy Multiplexing (ShadowImage/ShadowImage for Mainframe) options:

- The increase in copy volume, increases the amount of data to be written to the target volume.
- If the parity group (for example, physical disk) performance is less than the pair split or resync performance, the amount of data waiting to be written to cache memory (write pending ratio) may increase until it exceeds 60%, and the copy processing might be placed in the wait state. In such a case, consider the copy order to reduce the number of pairs for which copy processing is executed concurrently for volumes provisioned by the same parity group.
- If the number of volumes to be resynchronized or split increases, the maximum number of jobs for pair split or resynchronization that can execute concurrently for a pair decreases. In this case, when you split or resynchronize many pairs concurrently with this option set, the pair split or resynchronization performance might not be changed.
- The maximum number of copy operations that can be run concurrently is 128. This number includes initial copying, resynchronization, update copying, and differential data copying. When copy operations other than pair split and resynchronization are running concurrently, if you set this option, the pair split or resynchronization performance might not be changed.

Note: When the Copy Pace Ext. None option is set, copy operation is not performed for the pair in the PAIR status. In this case, the PSUS(SP)/PSUS and COPY(SP)/COPY status during split operation might last longer. If this is a problem, perform either of or both the following actions:

- Minimize the time that the pair status is PAIR to avoid lowering the sychronization ratio in the PAIR status.
- Use this option to change the status to Copy Pace Ext. Slower1 or Copy Pace Ext. Slower2. If you select either of them, the write response might be larger than the one for Copy Pace Ext. None.

Tip: Difference between the Host I/O Performance option and the Copy Pace Ext. options:

The Host I/O Performance option reduces the impact on host I/O by lowering the copy activity when a pair is in COPY(PD)/COPY, PAIR, COPY(SP)/COPY, PSUS(SP)/PSUS, COPY(RS)/COPY or COPY(RS-R)/RCPY status.

The Copy Pace Ext. option reduces the impact on host I/O by lowering the copy activity when the pair is the PAIR status. These options can be set concurrently. If you set both options, you can benefit from both.

Differences between Thin Image and ShadowImage

Item	Thin Image (HTI)	ShadowImage (SI)
P-VOL physical failures such as hard disks.	P-VOL data cannot be guaranteed.	P-VOL data can be recovered using the S-VOL.
P-VOL logical failures such as data update errors or viruses.	P-VOL data can be recovered using the S-VOL.	P-VOL data can be recovered using the S-VOL.
Capacity required for backup.	Less capacity is required for backups because only differential data of the P-VOL is retained.[1]	More capacity is required for backup because all data in the P-VOL is retained.
Impact on P-VOL performance when accessing backed up data.	P-VOL performance is affected because data in the P-VOL is shared.[2]	P-VOL performance is not affected because the P-VOL and the S-VOL can be disconnected.

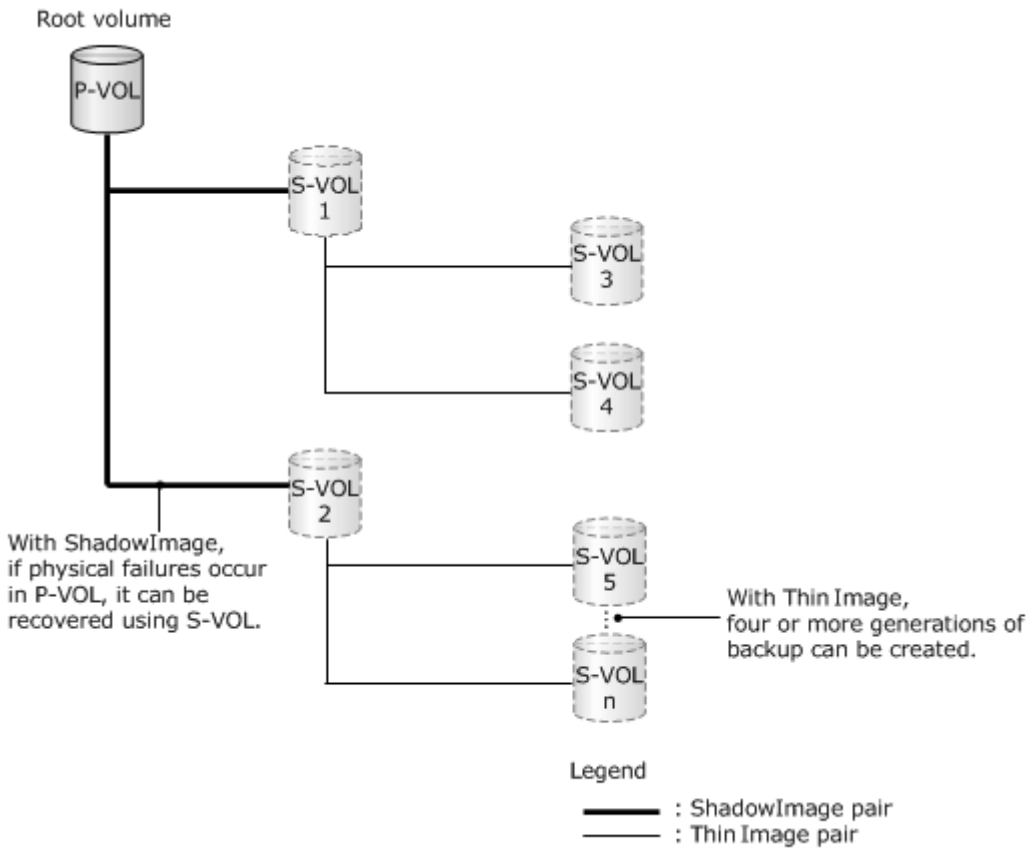
Notes:

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

Recommended usage

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

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



Use HTI to minimize P-VOL logical failures.

5

Managing ShadowImage pairs

This chapter provides information related to using HDvM - SN to complete SI pair tasks, and for using CCI to split pairs by consistency group.

- ☐ Workflow for managing ShadowImage pairs
- ☐ ShadowImage pair creation
- ☐ Suspending ShadowImage pair creation
- ☐ Changing ShadowImage pair options
- ☐ ShadowImage pair splitting
- ☐ ShadowImage pair resynchronization
- ☐ ShadowImage pair deletion

Workflow for managing ShadowImage pairs

During most pair 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 tasks.

Complete the following steps to complete pair tasks:

1. Check the SI pair status and the status of related L1 and L2 pairs to determine if you can perform a task.
2. Create the SI pairs.
3. (Optional) Suspend SI pair creation.
4. (Optional) Suppress update copy operations during pair restoration.
5. Split the pairs. You can do the following:
   - Split SI pairs.
   - Split SI pairs in a CTG.
6. Resynchronize or restore the SI pairs.
7. (Optional) If you have performed a Quick Resync on the pair (PAIR status), suppress copy processing.
8. Delete the SI pairs, which ends the pair relationship between the pair volumes.

It may be a long time before a ShadowImage copy operation starts, because differential tables are initialized for the relevant pairs, one pair at a time, before the copy operation starts. Especially when the pairs use a large volume of data, initialization can be a very long process.

Related concepts

- ShadowImage pair creation on page 57

Related tasks

- Suspending ShadowImage pair creation on page 68
- Suppressing update copy operations during pair restoration on page 90
- Splitting ShadowImage pairs on page 73
- Workflow for splitting pairs in a consistency group on page 78
- Resynchronizing or restoring ShadowImage pairs on page 86
- Suppressing update copy operations during pair restoration on page 90
- Deleting ShadowImage pairs on page 91

Related references

- Pair status and available pair tasks on page 98
- L1, L2 pair status and supported pair tasks on page 99

ShadowImage 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 blade or 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 concepts

- Considerations for creating ShadowImage pairs on page 58
- MP blade or unit and pair deletion on page 92

Related tasks

- Creating ShadowImage pairs on page 58
- Select Pair Configuration window on page 160

Workflow for creating ShadowImage pairs

Complete the following steps to create an SI pair:

1. If you are creating L1 and L2 pairs, check the status (see L1, L2 pair status and supported pair tasks on page 99).
2. Select the volume that you want to duplicate. This becomes the primary volume (P-VOL).

   Note: In Device Manager - Storage Navigator (HDvM - SN), the source volume is called "P-VOL" and the destination volume is called "S-VOL."

   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 (see Creating L1 and L2 pairs with different topologies on page 64).
4. Create the pair by associating the P-VOL and the S-VOLs (see Creating ShadowImage pairs on page 58).
   The storage system starts the initial copy (see Initial copy workflow on page 18).
5. (Optional) Suppress copy processing (see Suppressing update copy operations on page 67).

Considerations for creating ShadowImage 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 BEDs, 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. 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 it transitions to PAIR status. For virtual volumes, the more pages allocated to a virtual volume, the longer the time from pair creation to PAIR status. Even when no pages are allocated to a virtual volume, if the volume capacity is 60 TB, it takes at least 30 minutes until the status changes to PAIR after pair creation. If the volume capacity is 256 TB, it takes at least an hour.
- The value of the T10 PI attribute must be the same for the P-VOL and S-VOL.

Creating ShadowImage pairs

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



Note: If you create an SI pair during WriteSame or Unmap command processing, the pair creation might fail. In this case, create the pair again after the WriteSame or Unmap command processing finishes.

Before you begin

- The P-VOL and S-VOL must be 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 tasks on page 101.
- 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, see the *Hitachi Command Suite User Guide*.

Procedure

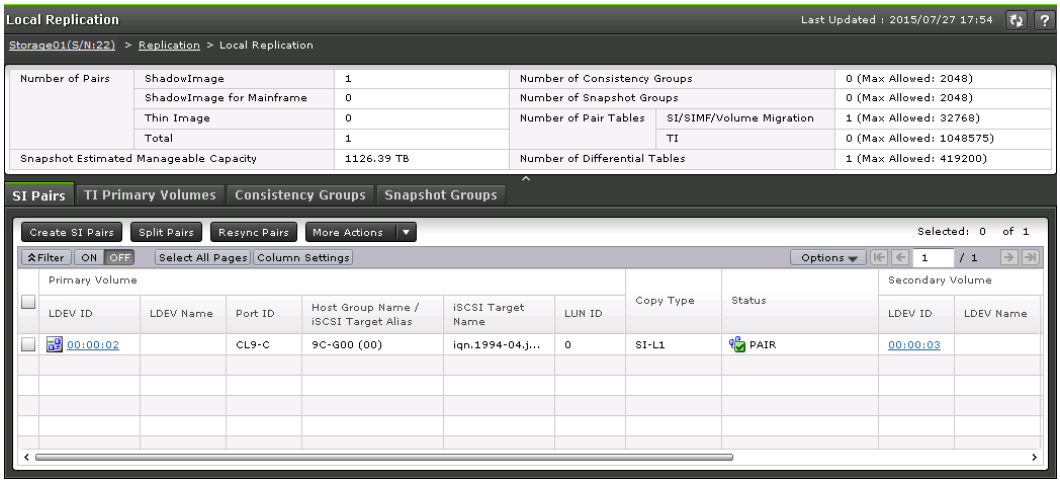
1. In Hitachi Command Suite:

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

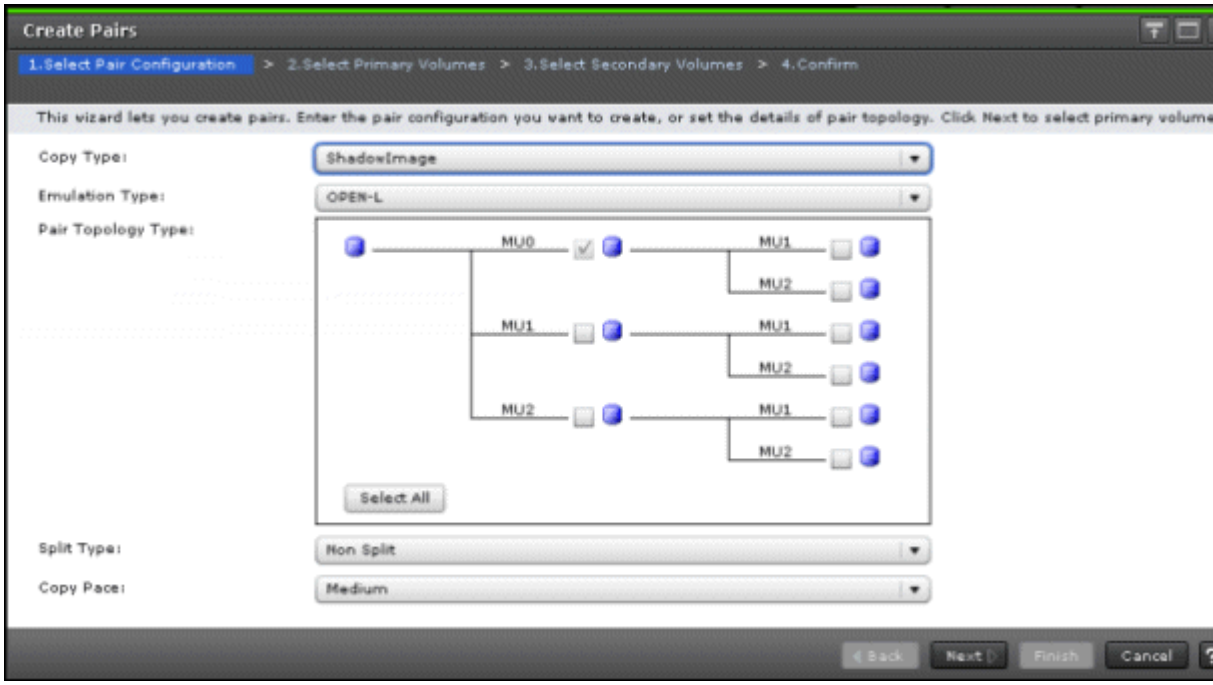
In Device Manager - Storage Navigator:

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

2. In the **Local Replication** window, select the **SI Pairs** tab.



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



4. In the **Select Pair Configuration** window, complete the following steps, and then click **Next**:
   - For **Copy Type**, select **ShadowImage**.
   - For **Emulation Type**, select the emulation type.
   - 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 64.
   - 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**.

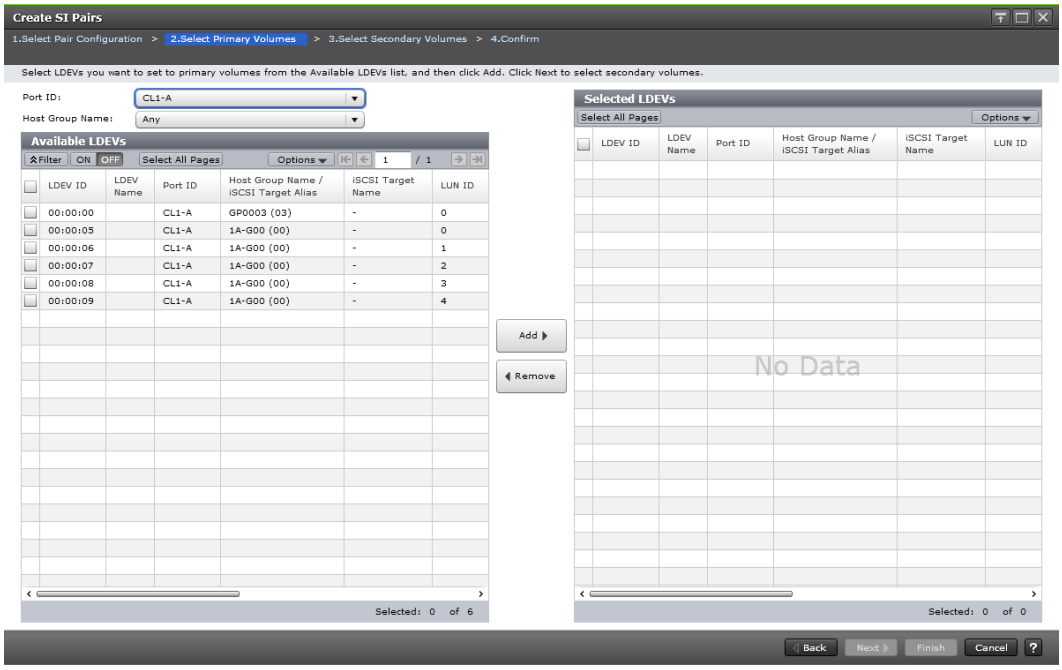
     - **Quick Split** (default): Splits the new pair, and then copies the data so that the S-VOL is immediately available for read and write I/O. The storage system copies the remaining differential data to the S-VOL in the background.
     - **Steady Split**: Copies the differential data to the S-VOL, and then splits the new pair.
   - 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** (default): Average processing speed and host server I/O performance.
     - **Faster**: Faster processing speed but slower host server I/O performance.

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

     For more information about performance, see Performance planning for ShadowImage on page 31.



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

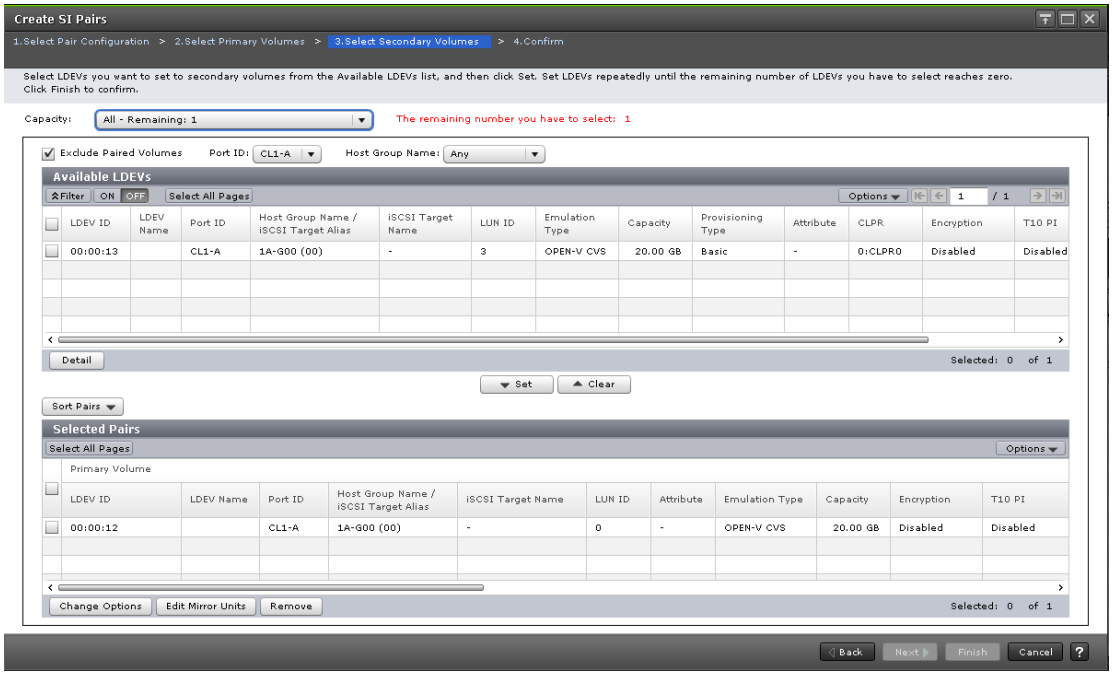
a. Optional: Filter LDEVs by port ID, host group name, or iSCSI target alias.

b. In the **Available LDEVs** table, select one or more LDEVs you want to be P-VOLs, and then click **Add**.

Note: Nondisruptive migration volumes do not appear in the **Available LDEVs** table.

Selected LDEVs are moved to the **Selected LDEVs** table.

c. Click **Next**.



6. In the **Select Secondary Volumes** window of the **Create SI Pairs** wizard, assign LDEVs as S-VOLs to the specified P-VOL LDEVs.
   - 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, select a P-VOL LDEV from the **Selected Pairs** table, and then click **Set**. Repeat this step as many times as needed to make all your pairings.
   - 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.

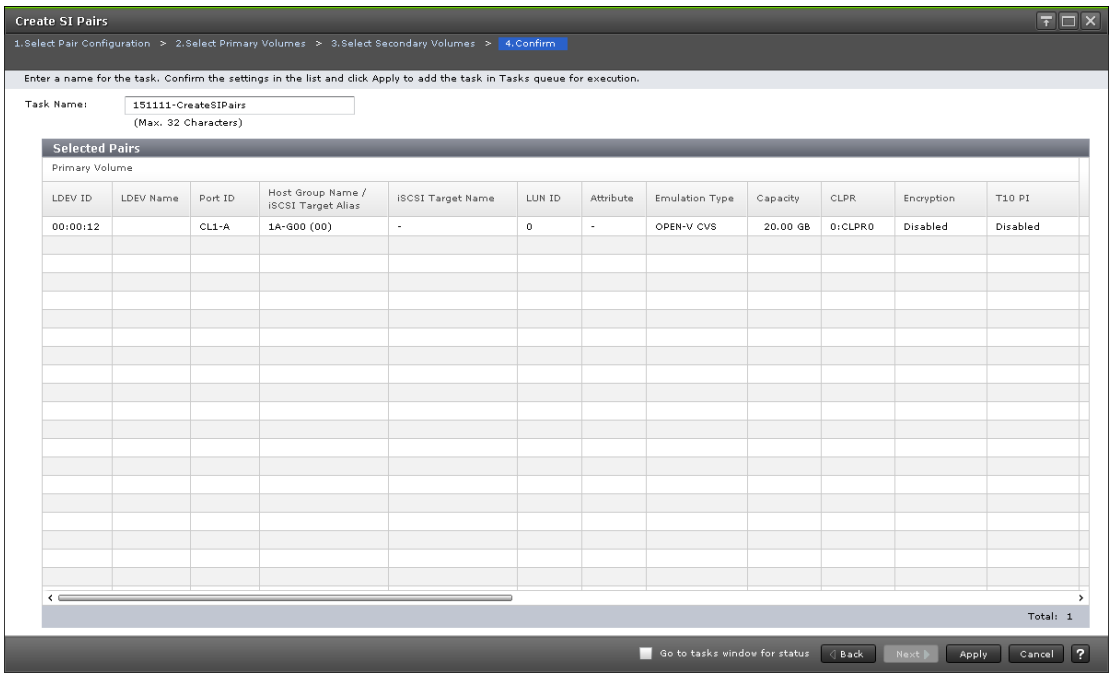
Note: Nondisruptive migration volumes do not appear in the **Available LDEVs** table.

After an S-VOL is selected, you can also perform the following optional steps:

- To sort the **Available LDEVs** and **Selected Pairs** tables according to the capacity, choose a capacity item for **Capacity**.
  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.
- To filter the **Available LDEVs** by a specific port ID, host group name, or iSCSI target alias, select **Port ID**, **Host Group Name**, or **iSCSI Target Alias**.

- Select the **Exclude Paired Volumes** check box to exclude paired LDEVs from display.
- To sort the **Selected Pairs** table, click **Sort Pairs** above the table.
- To change the split type and the rate at which data is copied, which applies to all new pairs, change the pair options (see Changing ShadowImage pair options on page 70).
- To change MU numbers, complete the following steps:
  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 64.
- Change the pair options (see Changing ShadowImage pair options on page 70).
- 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. Click **Finish**, and then confirm the settings.



8. Accept the default task name or enter a unique name.
You can enter up to 32 letters, numbers, and symbols, except the following:

\ / : , ; * ? " < > |

9. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
10. Click **Apply** to submit the task.
    The SI pair is created and the status is PAIR.

Related concepts

- Pair splitting methods on page 72

Related tasks

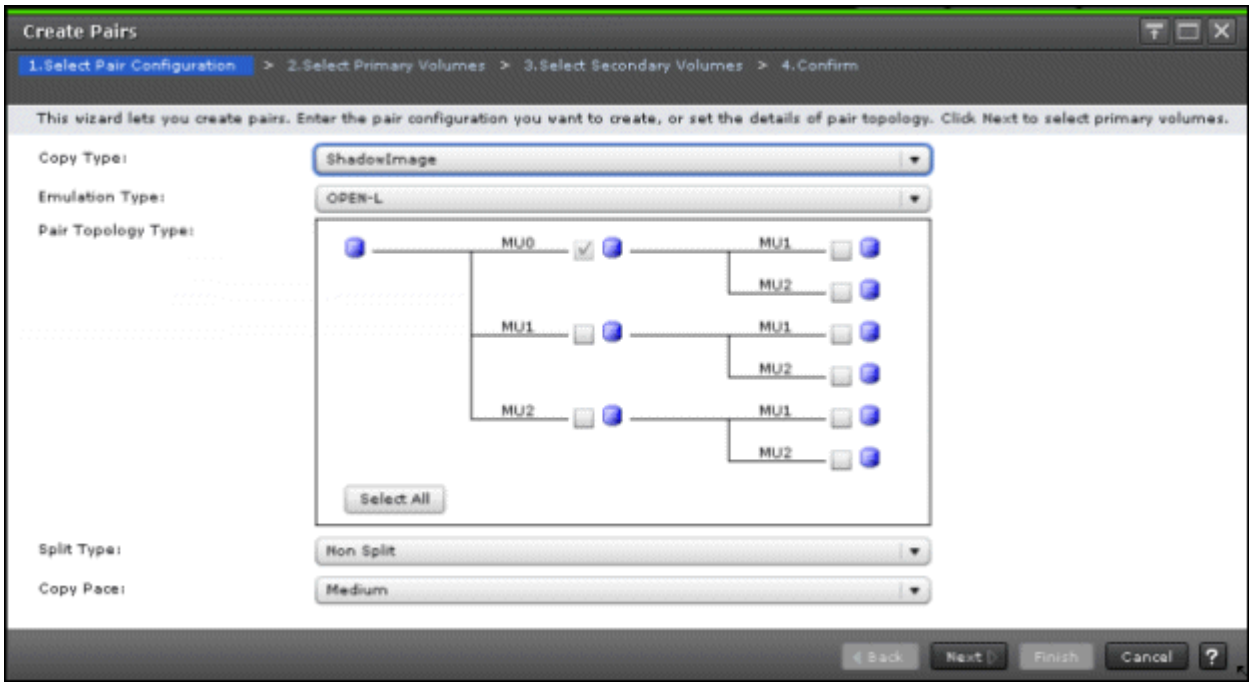
- Changing ShadowImage pair options on page 70

Related references

- Quick Split and Steady Split performance planning on page 31

Creating L1 and L2 pairs with different topologies

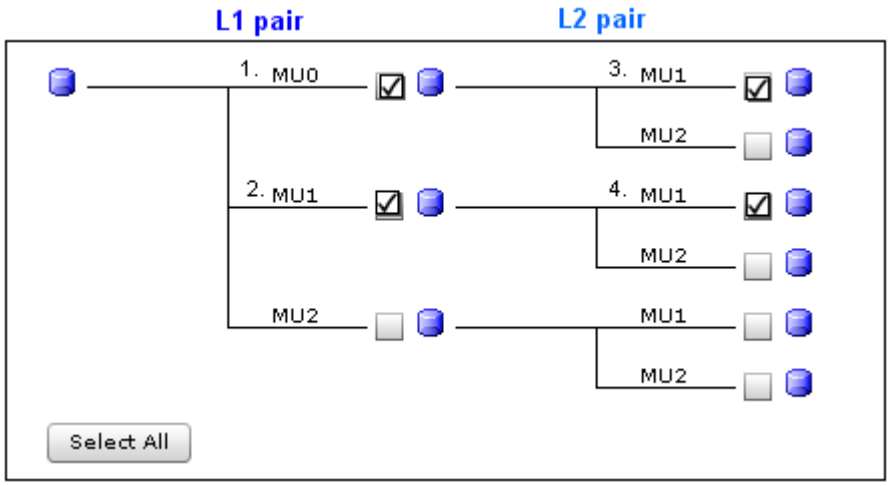
Begin creating a pair by specifying the L1 and L2 pair topology in the Select Pair Configuration window of the Create Pairs wizard.



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.

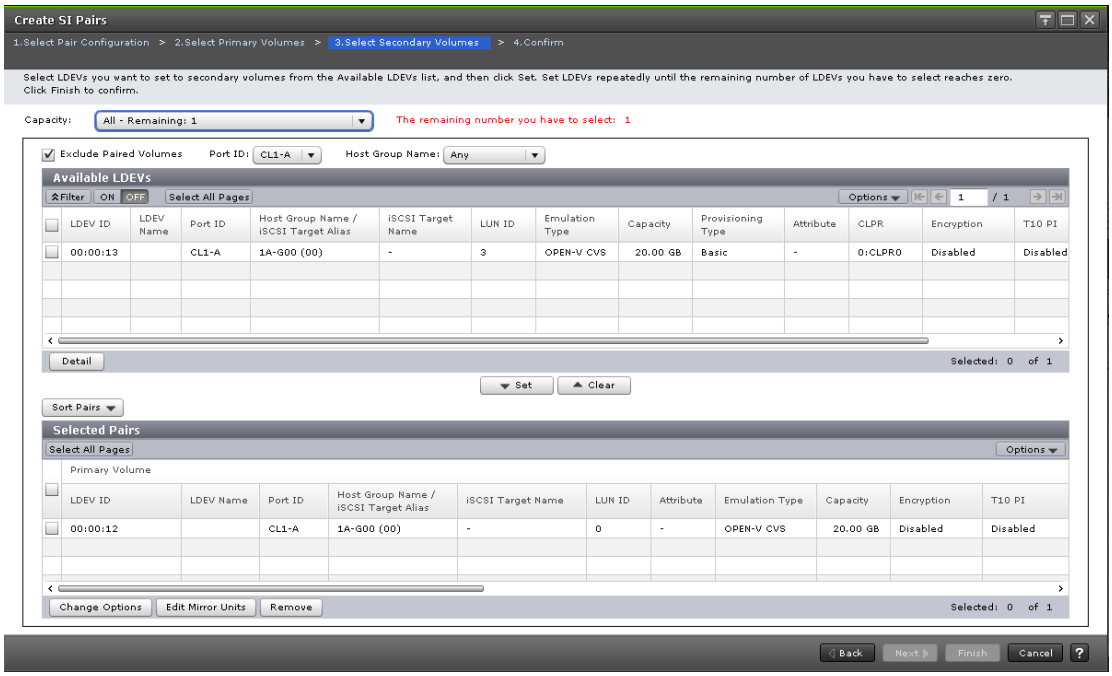


Example: Changing a pair L1 and L2 combination

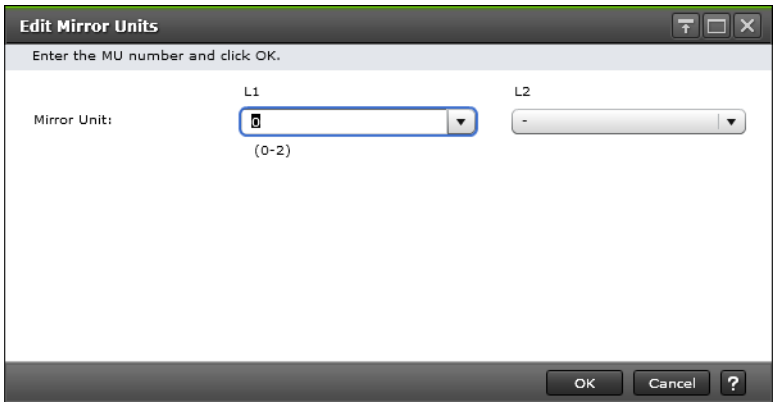
You can change L1 and L2 pair configurations that do not match the specified configuration in the Create SI Pairs wizard. You can also change L1 and L2 pair configurations when you create a new pair using an existing P-VOL with an existing configuration.

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

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



2. 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.



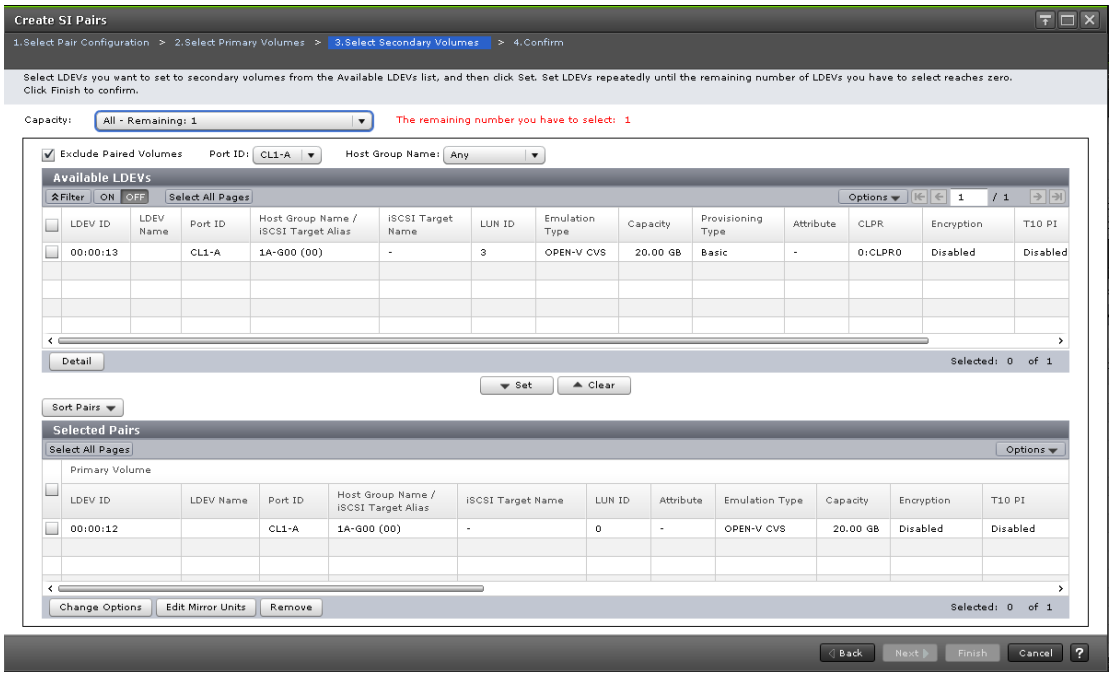
3. In the Edit Mirror Units dialog box, for Mirror Unit, select 0 for L1, and select 2 for L2.

Refining pair topology

You can refine a pair topology by removing unwanted volumes.

Procedure

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

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.

Before you begin

The pair status is PAIR.

Procedure

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

Releasing differential data for ShadowImage pairs

When an SI pair contains a DP-VOL that is larger than 4,194,304 MB (8,589,934,592 blocks), the differential data is managed by the pool to which the pair is related. If differential data management fails due to insufficient pool capacity, you need to release the differential data (pages) managed in

the pool. You also need to release pages when you downgrade to a microcode version that does not support SI pairs with volumes larger than 4,194,304 MB.

Procedure

1. Delete all pairs using the V-VOL that contains 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 ShadowImage pair creation

Suspending pair creation changes the ShadowImage pair status to Suspend/SUSPER. At this time, write I/Os to the P-VOL continue and all tracks of the P-VOL are saved as differential data. When the pair is resynchronized, the pair status changes to Resync/PENDING, and the entire P-VOL is copied to the S-VOL. For a split pair, resynchronization is completed in a short time. But it takes the same period of time for a suspended pair to be resynchronized as the initial copy operation.

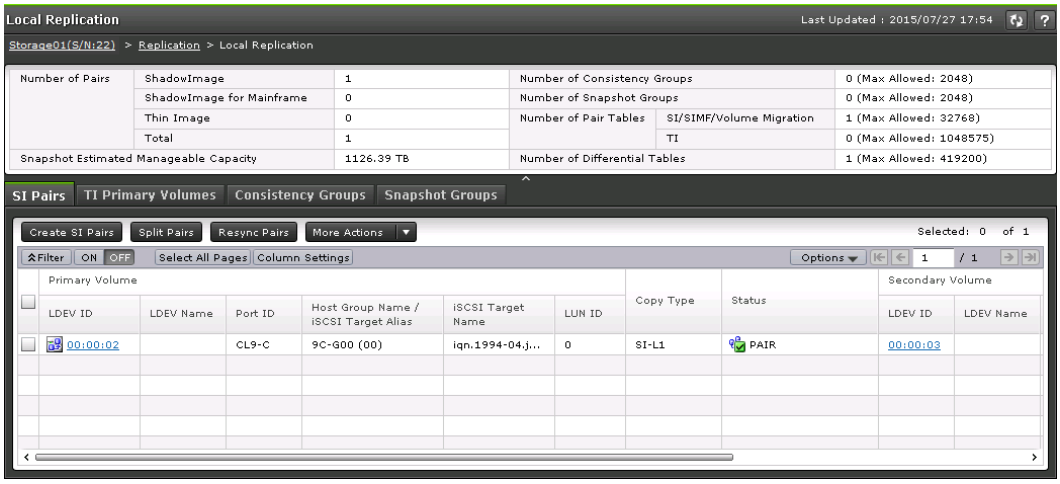
The storage system suspends a pair when:

- it detects an error condition related to an update copy operation
- it cannot keep the pair mirrored

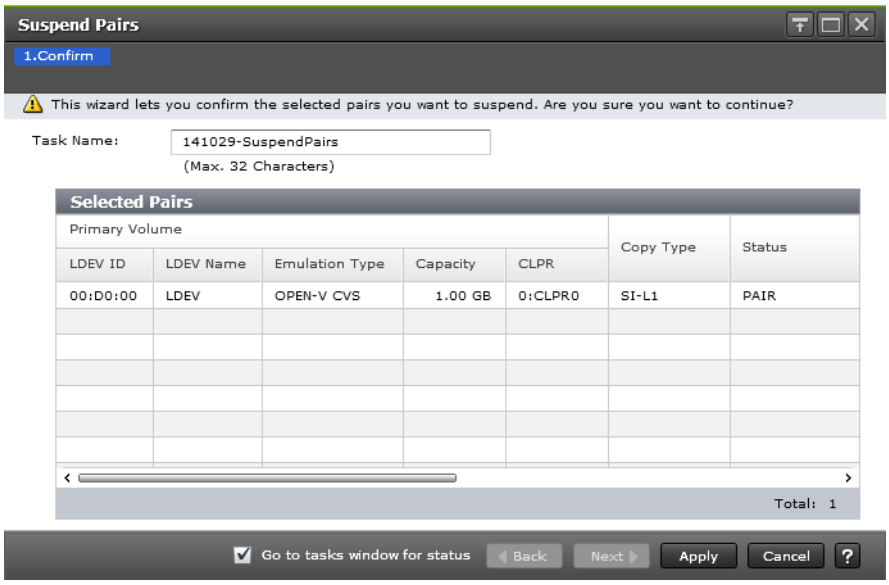
Procedure

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. In the **Local Replication** window, select the **SI Pairs** tab.



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



4. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

   \ / : , ; * ? " < > |
5. If you want to monitor the task after submitting it, select **Go to tasks window for status**.
6. Click **Apply** to submit the task.
   The pair is suspended (PSUE status).

Related concepts

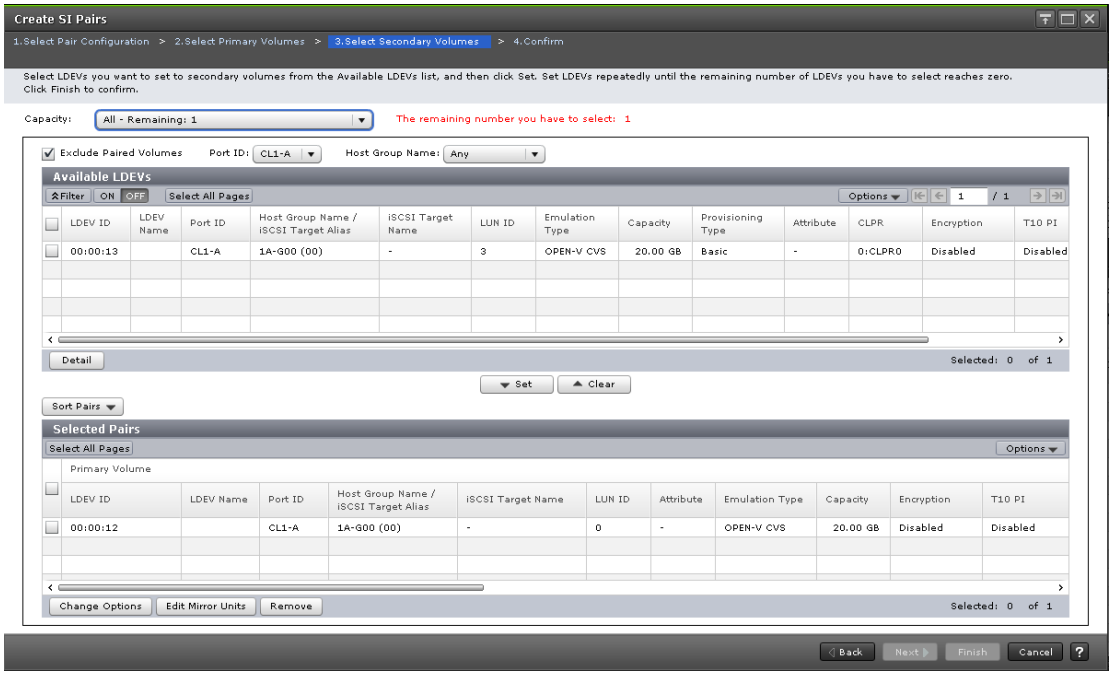
- ShadowImage pair creation on page 57
- Initial copy workflow on page 18
- Update copy workflow on page 19

Changing ShadowImage pair options

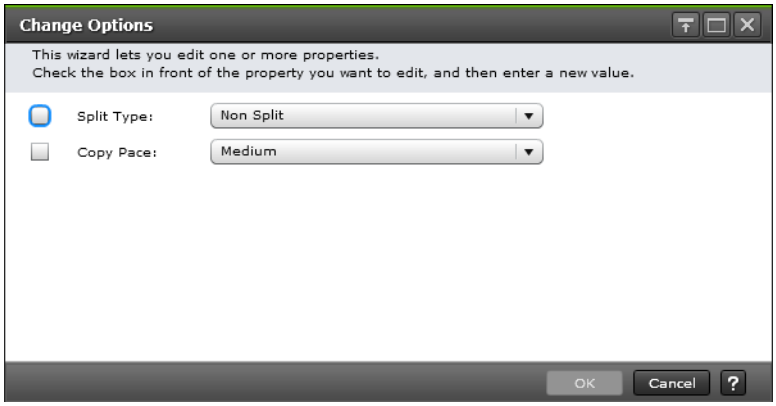
You can change the default setting for the Split Type and Copy Pace system options for all new pairs that you create.

Procedure

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 steps, and then click **OK**:
   - For **Split Type**, select a split type.
     Values:
     - **Non Split** (default): 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.
   - 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** (default): Average processing speed and host server I/O performance.
     - **Faster**: Faster processing speed but slower host server I/O performance.

Related concepts

- Pair splitting methods on page 72
- Initial copy workflow on page 18
- Performance planning for ShadowImage on page 31

ShadowImage pair splitting

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 that the data in the S-VOL at the time of the split is usable. The S-VOL contains a mirror image of the

original volume at that point in time, and 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 volumes on page 79).

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 might 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 concepts

- Pair splitting methods on page 72
- ShadowImage pair resynchronization on page 82

Related tasks

- Splitting ShadowImage pairs on page 73
- Splitting ShadowImage pairs on page 73
- Workflow for splitting pairs in a consistency group on page 78
- Split Pairs window on page 174

Related references

- Sharing volumes with Hitachi Volume Migration on page 43

Pair splitting methods

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

- **Steady Split:** Copies the differential data to the S-VOL, and 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 consistency group (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.
  This method can only be used with CCI.
- **Consistency group pair-split:** Simultaneously split all of the pairs in a CTG. You can use this method with 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 tasks

- Workflow for splitting pairs in a consistency group on page 78

Splitting ShadowImage pairs

Before you begin

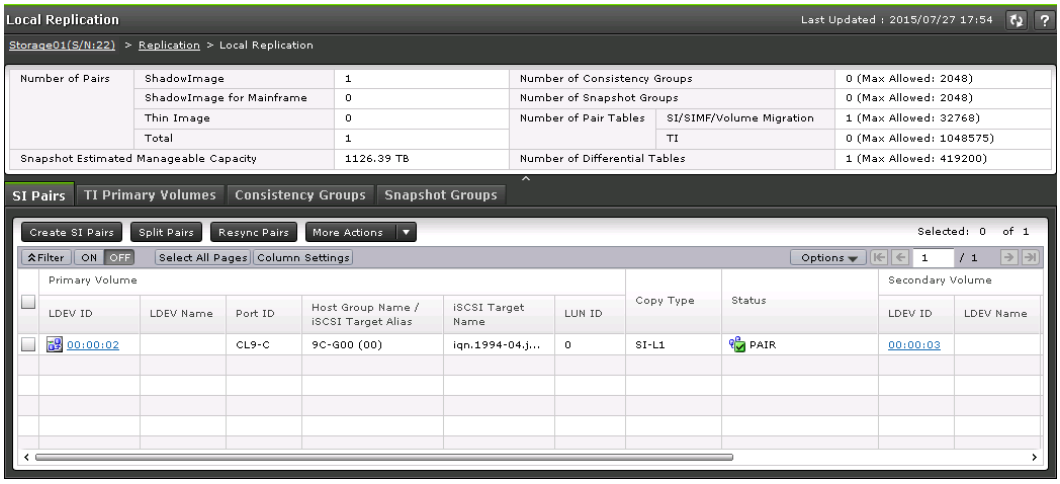
- The pair status must be one of the following:
  - If you are splitting an existing pair, the pair status must be PAIR.
  - If you are creating and then immediately splitting an L1 pair, the volumes are unpaired (SMPL).
  - If you are splitting an L1 pair that has L2 pairs, see L1, L2 pair status and supported pair tasks on page 99.
  - If you are splitting, or creating and immediately splitting, an L2 pair, the status of the L1 pair must be PSUS.
- To split pairs quickly, stop host access to the P-VOL before splitting the pairs.
- Check the I/O load to verify that it will not affect host server performance.
  For more information about checking I/O performance, see the *Hitachi Command Suite User Guide*.

Procedure

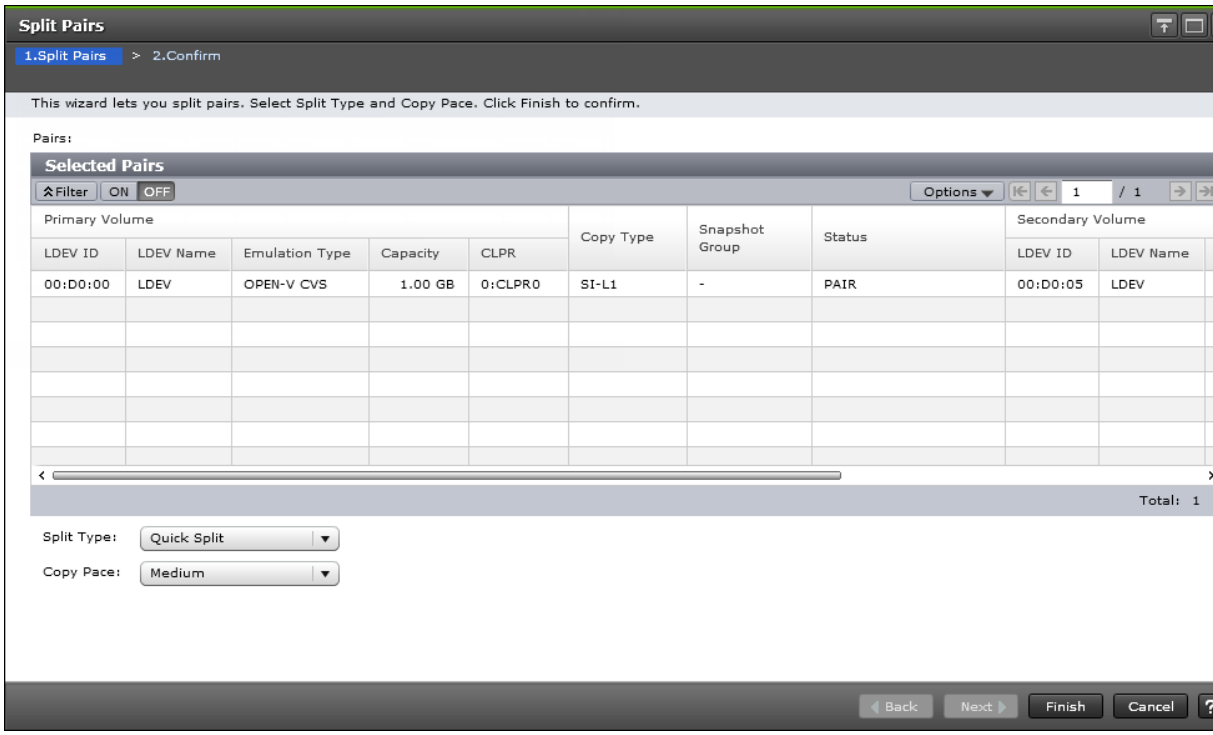
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

   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. In the **Local Replication** window, select the **SI Pairs** tab.



3. On 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 steps:

- For **Split Type**, select the split type.
  Values:
  - **Quick Split** (default): Splits the new pair, and then copies the data so that the S-VOL is immediately available for read and write I/O. The

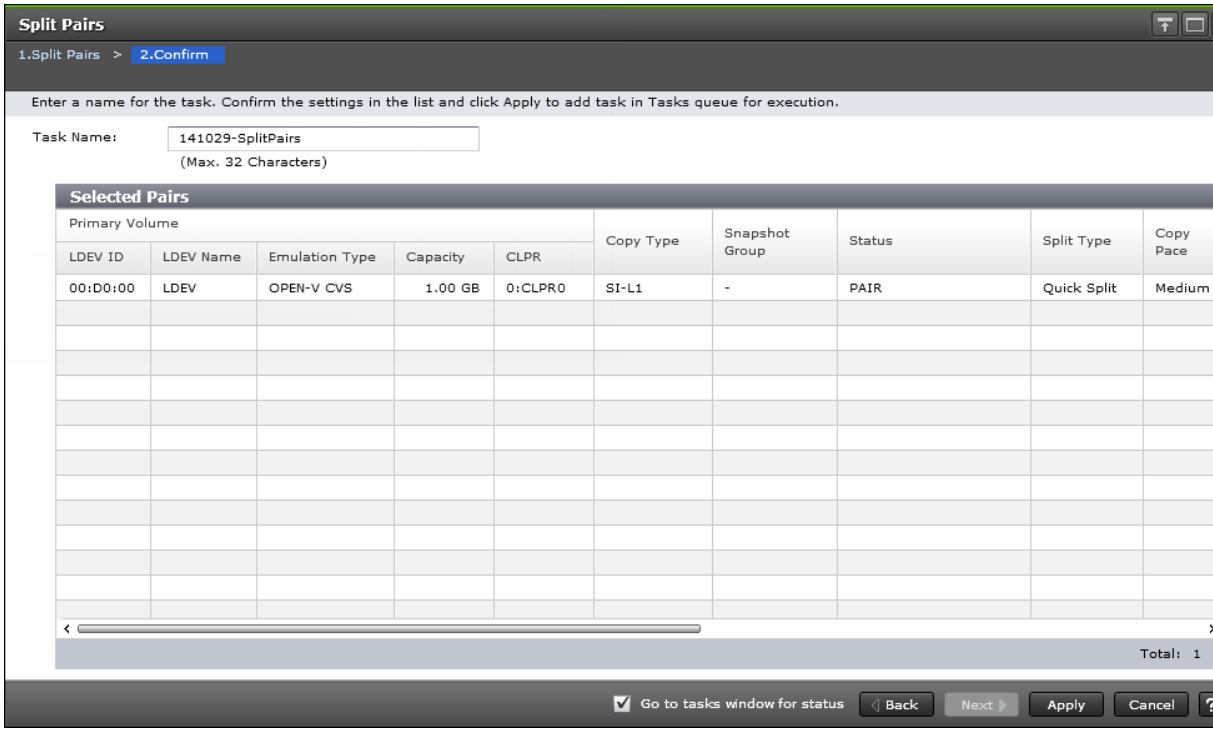
storage system copies the remaining differential data to the S-VOL in the background.
- **Steady Split**: Copies the differential data to the S-VOL, and then splits the new pair.
For more information about the methods you can use to split pairs, see Pair splitting methods on page 72.

- 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** (default): Average processing speed and host server I/O performance.
- **Faster**: Faster processing speed but slower host server I/O performance.

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

For more information about performance, see Performance planning for ShadowImage on page 31.

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



6. Accept the default task name or enter a unique name.
   You can enter up to 32 letters, numbers, and symbols, except the following:

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

Related concepts

- Pair splitting methods on page 72
- How to maximize host server I/O performance on page 32

Related tasks

- Workflow for splitting pairs in a consistency group on page 78

Related references

- Device Manager - Storage Navigator pair status names and descriptions on page 97
- L1, L2 pair status and supported pair tasks on page 99
- Quick Split and Steady Split performance planning on page 31

Using consistency groups to split pairs

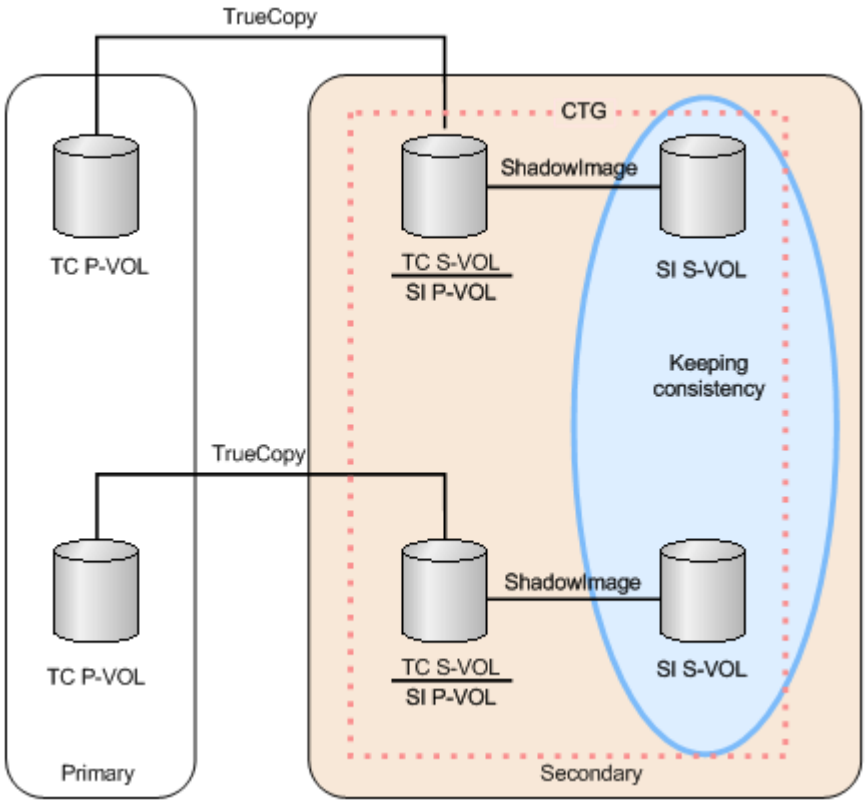
A consistency group (CTG) lets you perform tasks and change pair status on a group of SI pairs. With CTG pair-split, you can simultaneously split all of the pairs in a CTG.

Using consistency group pair-split with shared volumes

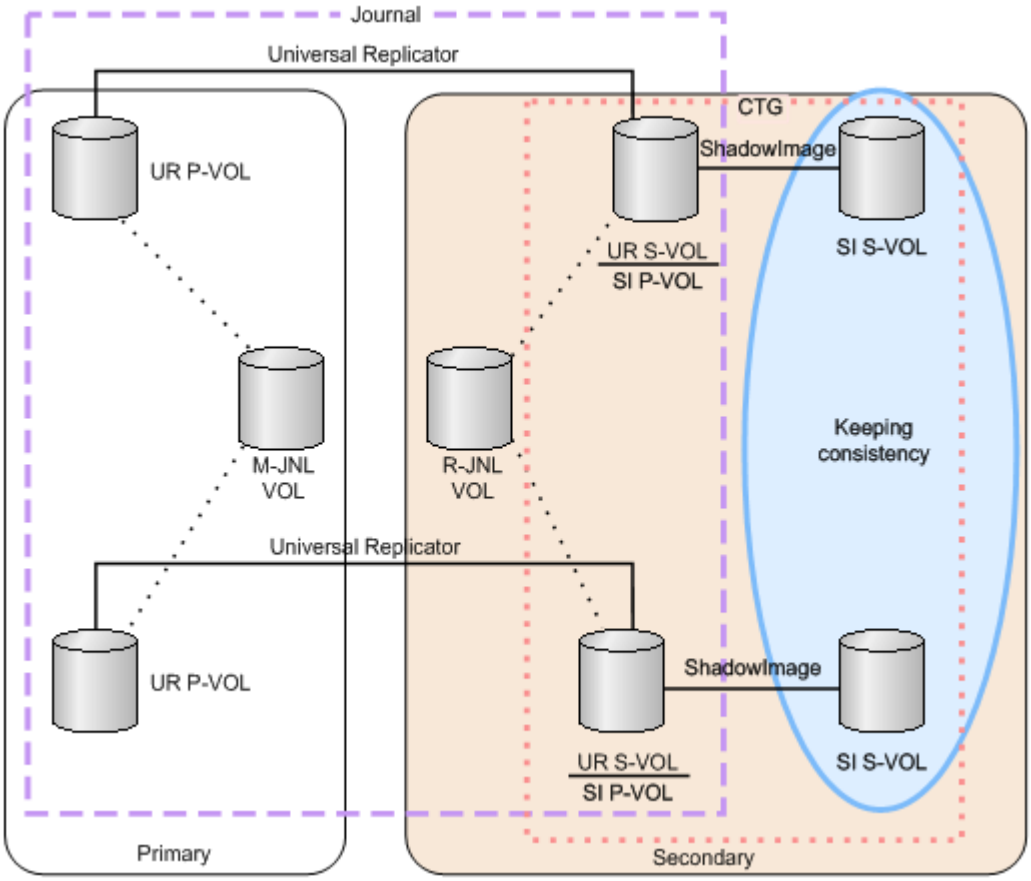
If you share SI P-VOLs in a storage system with TC or UR S-VOLs, you can use consistency group (CTG) pair-split to keep SI S-VOLs consistent.

When an SI P-VOL shares a UR or TC S-VOL to create pairs, you can assign the same CTG ID to the SI pairs in order to use the CTG pair-split function to maintain consistency among the SI S-VOLs.

The following image illustrates CTG pair-split with TC.



The following image illustrates 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.

Workflow for splitting pairs in a consistency group

Procedure

1. Define a CTG to which you want to assign the SI pairs using IBM PPRC or CCI.
2. Verify that all the SI pairs you want to be consistent are assigned to the same SI CTG.
3. If the pair-split operation fails, troubleshoot CTG pair-split failures (see Consistency group pair-split failures on page 114).
4. Create the pairs.

Related concepts

- Pair splitting methods on page 72

Related references

- Restrictions for consistency group pair-split on page 80
- Requirements, restrictions, and guidelines for using consistency group pair-split with shared volumes on page 79

Requirements, restrictions, and guidelines for using consistency group pair-split with shared 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 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 for each 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 72.

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 Maintaining consistent ShadowImage secondary volume backups on page 82.
- 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.

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 IBM PPRC or CCI. You cannot use CTG pair-split if the pairs were created using the HDvM - SN.

Related references

- Requirements, restrictions, and guidelines for using consistency group pair-split with shared volumes on page 79

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 describes 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

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
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 might 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

  The 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 might 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.

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*.

Procedure

1. Assign UR pairs to the same journal group.
   For more information about assigning SI pairs to journals, see the *Hitachi Universal Replicator User Guide*.
2. Register the journal group data volumes in an SI CTG that is not already being used.

Related references

- Requirements, restrictions, and guidelines for using consistency group pair-split with shared volumes on page 79

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 task.

Procedure

Complete one of the following actions 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 Workflow for splitting pairs in a consistency group on page 78.
- If you are using CCI to run commands, run the following command on the SI pair:
  `pairsplit`

ShadowImage pair resynchronization

You can resynchronize split (PSUS status) or suspend (PSUE status) pairs. Resynchronization changes the status of the split volume pairs to 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 and takes the same amount of time as the initial copy operation.

Note: Resynchronizing a pair does not ensure data consistency. Data in the two volumes is consistent only if the following conditions exist:

- The P-VOL is offline.
- The pair is split (the S-VOL status is PSUS).
  For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.

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 concepts

- Workflow for resynchronizing ShadowImage pairs on page 85
- Volume pairs on page 16
- Initial and update copy operations on page 17

Related tasks

- Resynchronizing or restoring ShadowImage pairs on page 86
- Types of pair resynchronization on page 83

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 references

- Forward resynchronization on page 83
- Reverse resynchronization on page 84

Forward resynchronization

You can use one of the following methods to forward resynchronize pairs:

- 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 does not ensure data consistency, even if there is no host I/O during the resynchronization.

Related concepts

- ShadowImage pair splitting on page 71

Reverse resynchronization

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

- 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.
  - A P-VOL shared 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-VOLs 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 nonencrypted volume.

Caution: To prevent the two volumes from being swapped, the P-VOL and S-VOLs must be assigned to the same cache logical 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 36.

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 *Provisioning Guide* for your storage system.
- A pair in which one volume is a DP-VOL, though not both.
- The capacity saving of either P-VOL or S-VOL is enabled.
- An SI S-VOL you are sharing with an HTI volume.

Workflow for resynchronizing ShadowImage pairs

Complete the following steps 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, see the *Hitachi Command Suite User Guide*.
4. Resynchronize the pair (see Resynchronizing or restoring ShadowImage pairs on page 86).

Related concepts

- Pair splitting methods on page 72

Related references

- Forward resynchronization on page 83

Workflow for restoring ShadowImage pairs

Complete the following steps 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 or suspending pairs, see Splitting ShadowImage pairs on page 73 or Suspending ShadowImage pair creation on page 68, respectively.

3. Restore the pair (see Resynchronizing or restoring ShadowImage pairs on page 86).

Related concepts

- Pair splitting methods on page 72

Related references

- Reverse resynchronization on page 84
- Sharing volumes with Universal Replicator on page 43
- Sharing volumes with TrueCopy on page 42

Resynchronizing or restoring ShadowImage pairs

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

Resynchronizing split pairs 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.

Before you begin

- 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.

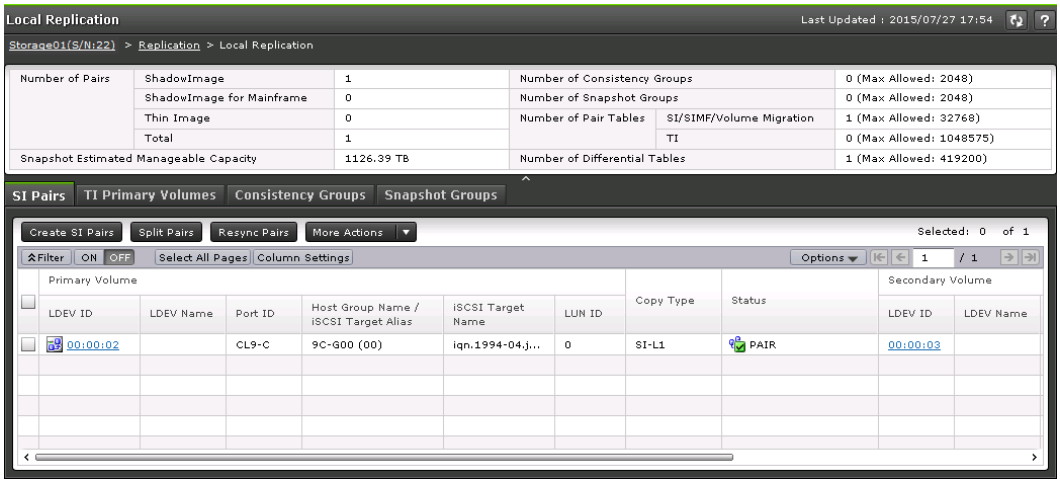
If you are using CCI to run commands, run the following command to resynchronize split pairs (PSUS status):

```
pairresync
```

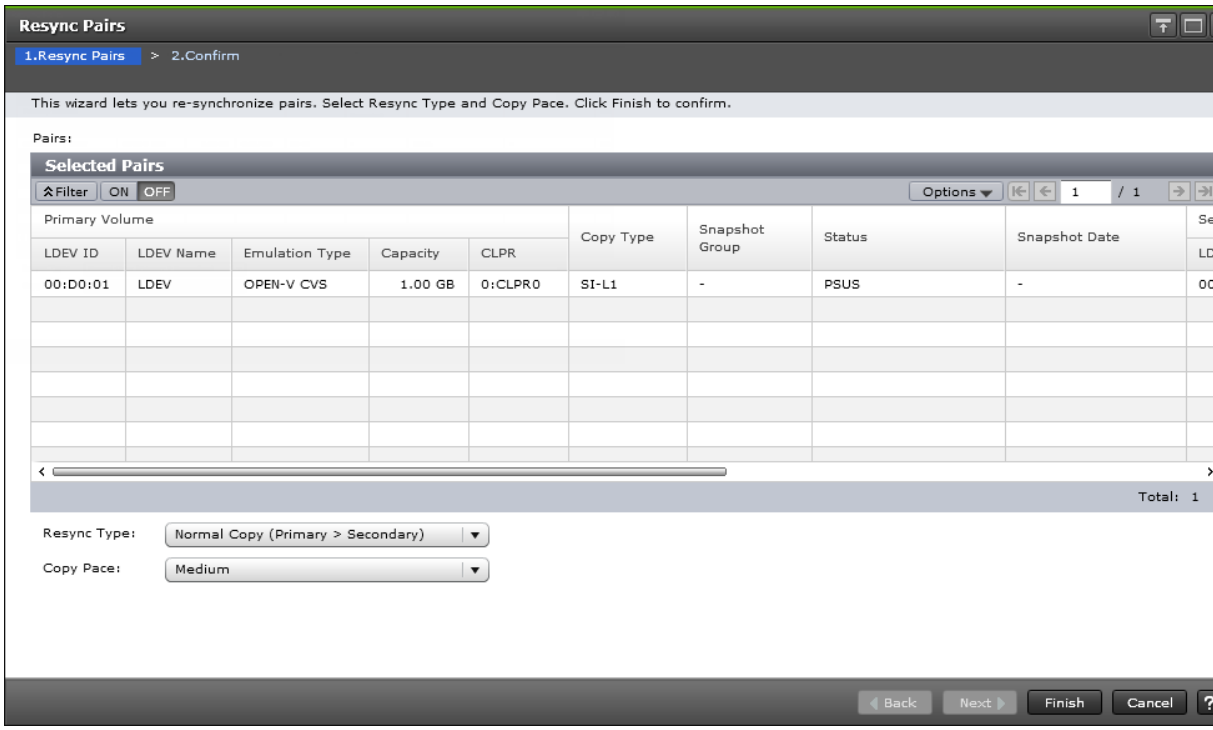
Procedure

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. In the **Local Replication** window, select the **SI Pairs** tab.



3. On the **SI Pairs** tab, 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 steps:

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

  Values:

  - **Normal Copy (Primary > Secondary)** (default): 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.

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 83.

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

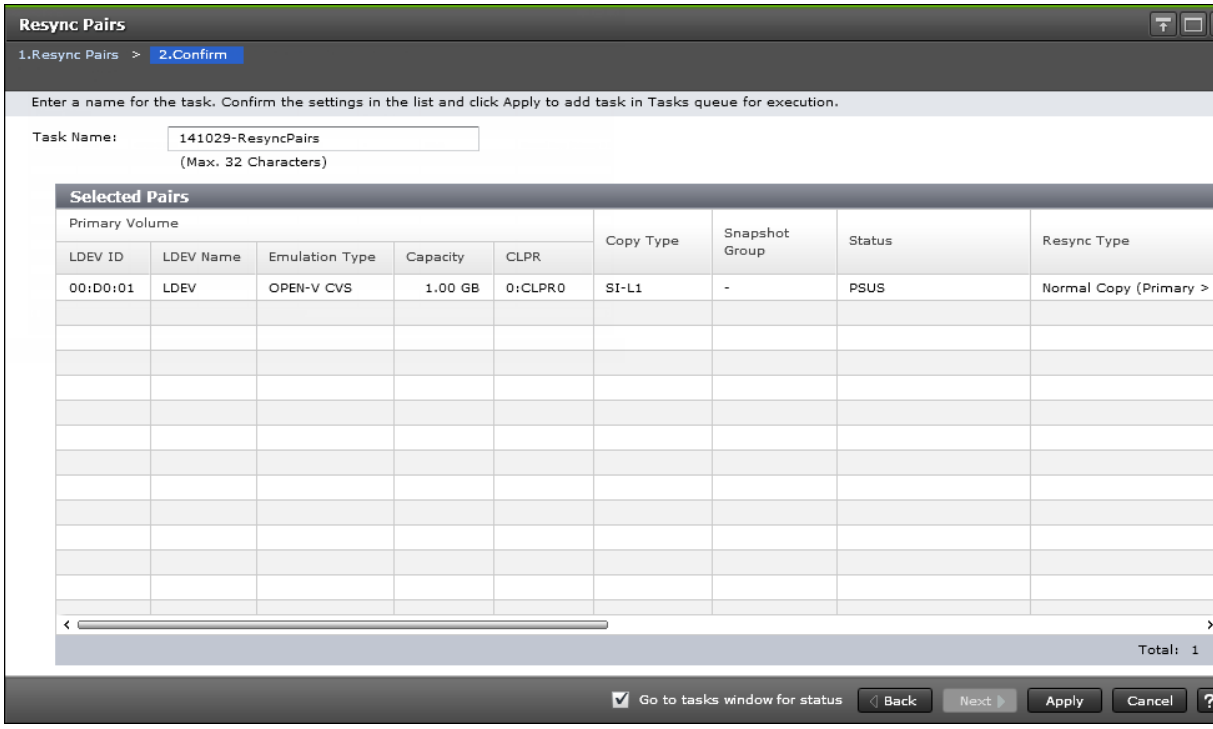
  Values:

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

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

  For more information about performance, see Performance planning for ShadowImage on page 31.

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



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

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

   \ / : , ; * ? " < > |

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

   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 Device Manager - Storage Navigator pair status names and descriptions on page 97.

- Types of pair resynchronization on page 83
- Resync Pairs wizard on page 179

Related references

- L1, L2 pair status and supported pair tasks on page 99

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.

The pair status is PAIR.

Procedure

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

Setting the RAID level

Complete the following steps 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.

Procedure

1. Split the pair.
2. Restore the pair using Quick Restore.

Related tasks

- Splitting ShadowImage pairs on page 73
- Resynchronizing or restoring ShadowImage pairs on page 86

ShadowImage 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 concepts

- MP blade or unit and pair deletion on page 92

Related tasks

- Deleting ShadowImage pairs on page 91
- Monitoring ShadowImage pair activity and status on page 95

Related references

- Prerequisites for deleting ShadowImage pairs on page 90

Prerequisites for deleting ShadowImage 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 ShadowImage pairs

Complete the following steps 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 Business Continuity Manager (BCM), IBM PPRC, HDvM - SN, or CCI.
4. Split the SI pair.
5. Delete the SI pair.

Related tasks

- Splitting ShadowImage pairs on page 73
- Deleting ShadowImage pairs on page 91

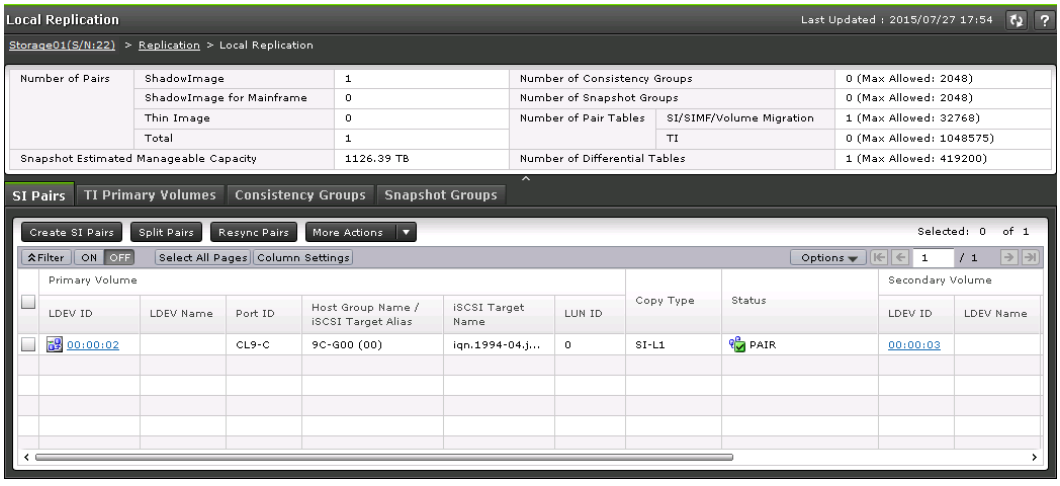
Deleting ShadowImage pairs

Procedure

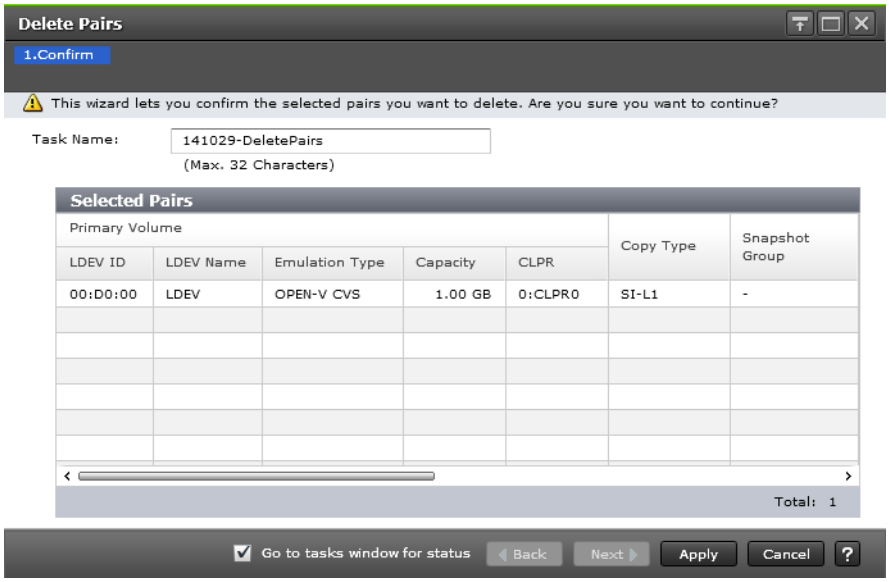
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

   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. In the **Local Replication** window, select the **SI Pairs** tab.



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



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

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

   \ / : , ; * ? " < > |

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

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 task, such as creating pairs, or event waiting.

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

Related references

- Prerequisites for deleting ShadowImage pairs on page 90
- Delete Pairs window on page 187

MP blade or unit and pair deletion

Creating a pair allocates the MP blade or 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.

6

Monitoring and maintaining ShadowImage

This chapter provides information related to monitoring and maintaining the SI system.

- Monitoring the ShadowImage system
- Maintaining the ShadowImage 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 94.
- Monitoring ShadowImage pair activity and status on page 95. This includes the status definitions, the pair tasks that you can complete based on the status, and the tasks that you can complete for L1 and L2 pairs.
- Monitoring ShadowImage pair and volume details on page 101.
- Monitoring ShadowImage pair synchronization rates on page 103.
- Monitoring consistency groups on page 105.
- Monitoring pair task history on page 108.

Viewing pair information for local replication

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.

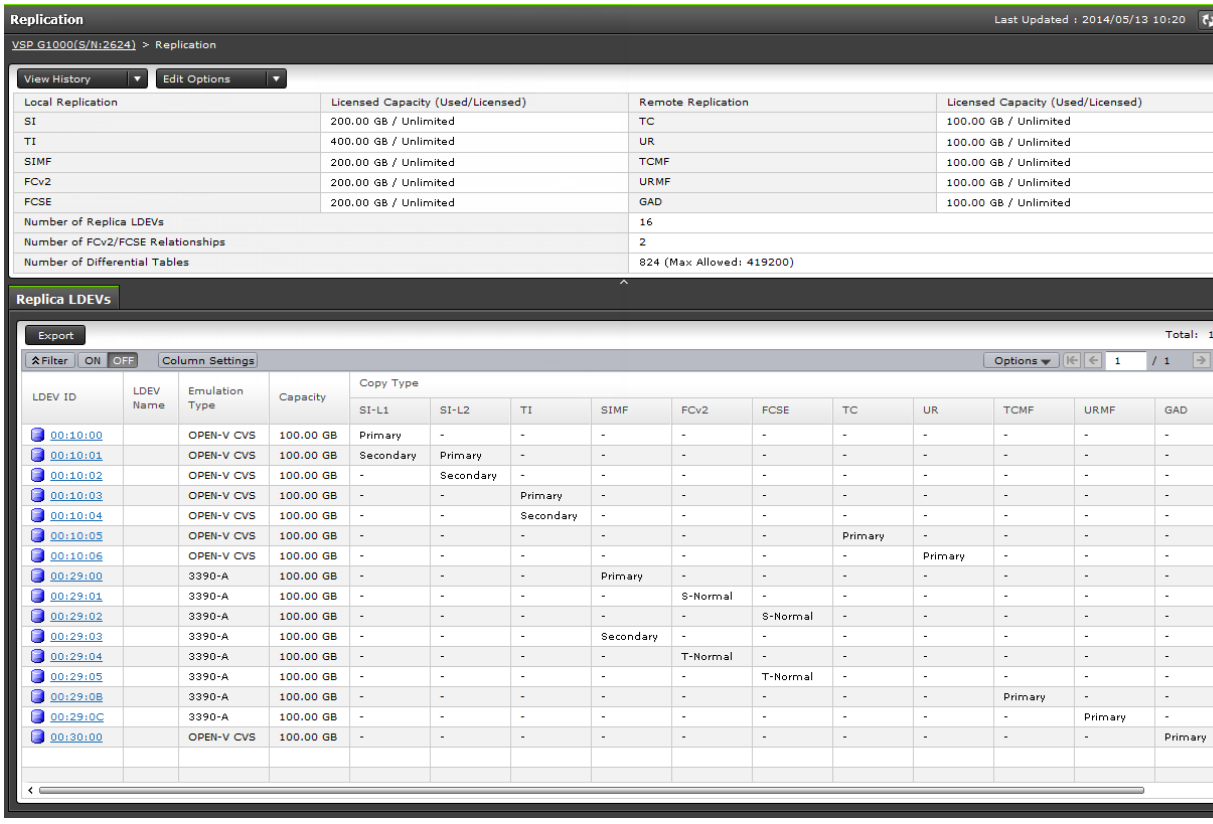
Note: If the information in the summary section is not up to date, the system has not completed processing the information. Click the refresh icon to refresh the information in the window.

Procedure

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. The **Replica LDEVs** tab in the **Replication** window shows a list of LDEVs. From this window, you can perform the following tasks:
   - 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.

Monitoring ShadowImage pair activity and status

You can monitor the status of SI pairs using Business Continuity Manager (BCM), IBM 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. To manually refresh the HDvM - SN information, click the refresh icon.

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

Procedure

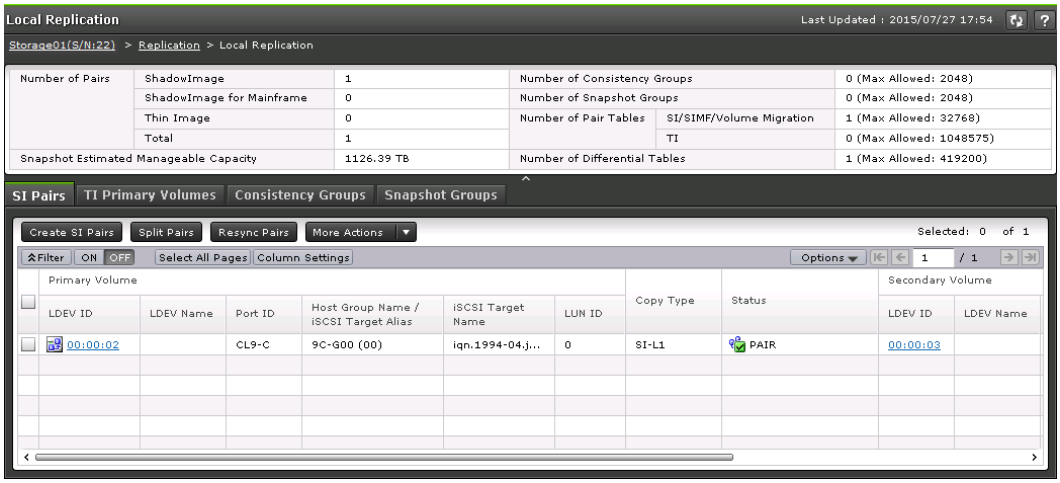
1. In Hitachi Command Suite:

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. In the **Local Replication** window, select the **SI Pairs** tab.



3. In the summary section of the **Local Replication** page, view license information.

   If the information in the window is not up to date, click the refresh icon to refresh the information in the window.

4. On the **SI Pairs** tab, locate the pair whose status you want to review, and then check the **Status** column.

   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 displayed. For more information about the items on this tab, see Monitoring ShadowImage pair and volume details on page 101.

5. (Optional) Click **More Actions > View Pair Properties** to view more details for a selected pair.

Related tasks

- Monitoring ShadowImage pair and volume details on page 101

Related references

- Device Manager - Storage Navigator pair status names and descriptions on page 97
- Pair status and available pair tasks on page 98
- Command Control Interface pair status names on page 98
- L1, L2 pair status and supported pair tasks on page 99

- Unaffected S-VOL status and pair tasks on page 101
- Local Replication window on page 135

Device Manager - Storage Navigator pair status names and descriptions

The following table lists 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 17.	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 the 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 72.	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 72.	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.[1] 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

Notes:

1. The starting time of the copy depends on the numbers of pairs and the storage system environment.
2. The pair status is displayed in the format of *screen pair status*/*CCI pair status*.
3. CCI display is as follows:
   - 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 references

- Command Control Interface pair status names on page 98

Command Control Interface pair status names

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

The following table lists the HDvM - SN pair status names and the corresponding pair status name in CCI. SMPL status will not be displayed on the Local Replication window SI Pairs tab because volumes in SMPL state are not listed.

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 references

- Device Manager - Storage Navigator pair status names and descriptions on page 97

Pair status and available pair tasks

The status of a pair determines the actions you can perform.

The following table lists the pair tasks that you can perform for each status.

Pair status	Pair 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 references

- L1, L2 pair status and supported pair tasks on page 99
- Unaffected S-VOL status and pair tasks on page 101

L1, L2 pair status and supported pair tasks

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

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

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

L2 pair status	L1 pair 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
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 lists the L2 pair tasks that you can perform based on the related L1 status.

L1 pair status	L2 pair 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 ShadowImage pairs on page 86.
2. For more information about the prerequisites for splitting L2 pairs, see Splitting ShadowImage pairs on page 73.

The following table lists 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 lists 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 tasks

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

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

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

Monitoring ShadowImage pair and volume details

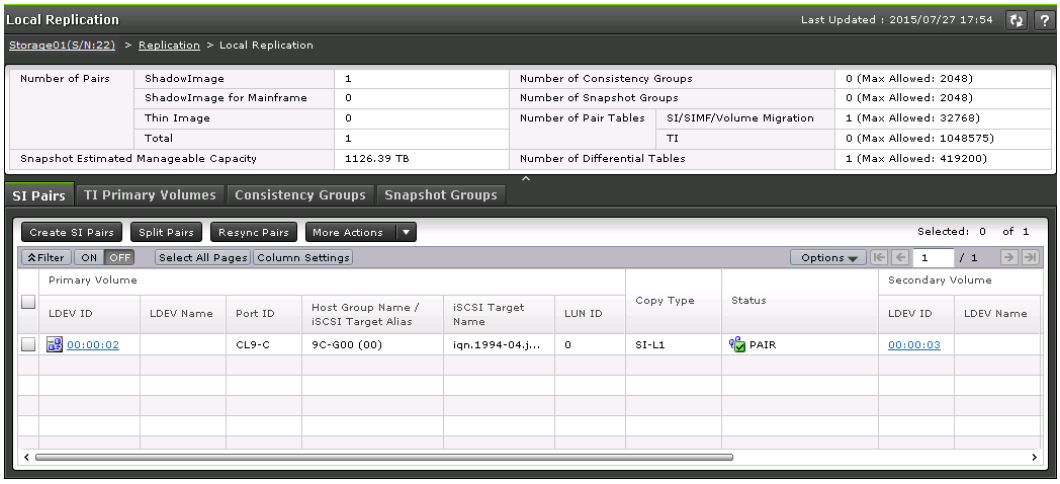
You can review the data related to L1 and L2 pairs and their volumes, including volume capacity, pair status, P-VOL and S-VOL, and identifiers.

Procedure

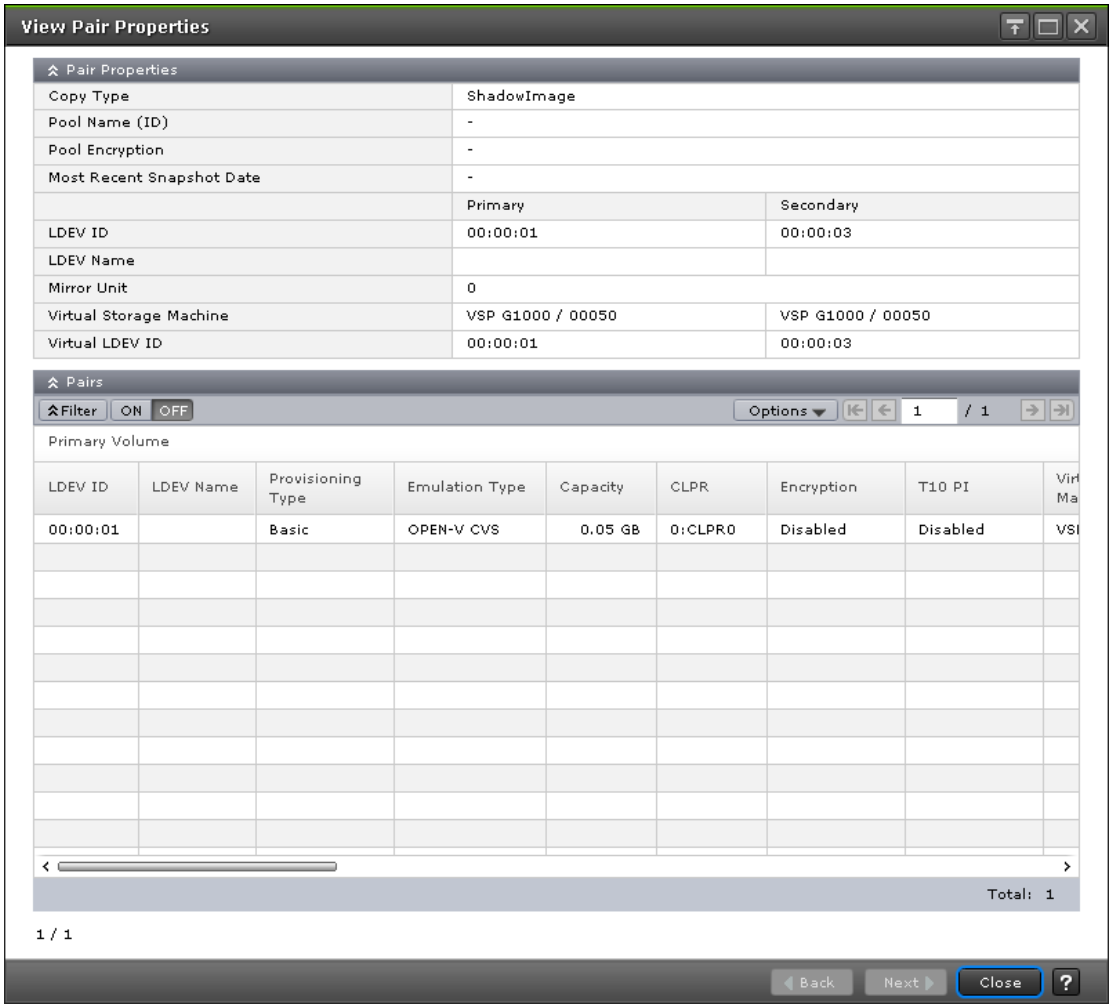
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

   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. In the **Local Replication** window, 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 tasks

- Monitoring ShadowImage pair activity and status on page 95

Related references

- View Pair Properties window on page 145
- Local Replication window on page 135

Monitoring ShadowImage pair synchronization rates

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

Procedure

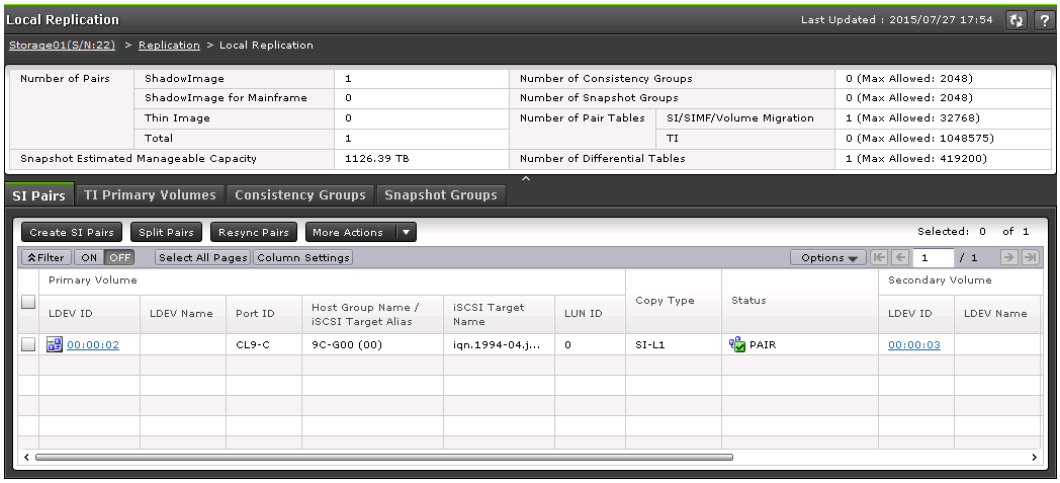
1. In Hitachi Command Suite:

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

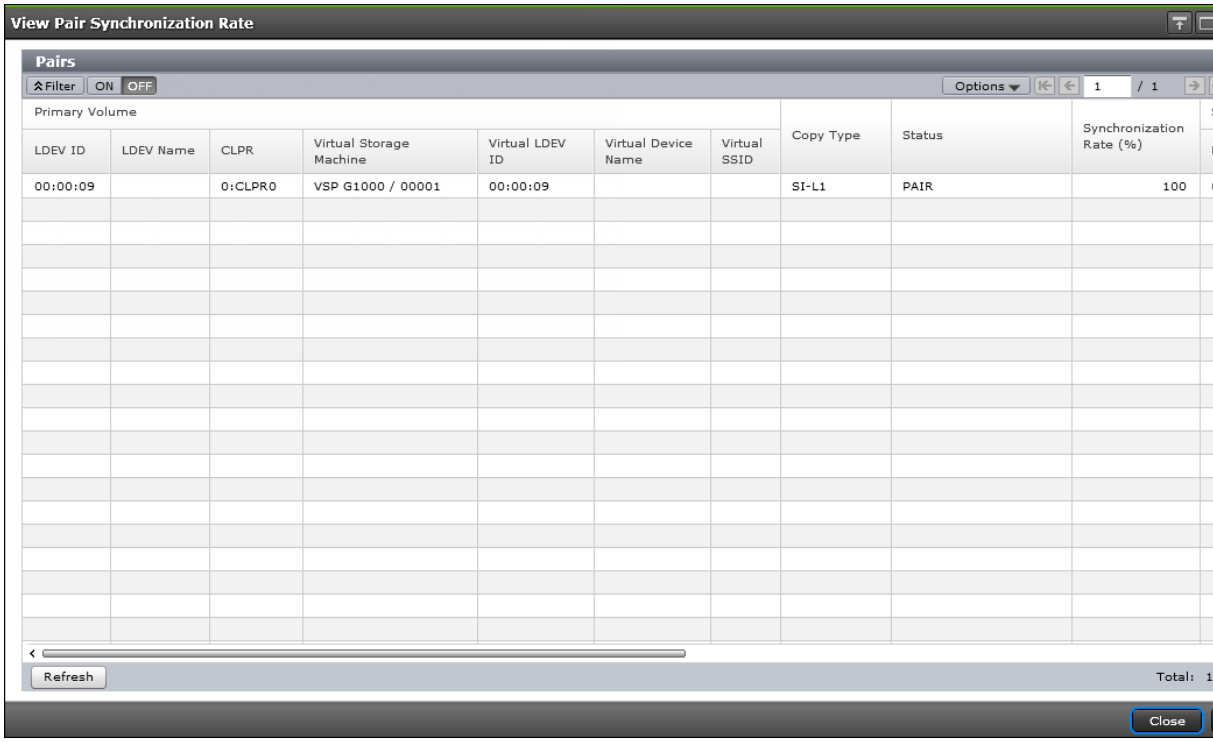
In Device Manager - Storage Navigator:

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

2. In the **Local Replication** window, select the **SI Pairs** tab.



3. On 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** to show the latest synchronization rate.

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

Related references

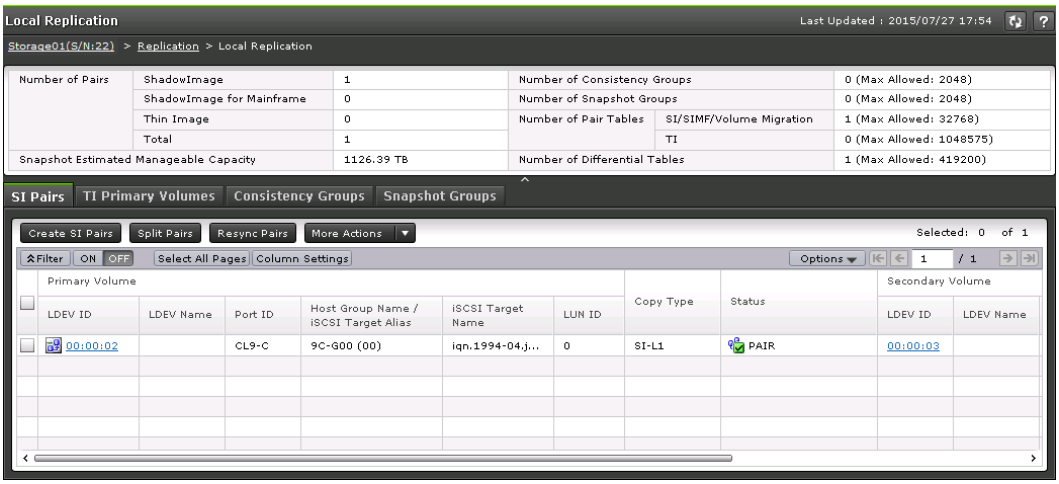
- View Pair Synchronization Rate window on page 150

Monitoring consistency groups

You can view the number of consistency groups (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 (see Monitoring ShadowImage pair activity and status on page 95).
  - Monitor pair synchronization rates (see Monitoring ShadowImage pair synchronization rates on page 103).
- 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 107).
- The Consistency Groups tab. Use this tab to:
  - View a list of CTGs.
  - View CTG properties (see Viewing consistency group properties on page 106).

The following figure shows the Local Replication window displaying the summary section and the SI Pairs tab.



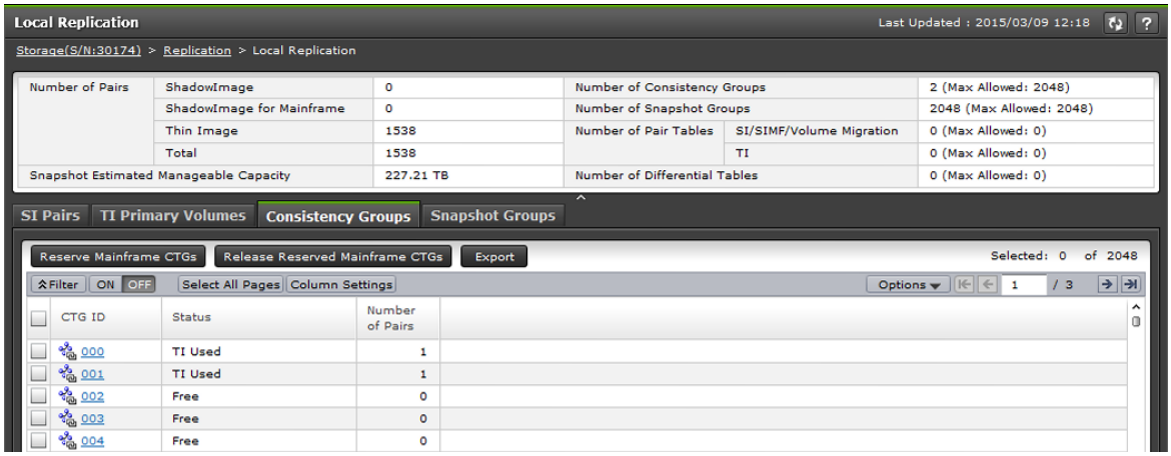
Viewing consistency group properties

Procedure

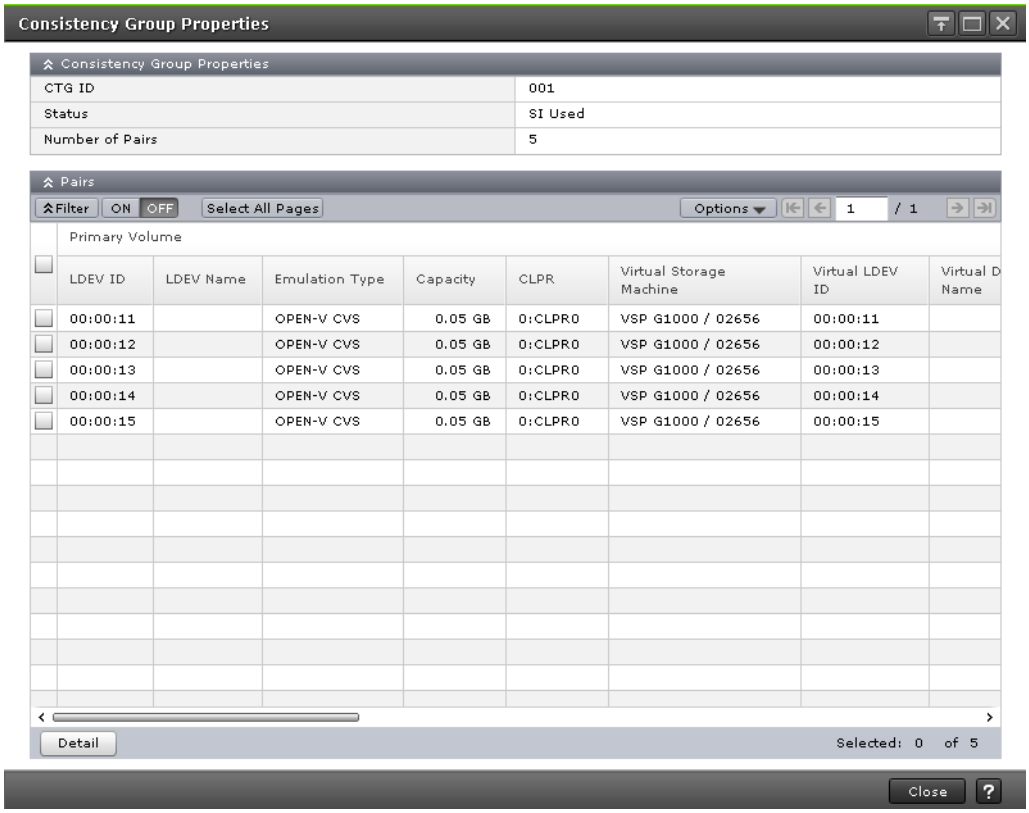
1. In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, expand the storage system tree, right-click the target storage system, and then select **Local Replication**.

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



3. On the **Consistency Groups** tab, 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

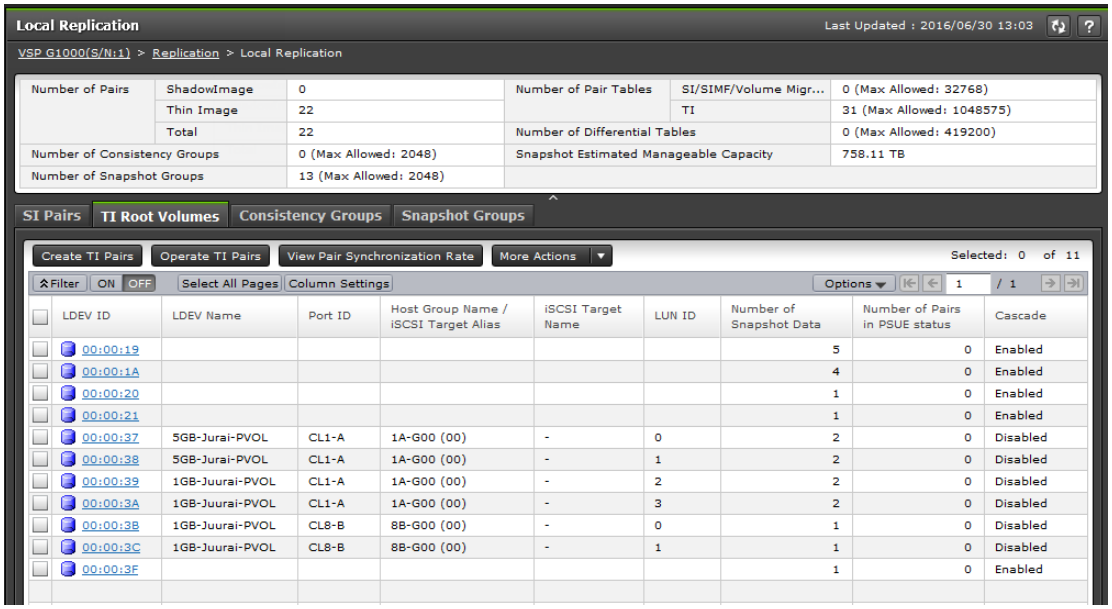
You can view a list of HTI pairs on the TI Primary Volumes tab in the Local Replication window.

Procedure

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



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

Related references

- Local Replication window on page 135

Monitoring pair task history

You can review a history of the tasks you have completed on a pair from the History window. This window shows up to 16,384 (VSP G1000, G1500, and VSP F1500) or 8,192 (VSP Gx00 models and VSP Fx00 models) pair tasks. The storage system stores a history of up to 1,024,000 of the last tasks.

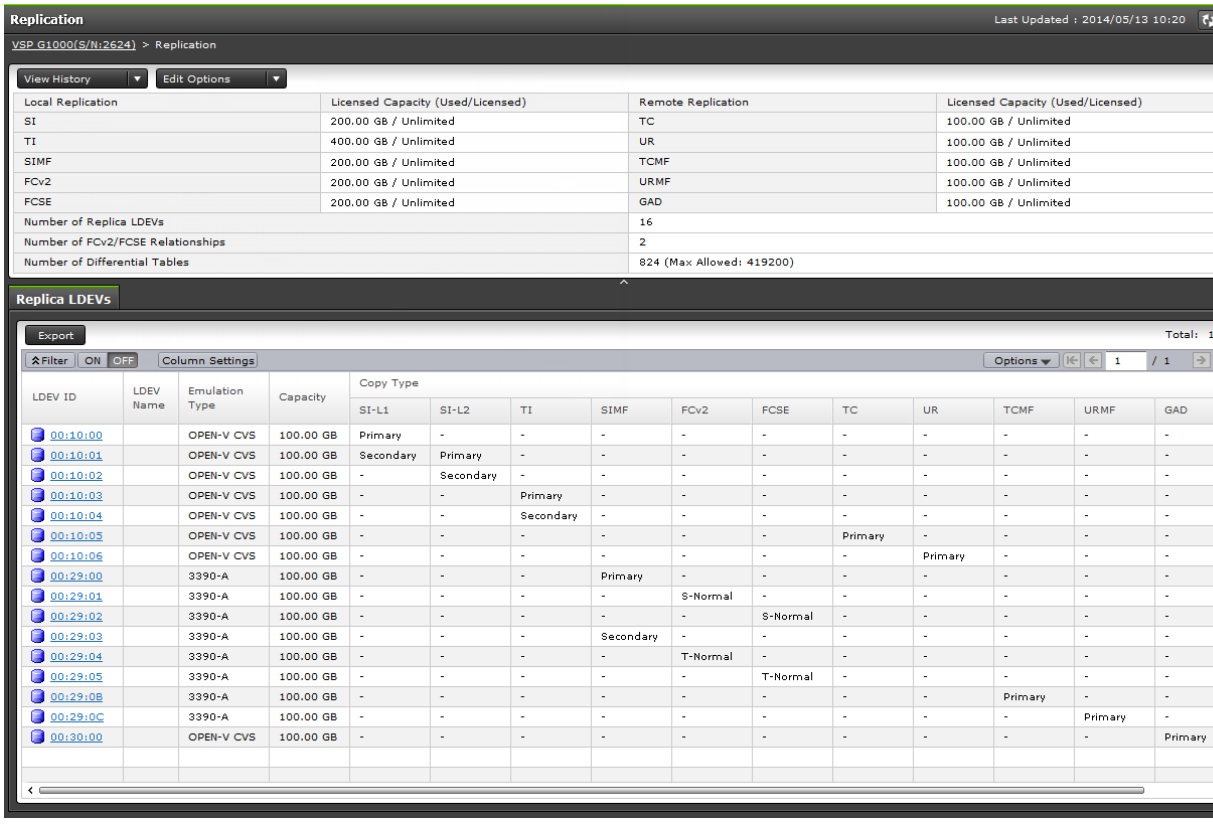
Before you begin

If you use 1,000 or more pairs concurrently, some operation history might not be recorded.

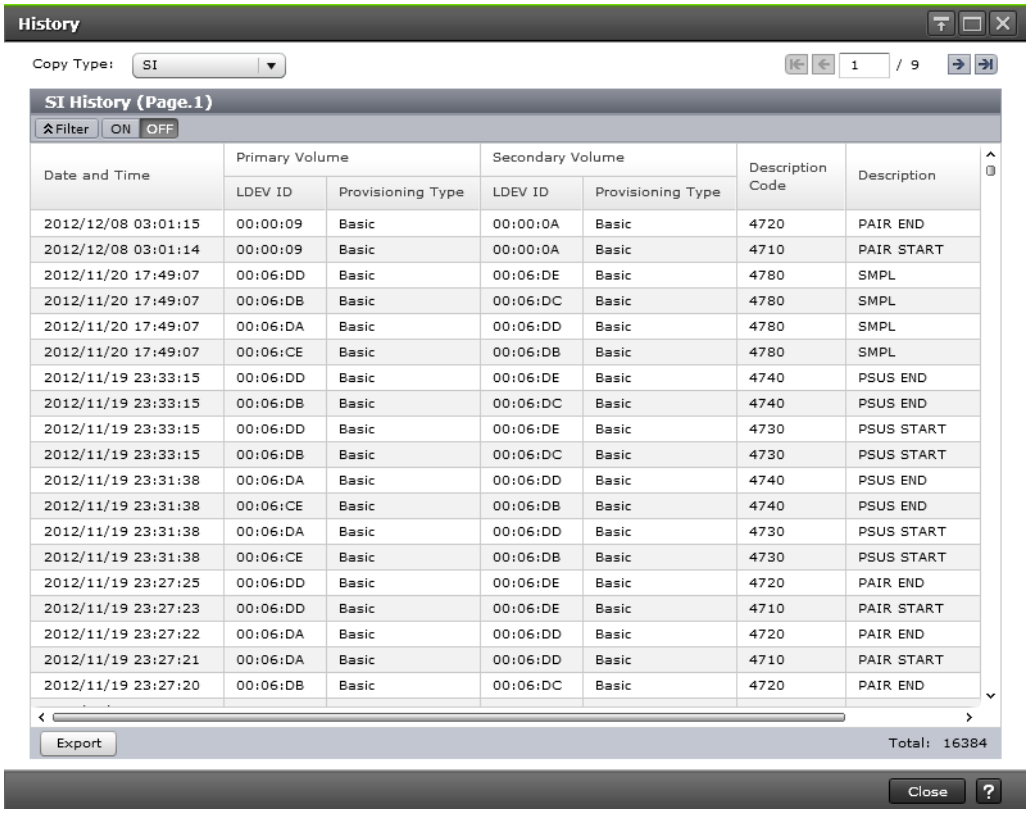
Procedure

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**, then click **Local Replication**.



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

Result

The Description column in the History table displays the pair tasks that you have completed.

The following table describes 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 **`pair resync`** CCI command has started.
4760	COPY(RS)/COPY END COPY(RS-R)/RCPY END	The **`pair resync`** 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.

Code	Description	Explanation
47D0	COPY ABNORMAL END	Copy processing has ended abnormally for reasons other than the ones stated previously 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 references

- History window on page 153

Maintaining the ShadowImage 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.

Perform the following steps to maintain the system:

1. Keep the system in tune with your changing requirements.
2. If you discover behavior while monitoring the system, maintain the system.

System and device maintenance

The following maintenance activities do not affect SI replication pairs:

- Cache maintenance can reduce overall performance and should be scheduled during times of low system activity.
- 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 use 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 concepts

- Performance planning for ShadowImage on page 31

Guidelines for maximizing host server I/O performance (VSP Gx00 models and VSP Fx00 models)

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* or the *System Administrator 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 Setting HOST I/O Performance options (VSP Gx00 models and VSP Fx00 models) on page 49.
  - About selecting a copy pace while creating SI pairs, see Creating ShadowImage pairs on page 58.
  - About selecting a copy pace while splitting SI pairs, see Splitting ShadowImage pairs on page 73.
  - About selecting a copy pace while resynchronizing SI pairs, see Resynchronizing or restoring ShadowImage pairs on page 86.

7

Troubleshooting ShadowImage

This topic provides SI troubleshooting information.

- ShadowImage pair issues and corrective actions
- Consistency group pair-split failures
- Pinned track recovery
- Extended copy time causes and corrective actions
- Interpreting error codes using Command Control Interface
- Contacting customer support

ShadowImage pair issues and corrective actions

The following table lists issues and suggested corrective actions for troubleshooting SI pairs.

Issue	Corrective action
HDvM - SN hangs, or SI pair tasks are not properly performed.	• Make sure all SI requirements and restrictions are met. • Make sure the storage system is powered on and fully functional. • Make sure the input values and parameters on the SI windows are correct (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.	In HDvM - SN, check if there is an error message for the failed task. **Note:** You can use HDvM - SN to set up email notifications of errors that occur during pair 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 might 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, contact customer support.

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 with another SI pair. If you are using CCI to run commands under these conditions, do not run the **`paircreate`** command with CTG pair-split.

  In this case, perform the following steps:

  1. In the Local Replication window, select the Consistency Groups tab.
  2. In the Status column, locate a CTG ID that is not being used by any pairs.
  3. Use CCI to explicitly specify the CTG ID you found.
  4. You can now create a pair for CTG pair-split by running the **`paircreate`** command on the host server.
- If you are using a UR S-VOL as an SI P-VOL and you are using 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 **pairsplit** command.

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 content. 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 ShadowImage pair activity and status on page 95.
- 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 tasks on page 99.
- 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, and then complete the following steps:

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

Pinned track recovery

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.

Extended copy time causes and corrective actions

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

Cause	Corrective action
A processor with an MP usage rate that exceeds 80% exists within the MP blade or unit to which the P-VOL and S-VOL are allocated.	Examine the configuration.

Cause	Corrective action
	For information about checking the MP usage rate, see the *Performance Guide* of your storage system.
The HOST I/O Performance option is enabled.	Disable the option (see System options on page 50).
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.	Review the error and make the necessary correction.
The S-VOL's HDD or external storage has an error.	Review the error and make the necessary correction.

Interpreting error codes using Command Control Interface

You can use the CCI operation logs to troubleshoot tasks that you have performed. The following procedure describes CCI error codes and how to locate and interpret them.

1. Open one of the following:
   - The CCI window.
   - The CCI operation log file.
2. In the log that is displayed, locate the log entry or error code you are investigating. 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 (,).
   - CCI window sample log entry:
     ```
     It was rejected due to SKEY=0x05,
     ASC=0x20,SSB=0xB9E1,0xB901 on Serial#(64015)
     ```
     SSB1 code: `B9E1`
     SSB2 code: `B901`
   - CCI operation log file sample error code:
     ```
     11:06:03-37897-10413- SSB = 0xb9a0,2089
     ```
     SSB1 code: `b9a0`
     SSB2 code: `2089`
3. Locate the description of the SSB2 error code in the following table. Unless otherwise indicated, these codes apply to SSB1 codes 2e31, b9a0, b9a1, b9a2, b9a5, b9a6, b9ae, and b9af.

For more information about the errors that are not described in the table, contact customer support (see Contacting customer support on page 125).

SSB2 code	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 other than PAIR/PSUS/PSUE. 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 P-VOL is different from the cache mode of the external S-VOL.
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.
2043 (VSP G1000, G1500, and VSP F1500)	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 delta resync or data volume.
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 delta resync or data volume.
2047	The pair task was rejected because the current microcode or firmware version does not support the specified P-VOL capacity.
2048	The pair task was rejected because the current microcode or firmware version does not support the specified S-VOL capacity.
204F (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the S-VOL is the volume for Volume Migration, and the transfer process could not be interrupted. Retry the operation after the Volume Migration transfer process has completed.
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 available pair tasks on page 98.
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 available pair tasks on page 98.
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).

SSB2 code	Description
2071 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the P-VOL is the volume for Volume Migration, and the transfer process could not be interrupted. Retry the operation after the Volume Migration transfer process has completed.
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: • 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 *Provisioning Guide* of your storage system.
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 *Provisioning Guide* of your storage system.
2093	The pair task was rejected because the T10 PI attributes for the P-VOL and S-VOL do not match.
2097	The Quick Restore operation was rejected for one of the following reasons: • 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.
2098 (VSP G1000, G1500, and VSP F1500)	The Quick Restore operation was rejected because both of the following conditions were met: • Either the SI P-VOL is an HDP V-VOL, but the S-VOL is a normal volume, or the SI P-VOL is a normal volume, but the S-VOL is an HDP V-VOL. • Differential data for a TC or UR pair is maintained in the pool with which the P-VOL is associated, and the P-VOL is linked with the TC or UR pair.
209A (VSP G1000, G1500, and VSP F1500)	The Quick Restore operation was rejected because both of the following conditions were met:

SSB2 code	Description
	• Either the SI P-VOL is an HDP V-VOL, but the S-VOL is a normal volume, or the SI P-VOL is a normal volume, but the S-VOL is an HDP V-VOL. • Differential data for a TC or UR pair is maintained in the pool with which the S-VOL is associated, and the S-VOL is linked with the TC or UR pair.
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 you specified either of the following volumes for the P-VOL: • External volume enabled with the Data Direct Mapping attribute • Volume belonging to a parity group with accelerated compression enabled These volumes can only be used as the pool volume.
20A7	The pair operation was rejected because you specified either of the following volumes for the S-VOL: • External volume enabled with the Data Direct Mapping attribute • Volume belonging to a parity group with accelerated compression enabled These volumes can only be used as the pool volume.
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.
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 that 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 that 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.
20C3	The pair task was rejected because the volume you specified as the P-VOL is a deduplication system data volume.
20C4	The pair task was rejected because the volume you specified as the S-VOL is a deduplication system data volume.
20C5	The command was rejected because you were in the process of turning off the storage system's power.
20D0	The P-VOL rejected the **paircreate** CCI command because the DP pool is initializing in the DP-VOL.
20D1	The S-VOL rejected the **paircreate** CCI command because the DP pool is initializing in the DP-VOL.

SSB2 code	Description
20DF (VSP G1000, G1500, and VSP F1500)	The volume which was specified as the S-VOL cannot be used, because the volume is undergoing online data migration.
20E4 (VSP G1000, G1500, and VSP F1500)	The command was rejected because if sharing volume between UR S-VOL and SI P-VOL, ShadowImage CTG pair created by BCM or IBM PPRC and ShadowImage CTG pair created by CCI cannot coexist.
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.
20EC (VSP G1000, G1500, and VSP F1500)	The volume which was specified as the P-VOL cannot be used, because the volume is undergoing online data migration and Cache Through is specified as the cache mode.
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 for the volume specified as the P-VOL because either the device model and serial number or the virtual LDEV ID for the virtual storage machine is being changed.
20F5	The pair task was rejected for the volume specified as the S-VOL because either the device model and serial number or the virtual LDEV ID for the virtual storage machine is being changed.
20F6 (VSP G1000, G1500, and VSP F1500)	The pair creation was rejected because one of the following applied to the volume specified as the P-VOL. • The volume was undergoing online data migration. • The volume was already used as the S-VOL of an SI pair whose P-VOL was undergoing online data migration.
20F7 (VSP G1000, G1500, and VSP F1500)	The pair operation was rejected because one of the following applied to the volume specified as the P-VOL. • The volume was undergoing online data migration. • The volume was already used as the S-VOL of an SI pair whose P-VOL was undergoing online data migration.
20F8 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected for the volume specified as the S-VOL because the volume is undergoing online data migration.
20FC (VSP G1000, G1500, and VSP F1500)	The command was rejected because the volume specified as the P-VOL is undergoing online data migration and the command is for creating a third pair.
22F6 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the P-VOL is a Compatible FlashCopy® T-VOL.
22F7 (VSP G1000,	The pair task was rejected because the volume you specified as the S-VOL is a Compatible FlashCopy® S-VOL or T-VOL.

SSB2 code	Description
G1500, and VSP F1500)	
22F9 (VSP G1000, G1500, and VSP F1500)	The pair was not restored because the volume you specified as the S-VOL is a Compatible FlashCopy® S-VOL or T-VOL.
2301	The pair task was rejected because there is not a sufficient amount of installed shared memory or SI is not installed.
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.
2312 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the S-VOL is online to the host.
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).
231F (VSP G1000, G1500, and VSP F1500)	The pair was not restored because the P-VOL of the specified pair is online to the host.
2322	The pair task was rejected because there is not a sufficient amount of installed shared 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.
2325	The pair task was rejected because the number of slots of the volume you specified as the S-VOL exceeded the upper limit.

SSB2 code	Description
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 capacity of the S-VOL.
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.
2334 (VSP G1000, G1500, and VSP F1500)	One of the following occurred: • The pair task was rejected because the volume you specified as the P-VOL had an emulation type that CCI could not handle. • The CTG pair-split was rejected because the volume you specified as the P-VOL is an intermediate volume.
2335 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the S-VOL had an emulation type that could not be handled by CCI.
2336 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the emulation type of the specified P-VOL is different from the emulation type of the S-VOL.
2337 (VSP G1000, G1500, and VSP F1500)	The pair operation was rejected because the volume you specified as the P-VOL is an intermediate volume.
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 a 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 (PSUSstatus) or suspended (PSUE status).

SSB2 code	Description
2342	The pair task was rejected because the volume you specified as the S-VOL is the destination of the Volume Migration.
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 available pair tasks on page 98.
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 available pair tasks on page 98.
234A (VSP G1000, G1500, and VSP F1500)	The pair creation for the cascade configuration was rejected because the volume you specified as the S-VOL is an intermediate volume.
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.
2352 (VSP G1000, G1500, and VSP F1500)	The pair was not restored because the specified P-VOL and S-VOLs is online to the host.
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).
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.

SSB2 code	Description
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 greater.
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.
2390	The Quick Restore operation was rejected because the volume specified as the P-VOL is a volume for which capacity saving function is enabled.
2391	The Quick Restore operation was rejected because the volume specified as the S-VOL is a volume for which capacity saving function is enabled.
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.
2397 (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because you are reverse resynchronizing the L2 pair sharing the specified P-VOL or S-VOL as the node 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).
23A8 (VSP G1000, G1500, and VSP F1500)	The reverse resynchronization was rejected because the volume you specified is the P-VOL for XRC.
23A9 (VSP G1000, G1500, and VSP F1500)	The pair was not restored because the volume you specified is the P-VOL for CC.

SSB2 code	Description
23AA (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the S-VOL is the P-VOL for XRC.
23AB (VSP G1000, G1500, and VSP F1500)	The pair task was rejected because the volume you specified as the S-VOL is the P-VOL for CC.
23AF (VSP G1000, G1500, and VSP F1500)	The pair was not registered in the CTG because IBM PPRC has reserved the specified CTG ID.
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.
B901 (SSB1 code: b980) (VSP Gx00 models and VSP Fx00 models)	The command was rejected because the specified port is for NAS Platform (system LU).
B903 (SSB1 code: b980) (VSP Gx00 models and VSP Fx00 models)	The command was rejected because the selected resource belongs to NAS_Platform_System_RSG.
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 references

- Consistency group pair-split failures on page 114

Contacting customer support

If you need to contact 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 in HDvM - 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. If you need technical support, log on to the HDS Support Portal for contact information: https://support.hds.com/en_us/contact-us.html.

A

Interface support for ShadowImage pair tasks and options

This appendix lists SI pair tasks 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 tasks and options that HDvM - SN and CCI support.

Pair task/Action	System option	HDvM - SN	CCI	
			Command	Option
Change system options	No options	YES	raidcom modify local_replica_opt	-opt_type -set_system_opt -reset_system_opt
Create SI 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
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 lists the SI consistency group (CTG) actions and options supported by HDvM - SN and CCI.

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
- Local Replication window
- View Pair Properties window
- View Pair Synchronization Rate window
- History window
- Consistency Group Properties window
- Create SI Pairs wizard
- Split Pairs wizard
- Resync Pairs wizard
- Suspend Pairs window
- Delete Pairs window
- Edit Mirror Units dialog box
- Change Options dialog box
- Edit Local Replica Options wizard

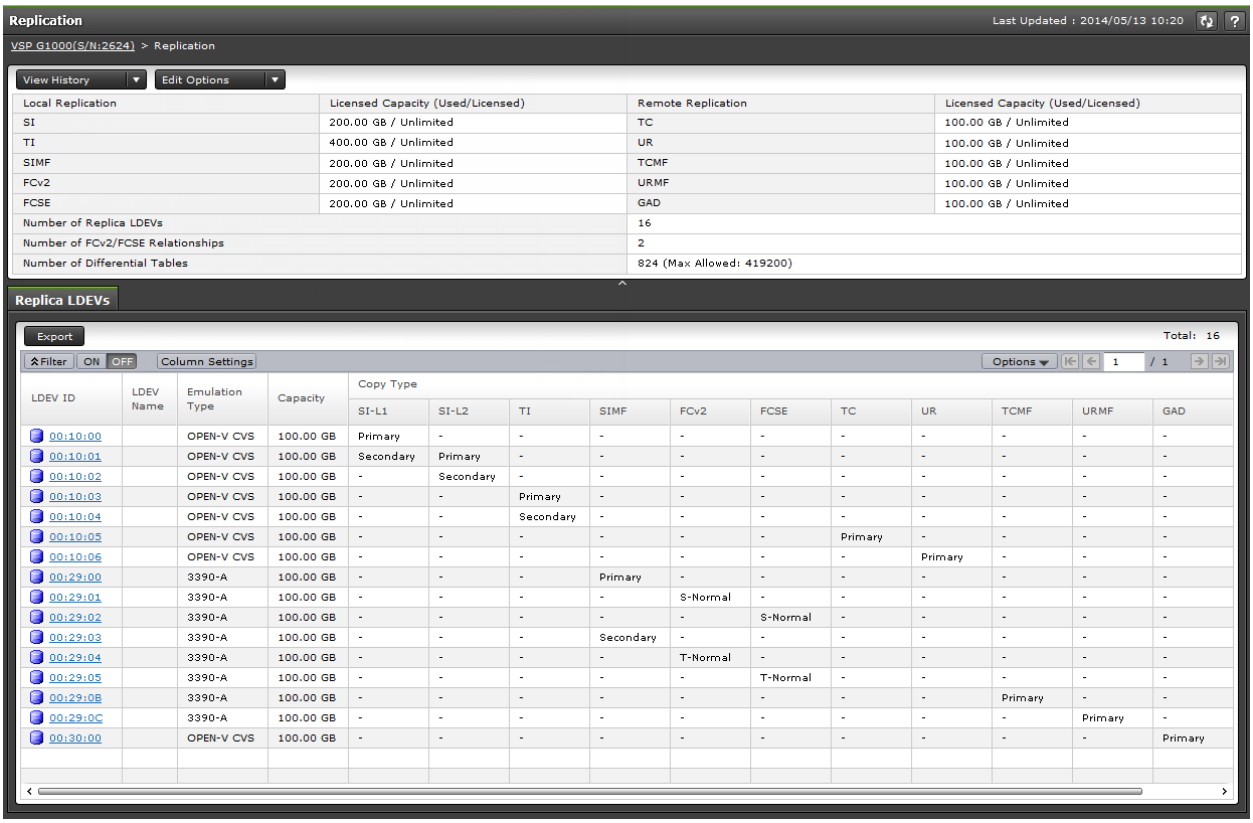
Replication window

Use this window to view pair information for local replication.

This window contains the following information:

- Summary section
- Replication tab (VSP Gx00 models and VSP Fx00 models)
- Replica LDEVs tab

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



Summary section

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

Item	Description
Licensed Capacity	The amount of used and licensed capacity of each software application.

Item	Description
Number of Replica LDEVs	The number of LDEVs used for all local replication pairs.
Number of FCv2/FCSE Relationships (VSP G1000, G1500, and VSP F1500)	The number of Compatible FlashCopy® V2 and Compatible FlashCopy® SE relationships in use.
Number of Differential Tables	The number of differential tables in use and the differential table limit, for local replication. Differential tables in use for remote replication are not included. Because differential tables are not used for all operations, the number of differential tables does not change when you execute the following operations: • Thin Image pair operations. • SI pair operations for a DP-VOL that exceeds 4 TB. • (VSP G1000, G1500, and VSP F1500) SIz pair operations for a DP-VOL that exceeds 262,668 cylinders. • (VSP G1000, G1500, and VSP F1500) Compatible FlashCopy® V2 or Compatible FlashCopy® SE relationship operations.
View History button	Click to show options. Options: • Local Replication: Click to open the **History** window for local replication. • Remote Replication: Click to open the **History** window for remote replication.
Edit Options button	Click to show options. Options: • Local Replication: Click to open the Edit Local Replica Options wizard. • Remote Replication: Click to open the **Edit Remote Replica Options** window. • (VSP G1000, G1500, and VSP F1500) SCP Time: Click to open the **Edit SCP Time** window.

Replication tab (VSP Gx00 models and VSP Fx00 models)

The Replication 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

Item	Description
	• Remote Connections

Replica LDEVs tab

The following table describes the items on this tab of 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.
LDEV Name	The selected LDEV's name.
Emulation Type (VSP G1000, G1500, and VSP F1500)	The selected LDEV's emulation type.
Capacity	The selected LDEV's capacity.
Copy Type	The copy type. Values: • SI-L1: ShadowImage L1 P-VOL or S-VOL • SI-L2: ShadowImage L2 P-VOL or S-VOL • TI: Thin Image P-VOL or S-VOL • (VSP G1000, G1500, and VSP F1500) SIMF: ShadowImage for Mainframe P-VOL or S-VOL • (VSP G1000, G1500, and VSP F1500) FCv2: Compatible FlashCopy® V2 relationship • (VSP G1000, G1500, and VSP F1500) FCSE: Compatible FlashCopy® SE relationship • TC: TrueCopy P-VOL or S-VOL • UR: Universal Replicator P-VOL or S-VOL • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe P-VOL or S-VOL • (VSP G1000, G1500, and VSP F1500) URMF: Universal Replicator for Mainframe P-VOL or S-VOL • GAD: Global-active device P-VOL or S-VOL Volume types are • 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

Item	Description
	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.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide*.	

Local Replication window

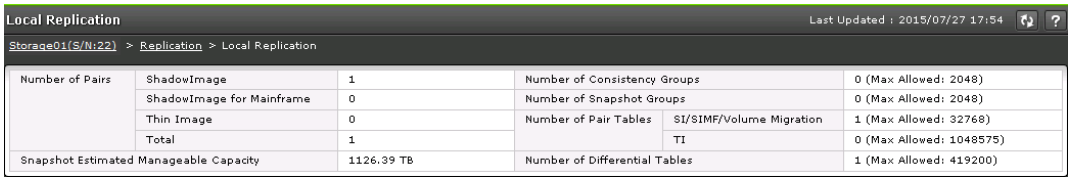
Use this window to perform the following tasks:

- Viewing SI pair, HTI pair, and CTG information for local replication.
- Creating ShadowImage pairs on page 58
- Splitting ShadowImage pairs on page 73
- Resynchronizing or restoring ShadowImage pairs on page 86
- Deleting ShadowImage pairs on page 91

This window contains 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 summary section of this window.



Summary section

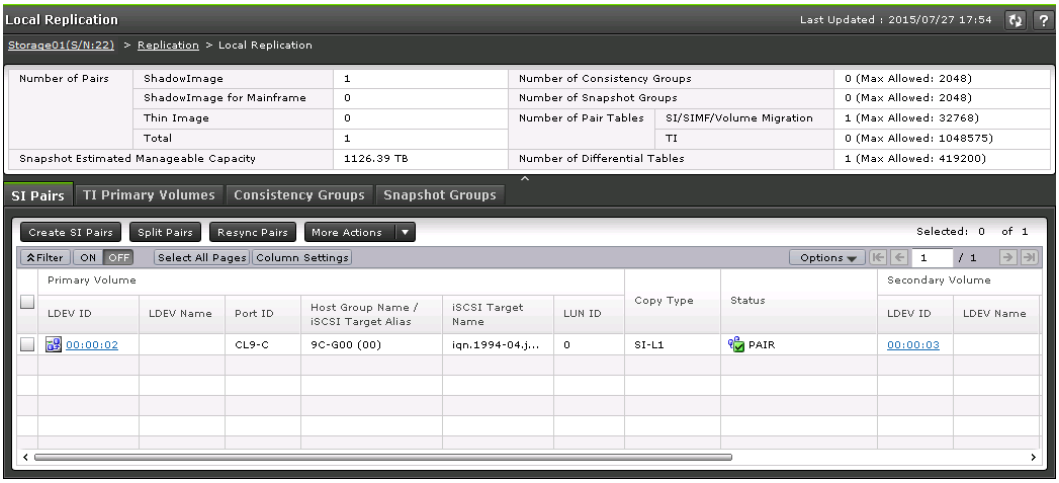
Item	Description
Number of Pairs	The number of pairs for each local replication software type.
Snapshot Estimated Manageable Capacity*	The estimated HTI pair capacity. The ⚠ icon appears when the estimated capacity is less than:

Item	Description
	• VSP G1000 and G1500, and VSP F1500: 128 TB • 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*.
Number of Consistency Groups	The number of consistency groups (CTGs) that have a status other than Free, and the maximum number of CTGs allowed.
Number of Snapshot Groups	The number of snapshot groups that are in use, and the maximum number of snapshot groups allowed.
Number of Pair Tables	The number of pair tables in use, and the maximum number of pair tables allowed. Values: • (VSP G1000, G1500, and VSP F1500) SI/SIMF/Volume Migration: SI, SIz, Volume Migration • (VSP Gx00 models and VSP Fx00 models) SI/Volume Migration: SI, Volume Migration • TI: HTI
Number of Differential Tables	The number of differential tables in use, and the maximum number of differential tables allowed. 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. • (VSP G1000, G1500, and VSP F1500) SIz pair operations for a DP-VOL that exceeds 262,668 cylinders.
*Snapshot Estimated Manageable Capacity is an estimation of Thin Image pair capacity that is calculated by subtracting shared memory used by Thin Image pools and Thin Image pairs from the shared memory capacity. Snapshot Estimated Manageable Capacity is only a reference estimation and does not guarantee that the space is available. The Snapshot Estimated Manageable Capacity value changes when Thin Image pool volumes or Thin Image pairs are added or deleted.	

SI Pairs tab

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

The following image shows this tab.



The following table describes 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 P-VOL's port identifier. SI only. For SI pairs with an undefined path, a blank is displayed. • Host Group Name / iSCSI Target Alias: The P-VOL's host group name and ID or iSCSI target alias and ID. SI only. For SI pairs with an undefined path, a blank is displayed. • iSCSI Target Name: The P-VOL's iSCSI target name. SI only. For SI pairs with an undefined path, a blank is displayed. • LUN ID: The P-VOL's LUN identifier. SI only. For SI pairs with an undefined path, a blank is displayed. • Provisioning Type*: The P-VOL's provisioning type, which can be one of the following: ○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume ○ (VSP G1000, G1500, and VSP F1500) External MF: Migration volume • (VSP G1000, G1500, and VSP F1500) Emulation Type*: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 or migration volume, a hyphen (-) is displayed. • T10 PI*: The P-VOL's T10 PI attribute information. ○ Enabled: The P-VOL's T10 PI attribute is enabled. ○ Disabled: The P-VOL's T10 PI attribute is disabled. (VSP G1000, G1500, and VSP F1500) For SIz pairs, a hyphen (-) is displayed. • 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
Status	The status of the pair. For SI status descriptions, see Device Manager - Storage Navigator pair status names and descriptions on page 97. For SI status descriptions, see the *Hitachi ShadowImage® User Guide*.
Secondary Volume	The S-VOL information. Values: • 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.

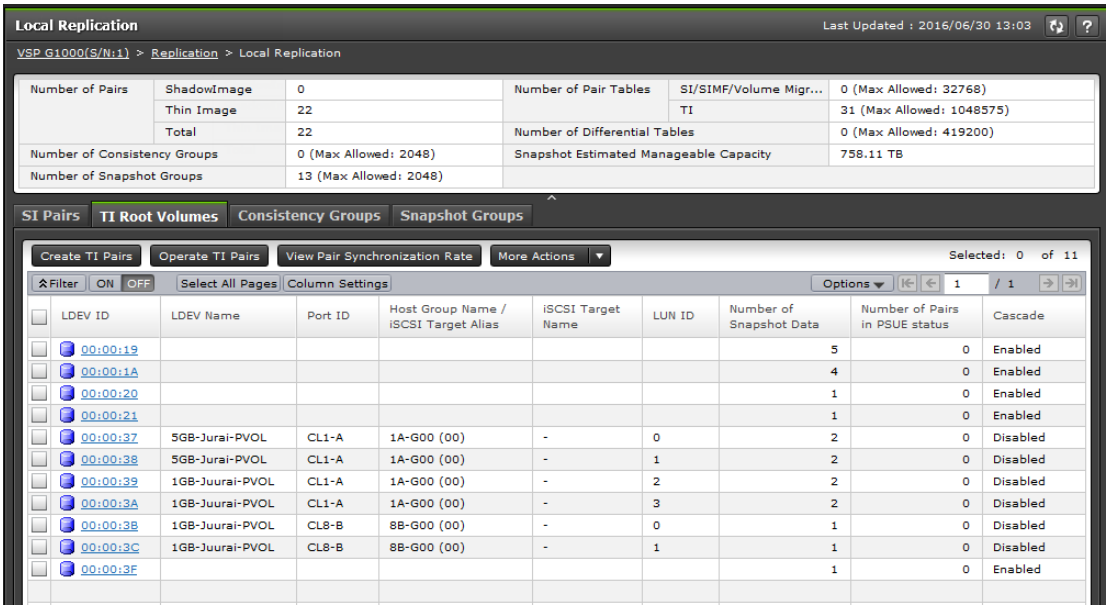
Item	Description
	SI only.For SI pairs with an undefined path, a blank is displayed. • Host Group Name / iSCSI Target Alias: The S-VOL's host group name and ID or iSCSI target alias and ID. SI only. For SI pairs with an undefined path, a blank is displayed. • iSCSI Target Name: The S-VOL's iSCSI target name. SI only. For SI pairs with an undefined path, a blank is displayed. • LUN ID: The S-VOL's LUN identifier. SI only. For SI pairs with an undefined path, a blank is displayed. • Provisioning Type*: The S-VOL's provisioning type, which can be one of the following: ○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume • (VSP G1000, G1500, and VSP F1500) Emulation Type*: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 or migration volume, a hyphen (-) is displayed. • T10 PI*: The S-VOL's T10 PI attribute information. ○ Enabled: The S-VOL's T10 PI attribute is enabled. ○ Disabled: The S-VOL's T10 PI attribute is disabled. • Virtual Storage Machine*: The model type and serial number of the virtual storage machine to which the S-VOL belongs. • 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.

Item	Description
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, a blank is displayed.
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: *LDEV ID of the volume* (*mirror units*) Example: 00.00.00 (MU0-MU1)
Create SI Pairs button	Click to open the Create SI Pairs wizard.
Create TI Pairs button (VSP Gx00 models and VSP Fx00 models)	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.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide*.	

TI Root Volumes tab or TI Primary Volumes tab

Use this tab of the **Local Replication** window to view HTI pair information for local replication.

The following image shows this tab.



The following table describes the items on this tab.

Item	Description
LDEV ID	The P-VOL's LDEV identifier. Click to open the **LDEV Properties** or **TI Pairs** window. Use this window to search for P-VOL information.
LDEV Name	The P-VOL's LDEV name.
Port ID	The port name of the P-VOL LDEV's LUN path. For SI pairs with an undefined path, a blank is displayed.
Host Group Name / iSCSI Target Alias	The P-VOL's host group name and ID or iSCSI target alias and ID. For SI pairs with an undefined path, a blank is displayed.
iSCSI Target Name	The P-VOL's iSCSI target name. For SI pairs with an undefined path, a blank is displayed.
LUN ID	The LUN ID of the P-VOL LDEV's LUN path. For SI pairs with an undefined path, a blank is displayed.
Attribute* (VSP Gx00 models and VSP Fx00 models)	The P-VOL's attribute.
Capacity*	The P-VOL's capacity.
CLPR* (VSP Gx00 models and VSP Fx00 models)	The P-VOL's CLPR ID.
Encryption*	The P-VOL's encryption information. • Enabled: Encryption is enabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. • Disabled: Encryption is disabled for the parity group to which the P-VOL's LDEV belongs, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.

Item	Description
	• Mixed: The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume or migration volume, a hyphen (-) is displayed.
Pool Name (ID)*	The P-VOL's pool name and identifier.
Number of Snapshot Data	The number of P-VOL snapshot data.
Number of Pairs in PSUE status	The number of P-VOL pairs in PSUE status.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created.
T10 PI*	The P-VOL's T10 PI attribute information. • Enabled: The P-VOL's T10 PI attribute is enabled. • Disabled: The P-VOL's T10 PI attribute is disabled.
Virtual Storage Machine*	The Virtual Storage Machine information. Values: • 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. If no virtual LDEV ID is assigned, a blank is displayed. • Device Name: The name of the P-VOL's virtual device, in a combined format of *virtual emulation type*, *number of virtual 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 button	Click to open the TI Pairs wizard.
View Pair Synchronization Rate button	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 **View LDEV Properties** window. • Split Pairs: Click to open the **Split Pairs** window. • Resync Pairs: Click to open the **Resync Pairs** window. • Assign Secondary Volumes: Click to open the **Assign Secondary Volumes** window.

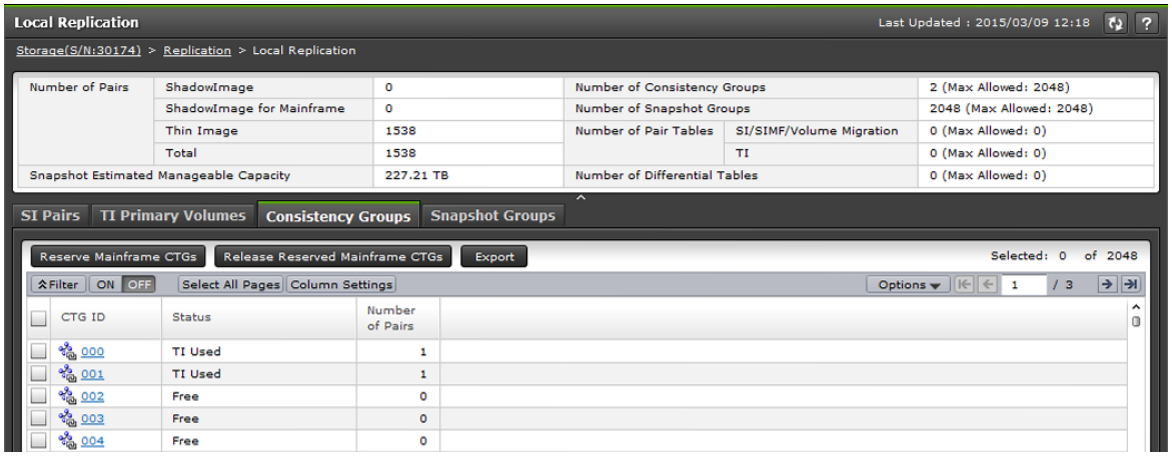
Item	Description
	• Remove Secondary Volumes: Click to open the **Remove Secondary Volumes** window. • Delete Pairs: Click to open the **Delete Pairs** window. • Export: Click to open a dialog for downloading table information to a tab-separated values (TSV) file.
* These items are not shown in the table by default. You must add them using the **Column Settings** window. For more information about how to add items to a table using this window, see the *Hitachi Command Suite User Guide*.	

Consistency Groups tab

Use this tab of the **Local Replication** window to perform the following tasks:

- View CTG information for local replication.

The following image shows this tab.



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

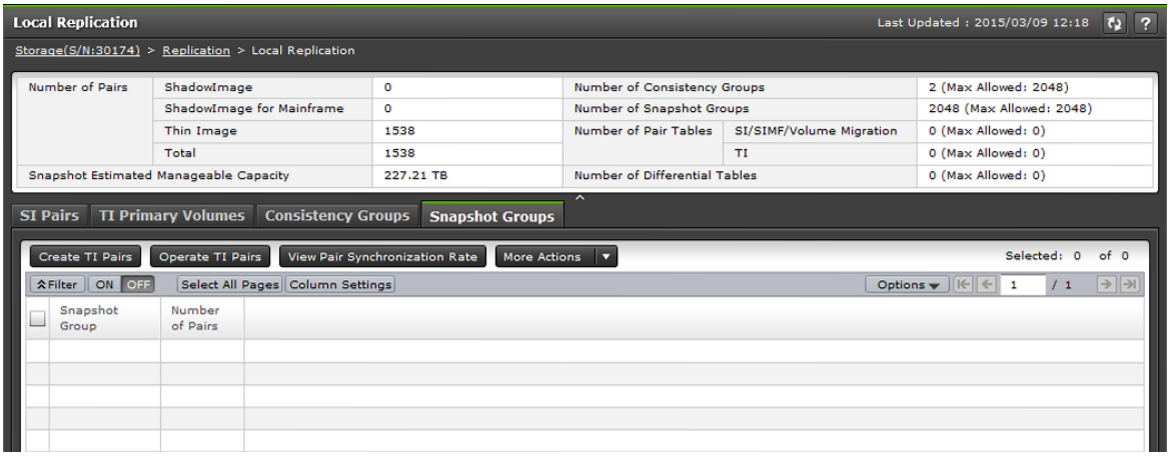
Item	Description
CTG ID	The SI pair's CTG identification number. Click to open the **Consistency Group Properties** window.
Status	The status. Values: • SI Used: The CTG is being used by SI. • (VSP G1000, G1500, and VSP F1500) SIMF Used (RAID Manager): SIz is using the CTG, and you are using CCI to manage the CTG.

Item	Description
	• (VSP G1000, G1500, and VSP F1500) SIMF Used (PPRC/BCM): SIz is using the CTG, and you are using Business Continuity Manager (BCM) or IBM PPRC to manage the CTG. • TI Used: HTI is using the CTG. • (VSP G1000, G1500, and VSP F1500)Mainframe Reserved: The CTG is reserved for use with BCM or IBM PPRC. • 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.
Reserve Mainframe CTGs button (VSP G1000, G1500, and VSP F1500)	Click to open the **Reserve Mainframe CTGs** window.
Release Reserved Mainframe CTGs button (VSP G1000, G1500, and VSP F1500)	Click to open the **Release Reserved Mainframe CTGs** window.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.

Snapshot Groups tab

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

The following image shows this tab.



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

Item	Description
Snapshot Group	The snapshot group name. Click to open the HTI pairs window.
Number of Pairs	The number of pairs currently used by the snapshot group.

Item	Description
Create TI Pairs button	Click to open the Create TI Pairs wizard.
Operate TI Pairs button	Click to open the TI Pairs wizard.
View Pair Synchronization Rate button	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.

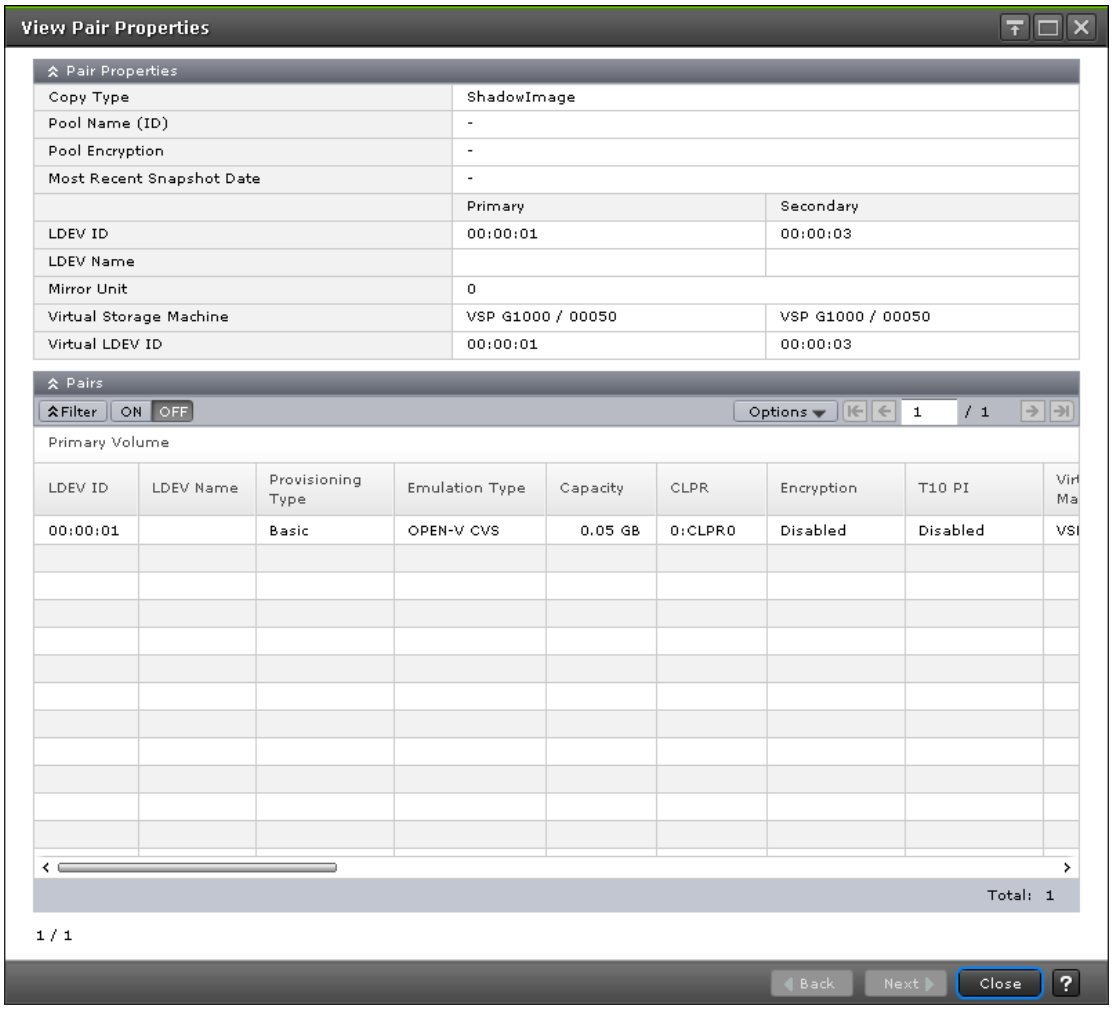
View Pair Properties window

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

This window contains the following section and table:

- Pair Properties section
- Pairs table

For more information about this window, see Monitoring ShadowImage pair and volume details on page 101.



Pair Properties section

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

Item	Description
Copy Type	The type of pair. Values: • ShadowImage (default): SI pair • (VSP G1000, G1500, and VSP F1500) ShadowImage for Mainframe: SIz pair • Thin Image: HTI pair
Pool Name (ID)	HTI only. The pool name and identification number. If you have not set a pool name for the pair, a blank is displayed. For non-HTI pairs, a hyphen is displayed.

Item	Description
Pool Encryption	HTI only. 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.
Most Recent Snapshot Date	HTI only. The date and time the snapshot was acquired. If you have not acquired a snapshot, a blank is displayed. For non-HTI pairs, a hyphen is displayed.
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 describes 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
	  ○ External: External volume
	• (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type.
	• (VSP Gx00 models and VSP Fx00 models) Attribute: The P-VOL's attribute.

Item	Description

	• 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 or migration volume, a hyphen is displayed.
	• T10 PI: The P-VOL's T10 PI attribute information.
	  ○ Enabled: The P-VOL's T10 PI attribute is enabled.
	  ○ Disabled: The P-VOL's T10 PI attribute is disabled.
	For SIz pairs, a hyphen is displayed.
	• 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, a blank is displayed. For non-HTI pairs, a hyphen is displayed.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Snapshot Date	HTI only. The date and time the snapshot was acquired. For non-HTI pairs, a hyphen is displayed.
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:

Item	Description
	○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume ○ Snapshot: HTI volume • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 or migration volume, a hyphen is displayed. • 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 displayed 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 displayed when the S-VOL cannot be read because you specified "-m noread" using CCI. - A hyphen indicates that the storage system has not written to the S-VOL. ○ For HTI: - W is displayed if the storage system has written data to the S-VOL when its pair status is PSUS. - A hyphen indicates that the storage system has not written to the S-VOL. ○ For SIz: - W is displayed when the storage system has written data to the S-VOL when its pair status is V-Split/SUSPVS or Split/SUSPOP. - Protect is displayed when you have set the Protect attribute using Business Continuity Manager (BCM) when the S-VOL's pair status is Split/SUSPOP, SP-Pend/TRANS, or V-Split/SUSPVS. - A hyphen indicates that the storage system has not written to the S-VOL. • T10 PI: The S-VOL's T10 PI attribute information. ○ Enabled: The S-VOL's T10 PI attribute is enabled. ○ Disabled: The S-VOL's T10 PI attribute is disabled. For SIz pairs, a hyphen is displayed.

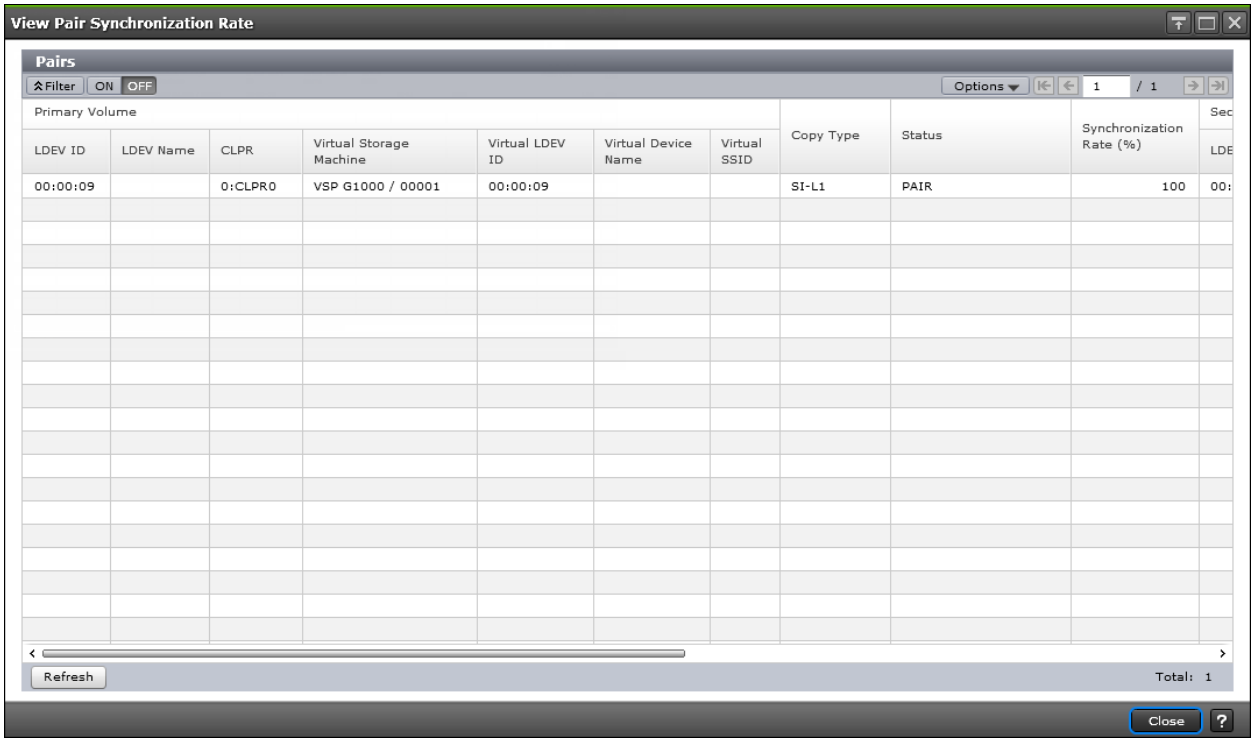
Item	Description
	• Virtual Storage Machine: The model type and serial number of the virtual storage machine to which the S-VOL belongs. • Virtual LDEV ID: The identification number of the S-VOL's virtual LDEV. If no virtual LDEV ID is assigned, a blank is displayed. • Virtual Device Name: The name of 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.
CTG ID	The identification number for the CTG to which the pair is assigned.
Copy Pace	SI and SIz only. For HTI pairs, a hyphen is displayed. The system option that determines the rate at which you want the storage system to copy data.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and 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 contains the Pairs table.

For more information about using this window, see Monitoring ShadowImage pair synchronization rates on page 103.

The following image shows this window.



Pairs table

The following table describes 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 and SIz only. The pair type.

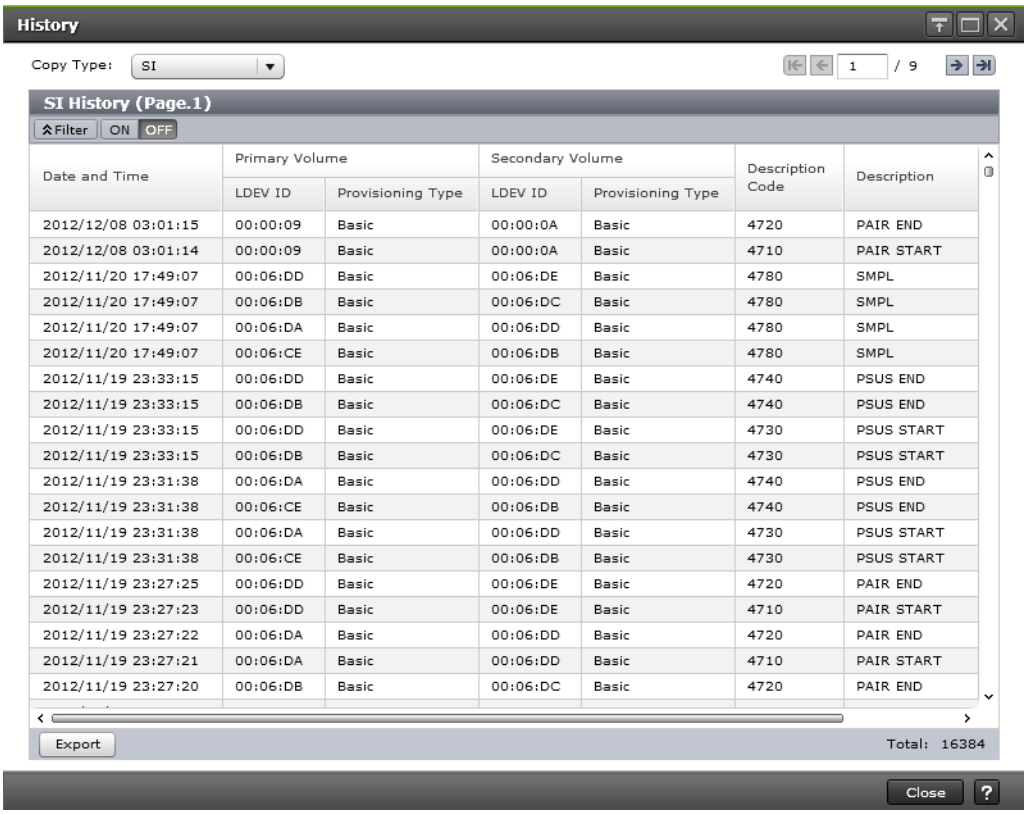
Item	Description
	Values: • SI-L1: SI L1 pair • SI-L2: SI L2 pair • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
Snapshot Group (VSP Gx00 models and VSP Fx00 models)	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, a blank is displayed.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Synchronization Rate (%)	For SI: • If the pair status is COPY(PD)/COPY, COPY(SP)/COPY, or PSUS (SP)/PSUS, the copy progress rate is displayed. • If the pair status is PAIR, PSUS, COPY(RS-R)/RCPY, or PSUE, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is COPY(RS)/COPY changed from PSUE, the copy progress rate is displayed. • If the pair status is COPY(RS)/COPY changed from other than PSUE, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is SMPL(PD), a hyphen is displayed. For SIz: • If the pair status is PENDING, SP-Pend/TRANS, or V-Split/SUSPVS, the copy progress rate is displayed. • If the pair status is DUPLEX, Split/SUSPOP, Resync-R/REVRSY, or Suspend/SUSPER, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is Resync/PENDING changed from Suspend/SUSPER, the copy progress rate is displayed. • If the pair status is Resync/PENDING changed from other than Suspend/SUSPER, the synchronization rate between P-VOL and S-VOL is displayed. • If the pair status is Deleting/TRANS, a hyphen is displayed. For HTI with invalid cascade attribute: • The synchronization rate computed by comparing the current S-VOL and the next new generation of the S-VOL. • When the S-VOL is the latest one, the synchronization rate computed by comparing the S-VOL and the P-VOL. For HTI with valid cascade attribute, according to pair status: • When the pair status is PAIR, PSUS, or PSUE, the synchronization rate is computed by comparing the current S-VOL and the next new generation of the S-VOL. If the S-VOL is the latest one, the synchronization rate is computed by comparing the S-VOL and the P-VOL. • When the pair status is COPY, PSUS(SP), RCPY, or SMPL(PD), the synchronization rate is computed by the progress rate of each process.
Secondary Volume	The S-VOL information.

Item	Description
	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 and SIz 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.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and the mirror unit number.
Refresh button	Click to update the information in the Pairs table.

History window

Use this window to monitor pair tasks performed on pairs consisting of P-VOLs and S-VOLs allocated to you.

For more information about monitoring pairs, see Monitoring pair task history on page 108.



Setting fields

The following table describes the setting fields for this window.

Item	Description
Copy Type	The pair type. Values: • SI: SI • TI: HTI • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • (VSP G1000, G1500, and VSP F1500) FCv2/FCSE: Compatible FlashCopy® V2 and Compatible FlashCopy® SE

SI or SIz History table

The following table describes the items in the History table.

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 ○ (VSP G1000, G1500, and VSP F1500) External MF: Migration 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.
Export button	Click to open a dialog for downloading table information to a tab-separated values (TSV) file.

HTI History table

The following table describes the items in the HTI History table. 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 16,384 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. Values: • LDEV ID: The S-VOL's LDEV identifier.

Item	Description
	• Provisioning type: The S-VOL's provisioning type, which can be one of the following: ○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume
Mirror Unit	The mirror unit number.
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.

Compatible FlashCopy® V2 or Hitachi Compatible Software for IBM® FlashCopy® SE history table (VSP G1000, G1500, and VSP F1500)

The following table describes the items in the FC History table. Only tasks performed on the pairs consisting of the P-VOL or S-VOLs to which you are allocated are shown.

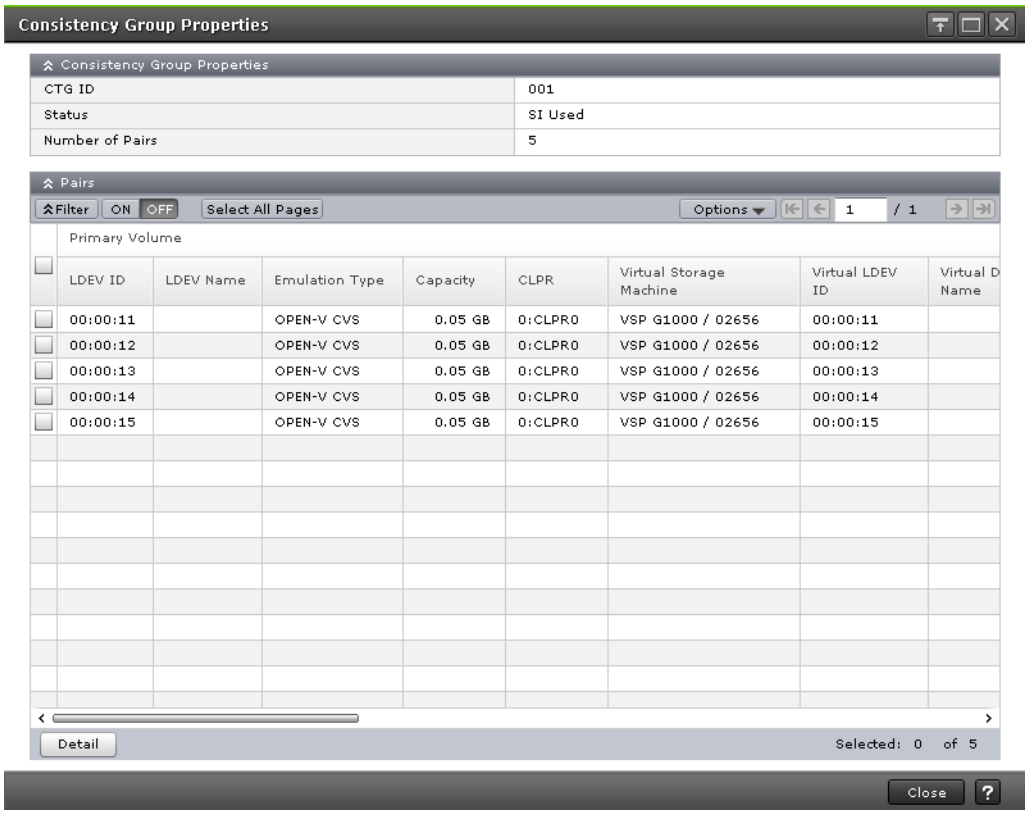
Item	Description
Date and Time	The date and time the operation was performed.
Source Volume	The source volume information. Values: • LDEV ID: The source volume's LDEV identifier. • Provisioning type: The source volume's provisioning type, which can be one of the following: ○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume
Target Volume	The target volume information. Values: • LDEV ID: The target volume's LDEV identifier. • Provisioning type: The target volume's provisioning type, which can be one of the following: ○ Basic: Internal volume ○ DP: DP-VOL ○ External: External volume
Relationship ID	The relationship identifier.
Description Code	The code for the type of operation performed.
Description	The description of the operation performed.
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 information about status and number of pairs.
- Viewing CTG properties.

For more information about this window, see Monitoring consistency groups on page 105.



Consistency Group Properties table

The following table describes 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 being used by SI.

Item	Description
	• (VSP G1000, G1500, and VSP F1500) SIMF Used (RAID Manager): SIz is using the CTG, and you are using CCI to manage the CTG. • (VSP G1000, G1500, and VSP F1500) SIMF Used (PPRC/BCM): SIz is using the CTG, and you are using Business Continuity Manager (BCM) or IBM PPRC to manage the CTG. • TI Used: HTI is using the CTG. • (VSP G1000, G1500, and VSP F1500) Mainframe Reserved: The CTG is reserved for use by BCM or IBM PPRC. • 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.

Pairs table

The Pairs table shows pairs with a P-VOL or S-VOL allocated to you.

The following table describes 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. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. Values: OPEN-V • 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 • TI: HTI • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
Snapshot Group	HTI only. The snapshot group name.

Item	Description
	If you have not assigned the pair to a snapshot group, a blank is displayed. For non-HTI pairs, a hyphen is displayed.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier. • LDEV Name: The S-VOL's LDEV name. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. Values: OPEN-V • 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.
Snapshot Date	HTI only. The date and time the snapshot was acquired. For non-HTI pairs, a hyphen is displayed.
Pool Name (ID)	HTI only. The pool name and identification number. For non-HTI pairs, a hyphen is displayed.
Copy Pace	SI and SIz only. The system option that determines the rate at which you want the storage system to copy data. For HTI pairs, a hyphen is displayed. 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.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created.

Item	Description
	A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and the mirror unit number.
Detail button	Click to open the **View Pair Properties** window.

Create SI Pairs wizard

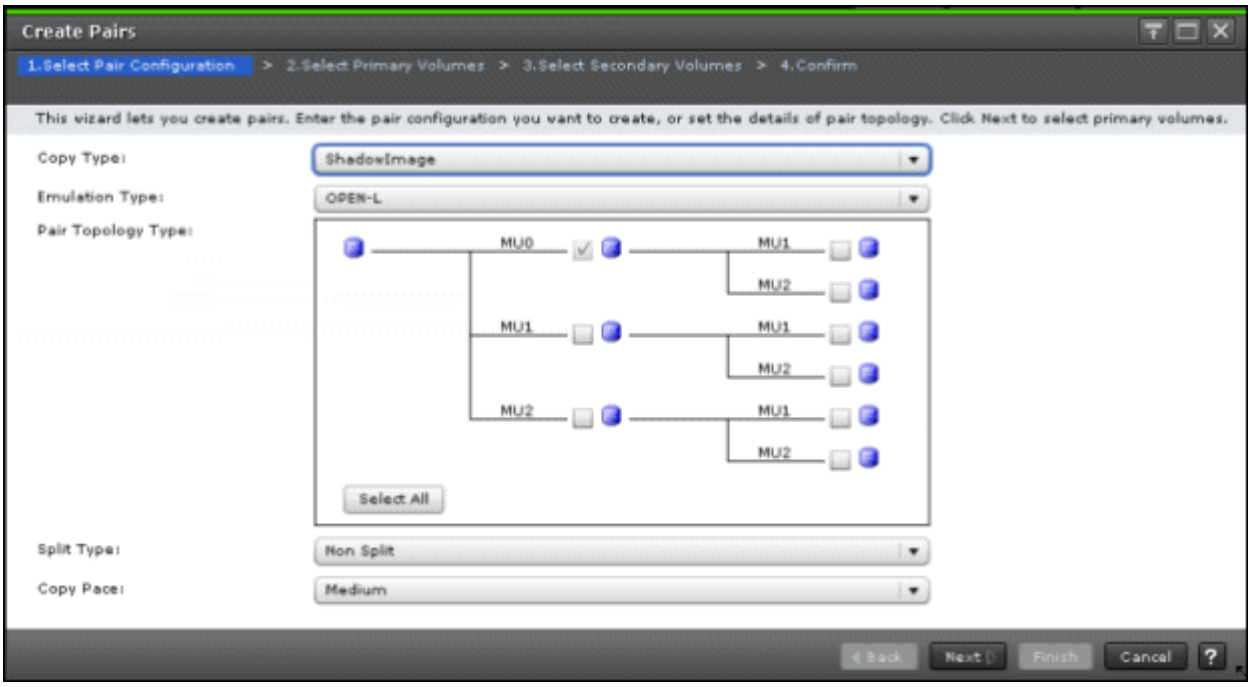
Use this wizard to create pairs and specify pair details.

For more information about using this wizard, see Creating ShadowImage pairs on page 58.

Select Pair Configuration window

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

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



The following table describes the items in this window.

Item	Description
Copy Type (VSP G1000, G1500, and VSP F1500)	The copy type. Values: • ShadowImage (default) • ShadowImage for Mainframe
Emulation Type (VSP G1000, G1500, and VSP F1500)	SI and SIz only. The emulation type.
Pair Topology Type	SI only. The SI pair configuration. Values: • Cleared but available: You can configure the pair. • 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 displayed only if you specify ShadowImage as the Copy Type.
Split Type	SI and SIz only. The split type. Values: • Non Split (default): 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

Item	Description
	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 and SIz 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 (default): Average processing speed and host server I/O performance. • Faster: Faster processing speed but slower host server I/O performance.

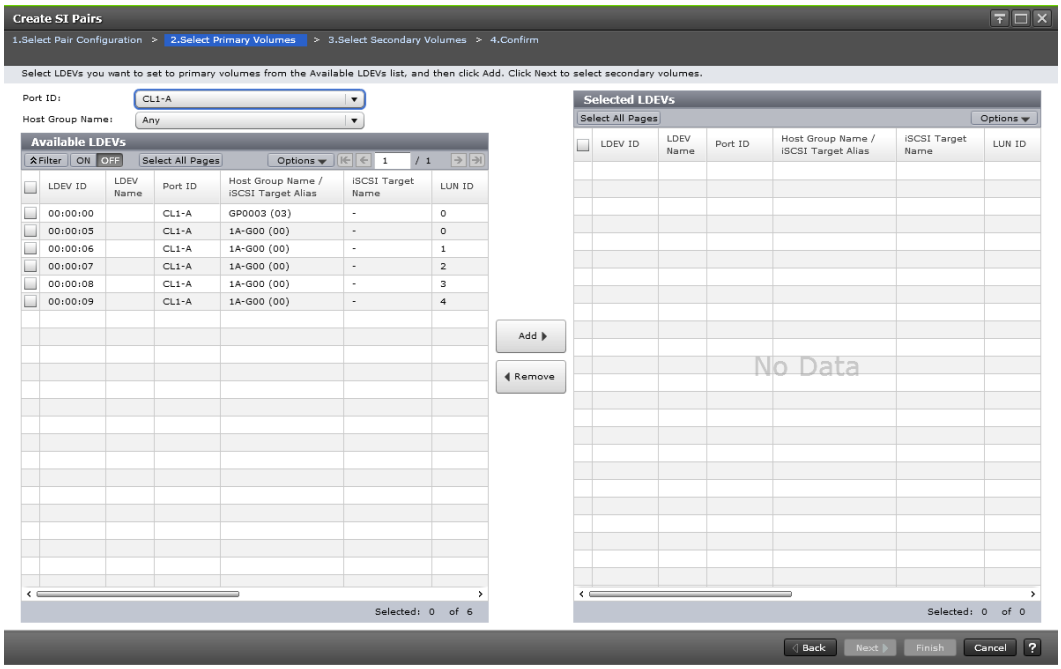
Select Primary Volumes window

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

This window contains the following tables:

- Available LDEVs table
- Selected LDEVs table

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



The following table describes items in this window.

Item	Description
Selection Object (VSP Gx00 models and VSP Fx00 models)	Filters LDEVs in the Available LDEVs table according to port type. Values: • Fibre • iSCSI
Port ID	SI and HTI only. Filters LDEVs in the Available LDEVs table according to the port ID. Default: Any
Host Group Name	SI and HTI only. Filters LDEVs in the Available LDEVs table by the host group name. This item is displayed if you select a Fibre Channel port for Port ID. Default: Any
iSCSI Target Alias	SI and HTI only. Filters LDEVs in the Available LDEVs table by the iSCSI target alias. This item is displayed if you select an iSCSI port for Port ID. Default: Any

Available LDEVs table

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

The following table describes the items in this table.

Item	Description
LDEV ID	The LDEV's identifier.
LDEV Name	The LDEV's name.
Port ID	SI and HTI only. The port name of the LDEV's LUN path.
Host Group Name / iSCSI Target Alias	SI and HTI only. The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path.
iSCSI Target Name	SI and HTI only. The iSCSI target name.
LUN ID	SI and HTI only. 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

Item	Description
	• ALU: Volume with ALU attribute.
Attribute	SI and HTI only. The LDEV's attribute. Values: • ALU: Volume with ALU attribute. • SLU: Volume with SLU attribute. • Data Direct Mapping: Volume with Data Direct Mapping attribute. • (VSP Gx00 models and VSP Fx00 models) NAS Platform (User LU): NAS User LU. If the attribute is not set, a hyphen (-) is displayed.
Emulation Type (VSP G1000, G1500, and VSP F1500)	SI and SIz only. The LDEV's emulation type.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Encryption	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 or migration volume, a hyphen (-) is displayed.
T10 PI (VSP Gx00 models and VSP Fx00 models)	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.
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 displayed on the **Select Primary Volumes** window.

The following table describes 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	SI and HTI only. The port name of the LDEV's LUN path.
Host Group Name / iSCSI Target Alias	SI and HTI only. The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path.
iSCSI Target Name	SI and HTI only. The iSCSI target name.
LUN ID	SI and HTI only. 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	SI and HTI only. The LDEV's attribute. Values: • ALU: Volume with ALU attribute. • SLU: Volume with SLU attribute. • Data Direct Mapping: Volume with Data Direct Mapping attribute. • (VSP Gx00 models and VSP Fx00 models) NAS Platform (User LU): NAS User LU. If the attribute is not set, a hyphen (-) is displayed.
Emulation Type (VSP G1000, G1500, and VSP F1500)	SI and SIz only. The LDEV's emulation type.
Capacity	The LDEV's capacity.
CLPR	The LDEV's CLPR ID.
Encryption	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.

Item	Description
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume or migration volume, a hyphen (-) is displayed.
T10 PI (VSP Gx00 models and VSP Fx00 models)	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.

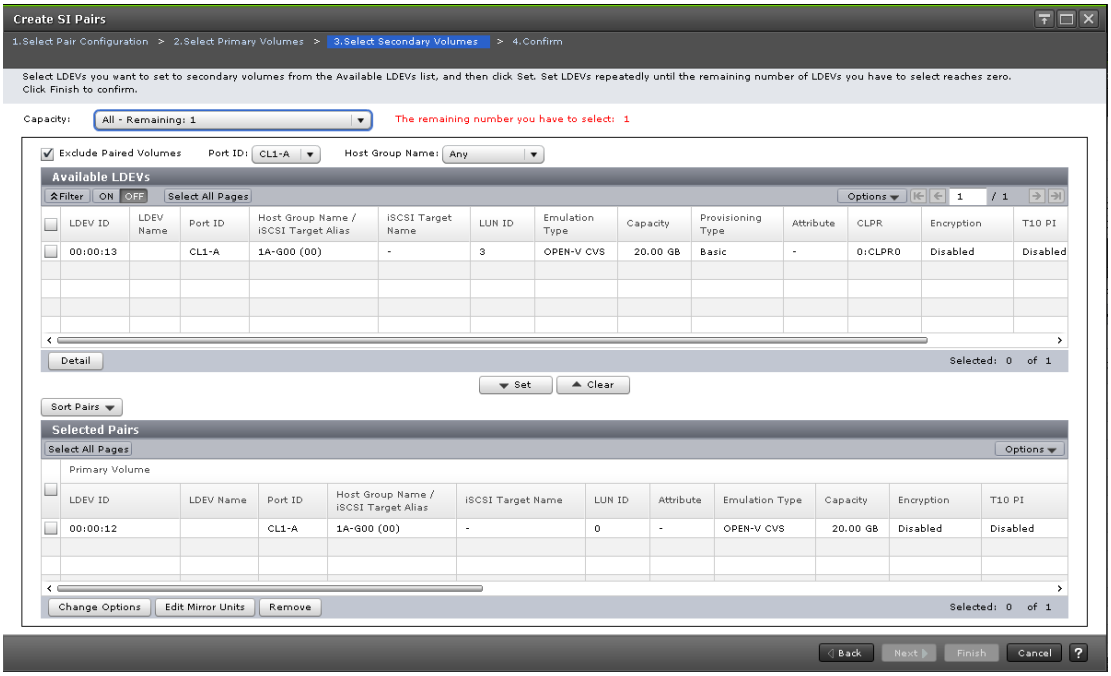
Select Secondary Volumes window

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

This window contains the following tables:

- Available LDEVs table
- Selected LDEVs table

The following image shows this window.



The following table describes 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 (default): Paired volumes are not shown in the list. • Cleared: Paired volumes are shown in the list.
Selection Object (VSP Gx00 models and VSP Fx00 models)	Filters LDEVs in the Available LDEVs table according to port type. Values: • Fibre • iSCSI
Port ID list	SI and HTI only. Filters LDEVs in the Available LDEVs table according to the port ID. Default: CL1-A
Host Group Name list	SI and HTI only. Filters LDEVs in the Available LDEVs table according to the host group name. This item is displayed when you select a Fibre Channel port or NAS user data port for Port ID. Default: Any
iSCSI Target Alias	SI and HTI only. Filters LDEVs in the Available LDEVs table by the iSCSI target alias. This item is displayed if you select an iSCSI port for Port ID. Default: Any
Set button	Click to move an LDEV that you have selected in the Available LDEVs table to the Selected Pairs table. You can also click to configure a pair you have selected in the Available LDEVs table and a pair you have selected in the Selected Pairs table.
Clear button	Click to return the selected S-VOL from the Selected Pairs table to the Available LDEVs table.
Sort Pairs button	SI only. Click to sort the Selected Pairs table in one of the following ways: • Arrange in Mirror Unit: Data is sorted by mirror units. • Arrange in Topology: Data is sorted by topology; for example, L1 or L2 pairs.

Available LDEVs table

The following table describes the items in this table in 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	SI and HTI only. The port name of the LDEV's LUN path.
Host Group Name / iSCSI Target Alias	SI and HTI only. The host group name and ID or iSCSI target alias and ID of the LDEV's LUN path.
iSCSI Target Name	SI and HTI only. The iSCSI target name.
LUN ID	SI and HTI only. LUN identifier of the LDEV's LUN path.
Emulation Type (VSP G1000, G1500, and VSP F1500)	SI and SIz only. The LDEV's emulation type.
Capacity	The LDEV's capacity.
Provisioning Type	SI and SIz 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	SI and HTI only. The LDEV's attribute. Values: • ALU: Volume with ALU attribute. • SLU: Volume with SLU attribute. • Data Direct Mapping: Volume with Data Direct Mapping attribute. • (VSP Gx00 models and VSP Fx00 models) NAS Platform (User LU): NAS User LU. If the attribute is not set, a hyphen (-) is displayed.
CLPR	The LDEV's CLPR ID.
Encryption	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.

Item	Description
	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 or migration volume, a hyphen (-) is displayed.
T10 PI	The LDEV's T10 PI attribute information. • Enabled: The LDEV's T10 PI attribute is enabled. • Disabled: The LDEV's T10 PI attribute is disabled. For SIz, a hyphen (-) is displayed.
Number of Secondary Volumes	SI only. The number of S-VOLs that have been assigned to the selected P-VOL.
Detail button	Click to open the **LDEV Properties** window, which contains additional information for the selected LDEV.

Selected Pairs table

The following table describes the items in this table in 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. • Port ID: The port name of the P-VOL LDEV's LUN path. • Host Group Name / iSCSI Target Alias: The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path. • iSCSI Target Name: The P-VOL's iSCSI target name. • LUN ID: The LUN identifier of the P-VOL LDEV's LUN path. • Attribute: The P-VOL's attribute. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • 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.

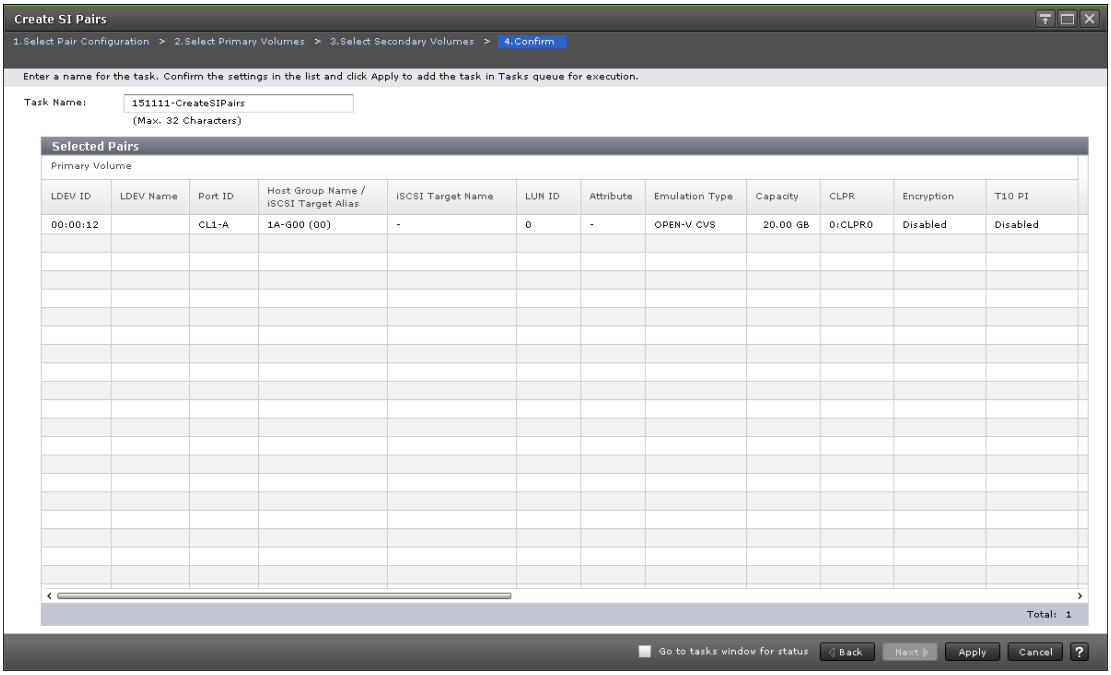
Item	Description
	For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume or migration volume, a hyphen (-) is displayed. • T10 PI: The P-VOL's T10 PI attribute information. ○ Enabled: The P-VOL's T10 PI attribute is enabled. ○ Disabled: The P-VOL's T10 PI attribute is disabled. For SIz pairs, a hyphen (-) is displayed. For SIz, Port ID, Host Group Name / iSCSI Target Alias, iSCSI Target Name, LUN ID, and Attribute are not displayed.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier. If no LDEV is assigned, a blank is displayed. • 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: The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. • iSCSI Target Name: The S-VOL's iSCSI target name. • LUN ID: The LUN identifier of the S-VOL LDEV's LUN path. • Attribute: The S-VOL's attribute. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • 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. ○ 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 or migration volume, a hyphen (-) is displayed. • T10 PI: The S-VOL's T10 PI attribute information. ○ Enabled: The S-VOL's T10 PI attribute is enabled. ○ Disabled: The S-VOL's T10 PI attribute is disabled. For SIz pairs, a hyphen (-) is displayed. For SIz, Port ID, Host Group Name / iSCSI Target Alias, iSCSI Target Name, LUN ID, and Attribute are not displayed.
Copy Type	The copy type. Values:

Item	Description
	• SI-L1: SI L1 • SI-L2: SI L2 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
Mirror Unit	SI and SIz only. The mirror unit number.
Split Type	SI and SIz 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 and SIz 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 and SIz only. Click to open the Change Options window. Options set in this window are applied to all newly created pairs.
Edit Mirror Units button	SI and SIz only. Click to open the Edit Mirror Units window. Use this window 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 ShadowImage pairs on page 58and Creating L1 and L2 pairs with different topologies on page 64.
Remove button	Click to remove the unwanted pairs or LDEV from the Selected Pairs table. **Note:** For SI, you cannot remove L1 pairs that 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 contains the Selected Pairs table.

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



Selected Pairs table

The following table describes the items in this table in the **Confirm** 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.
	• Port ID: Port name of the P-VOL LDEV's LUN path.
	• Host Group Name / iSCSI Target Alias: The host group name and ID or iSCSI target alias and ID of the P-VOL LDEV's LUN path.
	• iSCSI Target Name: The P-VOL's iSCSI target name.
	• LUN ID: The LUN identifier of the P-VOL LDEV's LUN path.
	• Attribute: The P-VOL's attribute.
	• (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type.
	• 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.

Item	Description
	○ Mixed: The pool to which the P-VOL's LDEV belongs contains both pool volumes for which encryption is enabled and ones for which encryption is disabled. **Note:** Data encryption is not ensured in an LDEV with Mixed encryption status. For DP-VOLs, the pool to which an LDEV belongs is an external volume or blocked. For an external volume or migration volume, a hyphen (-) is displayed. • T10 PI: The P-VOL's T10 PI attribute information. ○ Enabled: The P-VOL's T10 PI attribute is enabled. ○ Disabled: The P-VOL's T10 PI attribute is disabled. For SIz pairs, a hyphen (-) is displayed. For SIz, Port ID, Host Group Name / iSCSI Target Alias, iSCSI Target Name, LUN ID, and Attribute are not displayed.
Copy Type	The types of pairs. Values: • SI-L1: SI L1 • SI-L2: SI L2 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
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. • Host Group Name / iSCSI Target Alias: The host group name and ID or iSCSI target alias and ID of the S-VOL LDEV's LUN path. • iSCSI Target Name: The S-VOL's iSCSI target name. • LUN ID: The LUN identifier of the S-VOL LDEV's LUN path. • Attribute: The S-VOL's attribute. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • 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 or migration volume, a hyphen (-) is displayed.

Item	Description

	• T10 PI: The S-VOL's T10 PI attribute information.
	  ○ Enabled: The S-VOL's T10 PI attribute is enabled.
	  ○ Disabled: The S-VOL's T10 PI attribute is disabled.
	
	For SIz pairs, a hyphen (-) is displayed.
	
	For SIz, Port ID, Host Group Name / iSCSI Target Alias, iSCSI Target Name, LUN ID, and Attribute are not displayed.

Split Type	SI and SIz 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 and SIz 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.
Pool Name (ID)	HTI only. The pool name and identifier.
Mirror Unit	SI and SIz only. The mirror unit number.

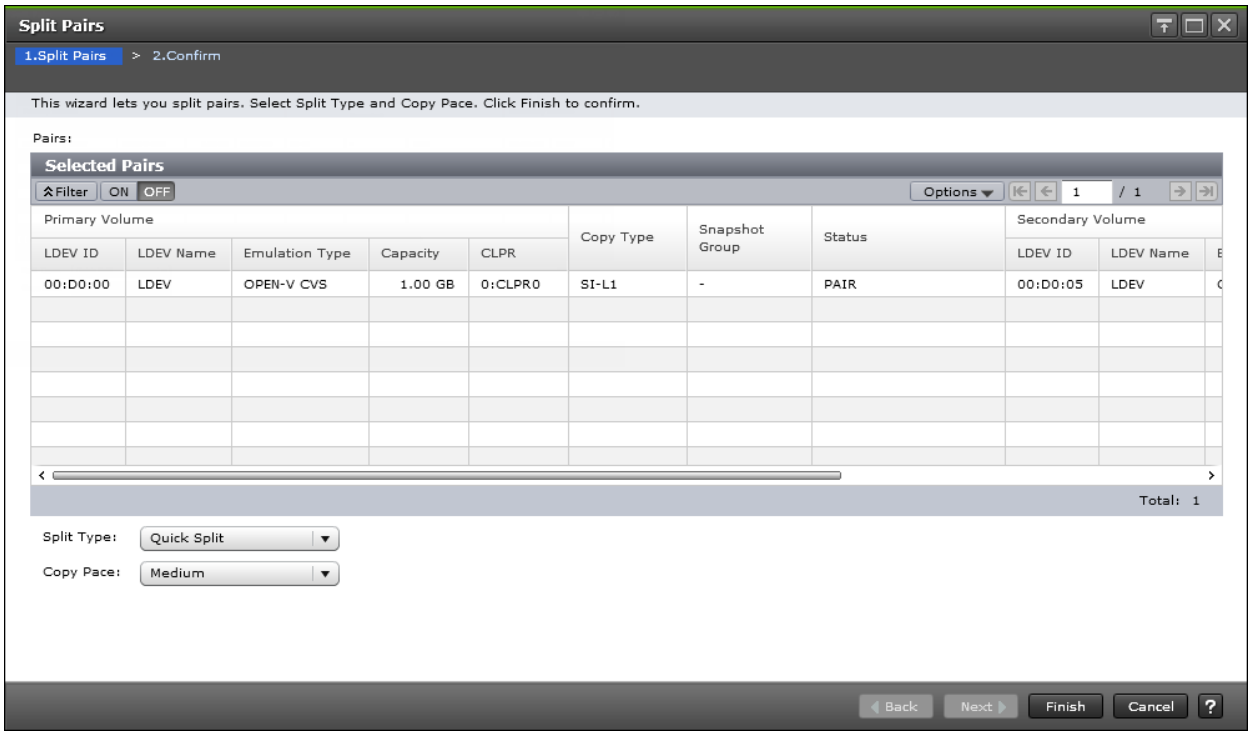
Split Pairs wizard

Use this wizard to split pairs.

Split Pairs window

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

For more information about using this window, see Splitting ShadowImage pairs on page 73.



Selected Pairs table

The following table describes 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 displayed 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. • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • TI: HTI

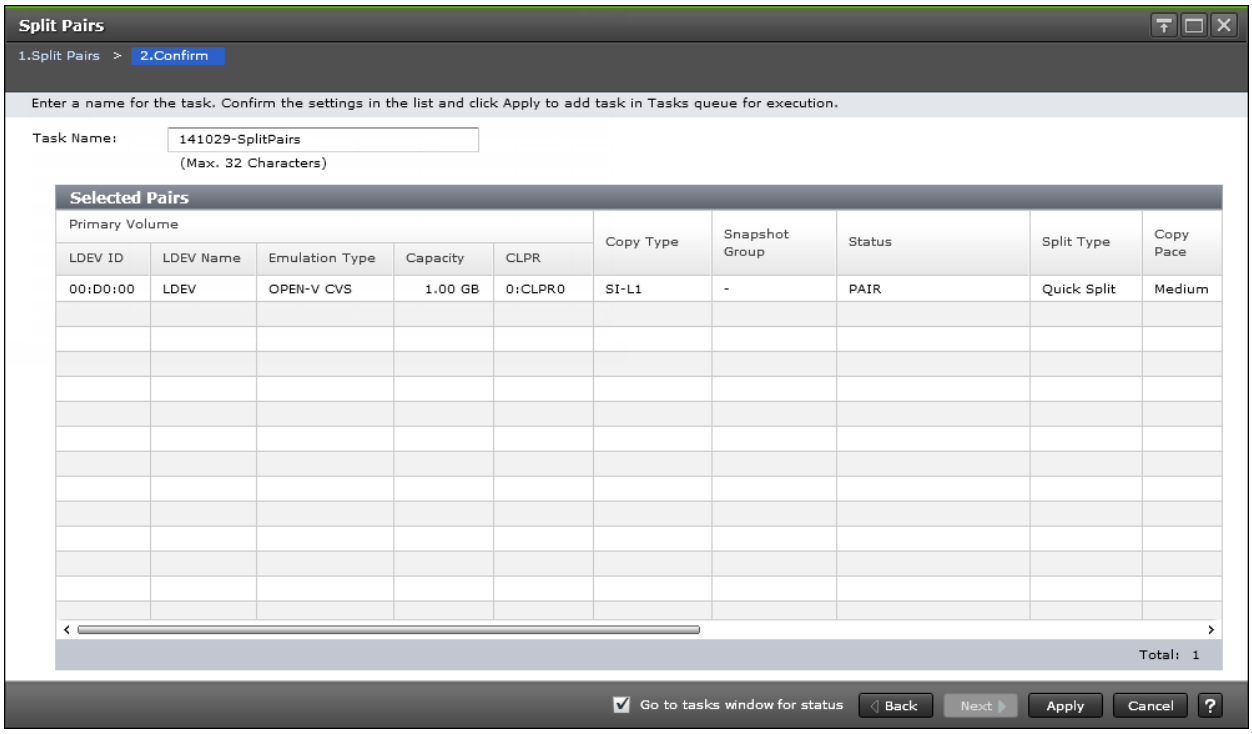
Item	Description
Snapshot Group	HTI only. The snapshot group name. If the pair is not a Thin Image pair, a hyphen appears. If the pair is a Thin Image pair and the snapshot group is not set, a blank appears.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 identifier. For pairs that are not Thin Image, a hyphen appears.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and 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.

Item	Description
	• Steady Split: Splits the pair after all of the differential data is copied.
Copy Pace list	SI and SIz 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. For HTI pairs with the snapshot attribute, you cannot select the copy pace and a hyphen appears.

Split Pairs confirmation window

This window of the Split Pairs wizard contains the Selected Pairs table.

The following image shows this window.



Selected Pairs table

The following table describes 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 • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • TI: HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, a blank is displayed. For non-HTI pairs, a hyphen is displayed.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
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 and SIz 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.

Item	Description
	Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The P-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. A hyphen appears for pairs that are not HTI.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and the mirror unit number.

Resync Pairs wizard

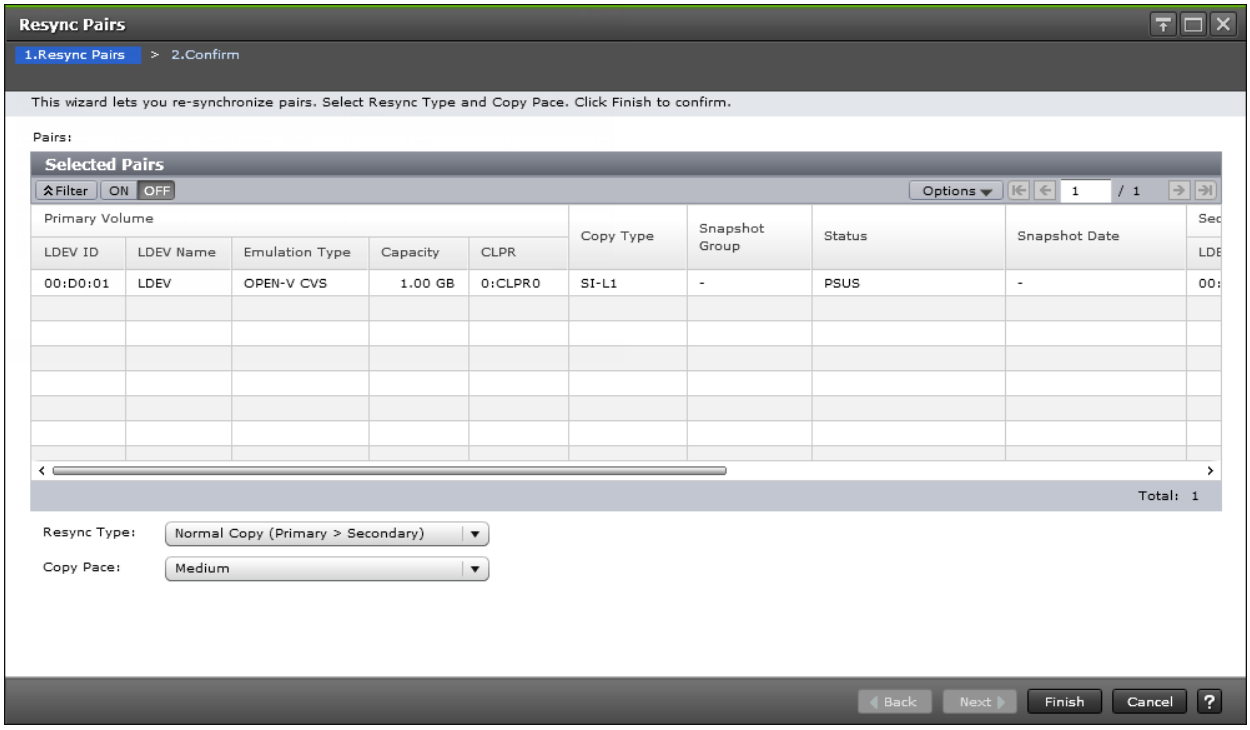
Use this wizard to resynchronize pairs.

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 ShadowImage pairs on page 86.

The following image shows this window.



Selected Pairs table

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

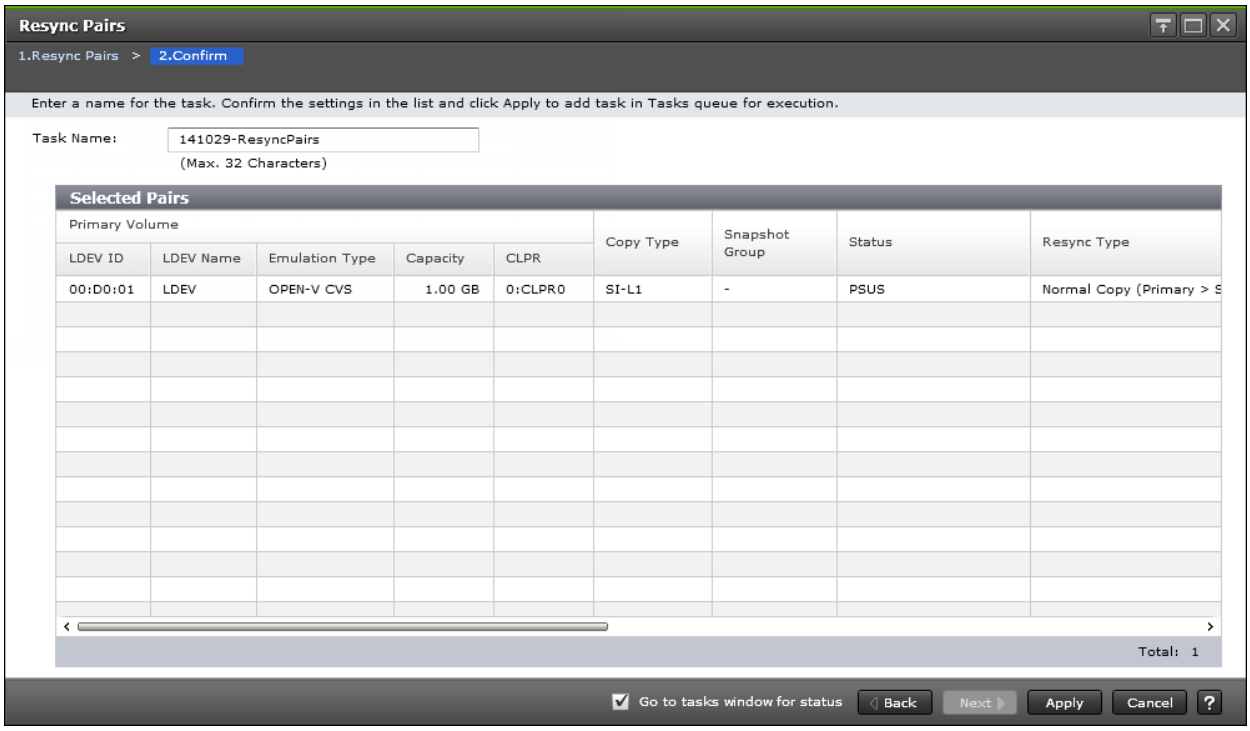
Item	Description
Primary Volume	The P-VOL information. Values: • LDEV ID: The P-VOL's LDEV identifier • LDEV Name: The P-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The P-VOL's attribute. • Capacity: 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • TI: HTI
Snapshot Group	The snapshot group name. If the pair is not a Thin Image pair, a hyphen is displayed.

Item	Description
	If the pair is a Thin Image pair and the snapshot group is not set, a blank is displayed.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Snapshot Date	HTI only. The date and time the snapshot was acquired. If the pair is not a Thin Image pair, a hyphen is displayed.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The S-VOL's attribute. • Capacity: The S-VOL's volume capacity • CLPR: The S-VOL's CLPR ID
Pool Name (ID)	The pool name and identification number. If the pair is not a Thin Image pair, a hyphen is displayed.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and the mirror unit number.
Resync Type	The type of resynchronization. Values: • Normal Copy (Primary > Secondary) (default) 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 SI L2 or SIz pair sharing the P-VOL with an FCv2/FCSE pair.

Item	Description
	• 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 SI or SIz pairs only. • Quick Restore (Secondary > Primary) Swaps the P-VOL and S-VOLs. The update copy operation copies the differential data to the S-VOL. Only SI or SIz 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 ○ SI pairs with HTI pairs in P-VOL and S-VOL ○ SIz pairs sharing the P-VOL with an FCv2/FCSE pair For more information about the methods you can use to resynchronize pairs, see Types of pair resynchronization on page 83.
Copy Pace	SI and SIz only. The system option that determines the rate at which you want the storage system to copy data. A hyphen appears for HTI pairs. 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 describes 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 • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • TI: HTI
Snapshot Group	HTI only. The snapshot group name.

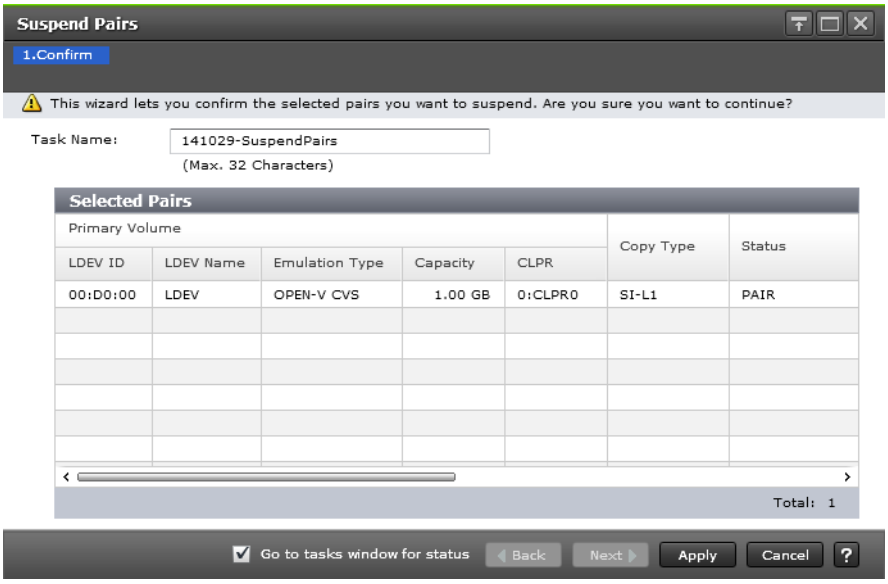
Item	Description
	If you have not assigned the pair to a snapshot group, a blank appears. If the pair is not Thin Image, a hyphen appears. If the pair is Thin Image and the snapshot group is not set, a blank appears.
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Resync Type	The type of resynchronization. Values: • Normal Copy (Primary > Secondary) (default) 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. For more information about the types of resynchronization, see Types of pair resynchronization on page 83.
Copy Pace	SI and SIz 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. • For pairs that are not Thin Image, a hyphen appears.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The P-VOL's attribute. • Capacity: The S-VOL's volume capacity • CLPR: The S-VOL's CLPR ID
Snapshot Date	HTI only.

Item	Description
	The date and time the snapshot was acquired.
Pool Name (ID)	HTI only. The pool name and identifier. For pairs that are not Thin Image, a hyphen appears.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created. Disabled: Cascade pairs cannot be created. For pairs that are not Thin Image, a hyphen appears.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute For pairs that are not Thin Image, a hyphen appears.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and the mirror unit number.

Suspend Pairs window

Use this window to suspend pair creation. This window contains the Selected Pairs table.

For more information about using this window, see Suspending ShadowImage pair creation on page 68.



Selected Pairs table

The following table describes 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 • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz
Status	The status of the pair. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name

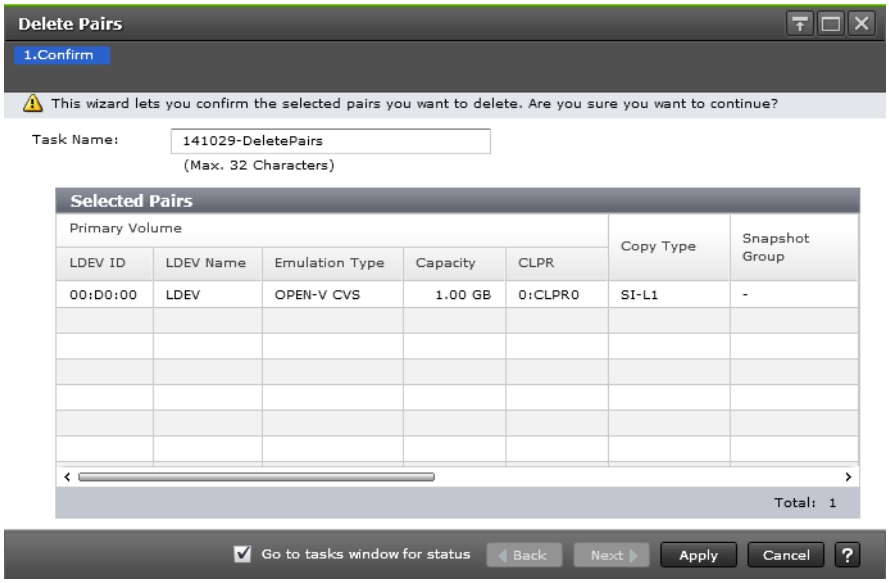
Item	Description
	• (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The S-VOL's attribute. • Capacity: The S-VOL's volume capacity • CLPR: The S-VOL's CLPR ID
Mirror Unit	The mirror unit number.

Delete Pairs window

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

For more information about deleting pairs, see Deleting ShadowImage pairs on page 91.

The following image shows this window.



Selected Pairs table

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

Item	Description
Primary Volume	The P-VOL information. Values:

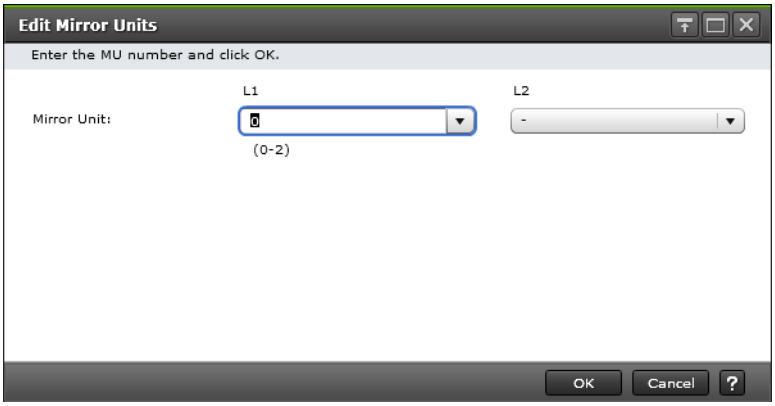
Item	Description
	• LDEV ID: The P-VOL's LDEV identifier • LDEV Name: The P-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The P-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) Attribute: The P-VOL's attribute. • Capacity: The P-VOL's volume capacity • CLPR: The P-VOL's CLPR ID
Copy Type	The types of pairs. Values: • SI-L1: SI L1 • SI-L2: SI L2 • (VSP G1000, G1500, and VSP F1500) SIMF: SIz • TI: HTI
Snapshot Group	HTI only. The snapshot group name. If you have not assigned the pair to a snapshot group, a blank appears. If the pair is not Thin Image, a hyphen appears. If the pair is Thin Image and the snapshot group is not set, a blank appears.
Status	The pair status. For more information about pair status, see Device Manager - Storage Navigator pair status names and descriptions on page 97.
Snapshot Date	HTI only. The date and time the snapshot was acquired. If the pair is not HTI, a hyphen appears.
Secondary Volume	The S-VOL information. Values: • LDEV ID: The S-VOL's LDEV identifier • LDEV Name: The S-VOL's LDEV name • (VSP G1000, G1500, and VSP F1500) Emulation Type: The S-VOL's emulation type. • (VSP Gx00 models and VSP Fx00 models) 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 identifier. For pairs that are not Thin Image, a hyphen appears.
Mirror Unit	The mirror unit number.
Cascade (VSP G1000, G1500, and VSP F1500)	Indicates whether cascade pairs can be created. Enabled: Cascade pairs can be created.

Item	Description
	Disabled: Cascade pairs cannot be created. A hyphen appears for pairs that are not HTI.
Type (VSP G1000, G1500, and VSP F1500)	The pair type. Snapshot: The pair has the snapshot attribute. Clone: The pair has the clone attribute A hyphen appears for pairs that are not HTI.
Topology ID (VSP G1000, G1500, and VSP F1500)	The topology ID, which indicates the layer of the pair based on the mirror unit. The topology ID consists of the LDEV ID of the volume (root volume for Thin Image pairs), which is the base of the target pair, and 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 the dialog box, click Edit Mirror Units in the **Select Secondary Volumes** window of the Create SI Pairs wizard.

The following image shows this dialog box.



The following table describes the items in this dialog box.

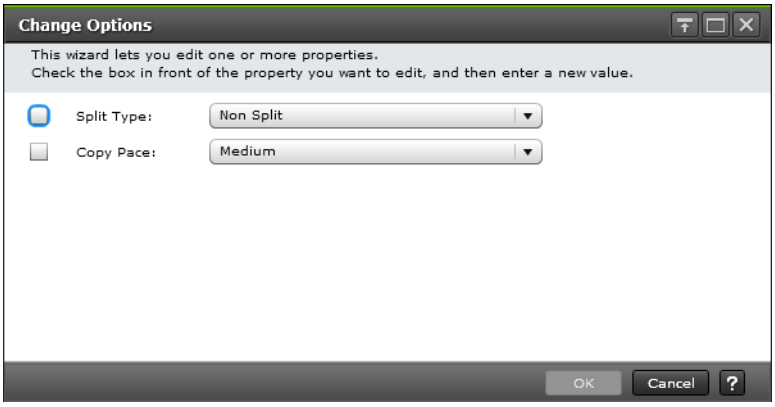
Item	Description
Mirror Unit	The mirror unit number. For SI, the mirror unit assigned to L1 and L2 volumes. For more information about the values you can set for the mirror unit number, see Creating ShadowImage pairs on page 58.

Change Options dialog box

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

For information about how to navigate to this dialog box, see Changing ShadowImage pair options on page 70.

The following image shows this dialog box.



Item	Description
Split Type	The split type. Values: • Non Split (default): 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	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 (default): Average processing speed and host server I/O performance. • Faster: Faster processing speed but slower host server I/O performance.

Edit Local Replica Options wizard

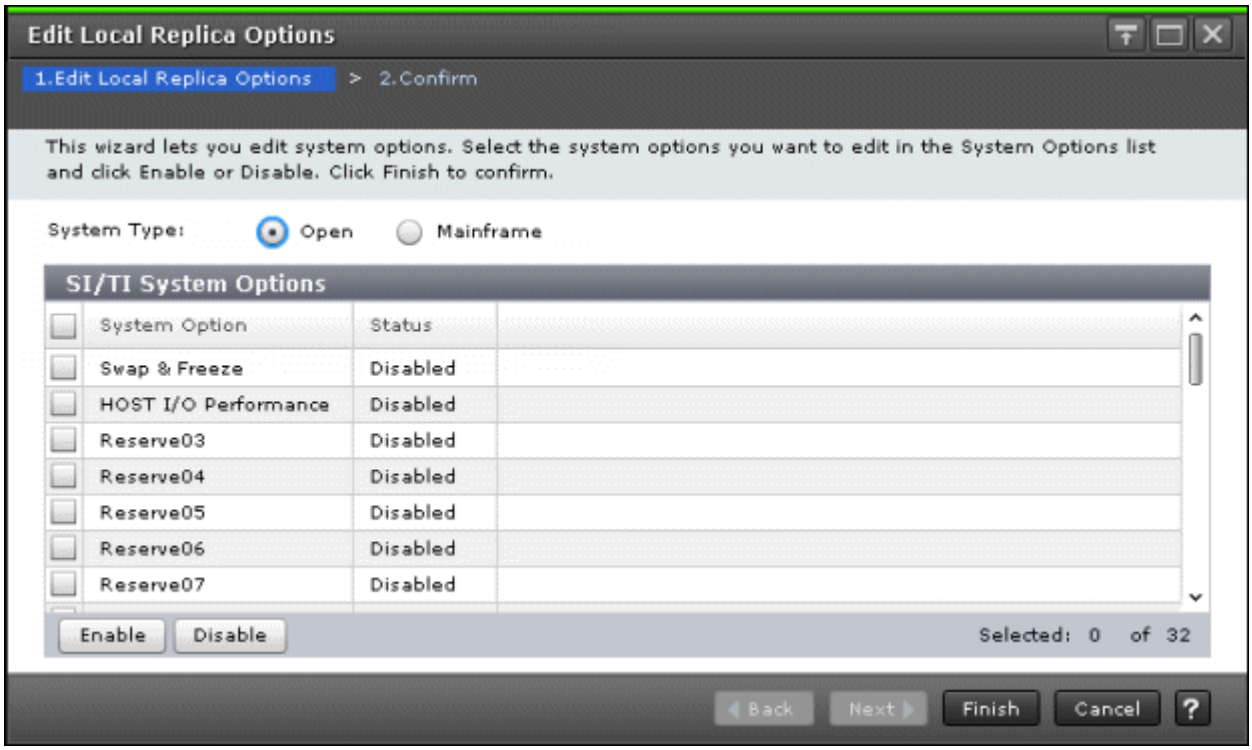
Use this wizard to enable or disable options that affect host server I/O performance.

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 more information, see System options on page 50.

The following image shows this window.



Setting fields (VSP G1000, G1500, and VSP F1500)

The following table describes the setting fields for this window.

Item	Description
System Type	The system type. Values: • Open: SI or HTI

Item	Description
	• Mainframe: SIz, FCv2, or FCSE

System Options table

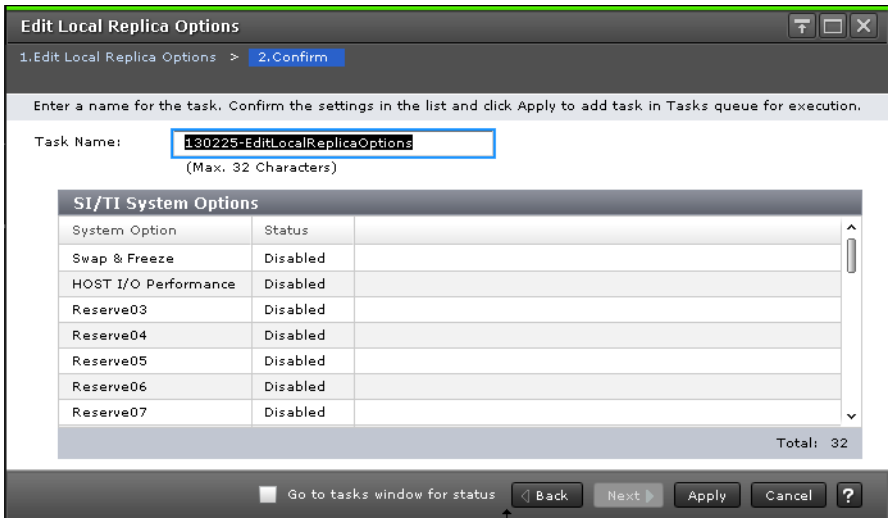
The following table describes the items in this table.

Item	Description
System Option	Displays the system options. The number next to each system option indicates the system option number. Values: • Swap & Freeze (1): Use this option to suppress the storage system's update copy operations. After a Quick Restore and the pair is in DUPLEX status (for SIz, FCv2, or FCSE) or PAIR status (for SI or HTI). The S-VOL (target volume for FCv2 or FCSE) remains unchanged, and differential data is not copied to the new S-VOL. Default status: Disabled • HOST I/O Performance (2): 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 DUPLEX (for SIz, FCv2, or FCSE) or PAIR (for SI or HTI). Processing-suppression/performance-improvement levels: ○ (FCv2, SIz, and FCSE only) FC Slower Copy1 (3): Reduces background copying to one half, thereby improving host I/O response. ○ (FCv2, SIz, and FCSE only) FC Slower Copy2 (4): Reduces background copying to one quarter, thereby improving host I/O response. ○ (FCv2, SIz, and FCSE only) FC Ext. Slower Copy1 (17): When the MP operating ratio of the MP blade or unit to which the source volume or target volume in a Compatible FlashCopy® V2 relationship is allocated exceeds 65%, background copy operations are suppressed, thereby improving the host I/O response. ○ (FCv2, SIz, and FCSE only) FC Ext. Slower Copy2 (18): When the MP operating ratio of the MP blade or unit to which the source volume or target volume in a Compatible FlashCopy® V2 relationship is allocated exceeds 50%, background copy operations are suppressed, thereby improving the host I/O response. ○ Copy Pace Ext. Slower1 (20) Default status: Disabled ○ Copy Pace Ext. Slower2 (21) Default status: Disabled ○ Copy Pace Ext. None (22) 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.

Item	Description
	• Non-disruptive Migration Data Consistency (16) : Use this option to keep the latest data in the source storage system instead of distributing data in both the destination and source storage systems during data migration. • (VSP G1000, G1500, and VSP F1500) ShadowImage/ ShadowImage for Mainframe • Quick/Steady Split Multiplexing (24): Accelerates the resynchronization of ShadowImage pair split. The number of jobs for which copy processing can be executed concurrently of copy processing for each pair is changed from 1 to 24. • Reverse Copy Multiplexing (25): Accelerates the resynchronization of ShadowImage pair split. The number of jobs for which copy processing can be executed concurrently of copy processing for each pair is changed from 1 to 24. For more information about the system options, see System options on page 50.
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 describes 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

#

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 primary volume at the local site to the UR master journal volume at an intermediate site, then replicated to the UR secondary volume at the remote site. Since this configuration side-steps the TC secondary volume 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 (for example, port, target ID, or 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)*.

array

See disk array

array group

A set of drives in a storage system that have the same capacity and are treated as one RAID unit. An array group contains user data and parity information, which ensures user data integrity in the event of a disk drive failure in the array group.

audit log

Files that store a history of the operations performed from Device Manager - Storage Navigator and the commands that the storage system received from hosts, and data encryption operations.

B

blade

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

C

C/T

See consistency time.

cache logical partition (CLPR)

Consists of virtual cache memory that is set up to be allocated to different hosts in contention for cache memory.

capacity

The amount of data storage space available on a physical storage device, usually measured in bytes (MB, GB, TB, and so on).

cascade function

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

cascaded pair

A ShadowImage pair in a cascade configuration. See also *cascade configuration*.

CCI

Command Control Interface

channel adapter (CHA)

The hardware component that processes channel commands from hosts and manages host access to cache.

CLPR

See *cache logical partition (CLPR)*.

cluster

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

command device

A dedicated logical volume used only by Command Control Interface and Business Continuity Manager to interface with the storage system. Can be shared by several hosts.

configuration definition file

A text file that defines the configuration, parameters, and options of Command Control Interface (CCI) operations. It also defines the connected hosts and the volumes and groups known to the CCI instance.

consistency group (CTG)

A group of copy relationships between virtual disks that are managed as a single entity. A group of pairs on which copy operations are performed simultaneously. When a CTG ID is specified for a specific operation, the operation is performed simultaneously on all pairs belonging to the CTG while keeping data consistency.

consistency time (C/T)

A replication policy or threshold that indicates the amount of time that a replication target (volume, journal group, or extended consistency group, for example) is allowed to lag behind replication of the master, or source, volume.

copy pair

A pair of volumes in which one volume contains original data and the other volume contains the copy of the original. Copy operations can be synchronous or asynchronous, and the volumes of the copy pair can be located in the same storage system (local copy) or in different storage systems (remote copy).

A copy pair can also be called a volume pair, or just pair. A pair created by Compatible FlashCopy® is called a relationship.

D

data consistency

When the data on the secondary volume is identical to the data on the primary volume.

data path

The physical paths used by primary storage systems to communicate with secondary storage systems in a remote replication environment.

data pool

One or more logical volumes designated to temporarily store original data. When a snapshot is taken of a primary volume, the data pool is used if a data block in the primary volume is to be updated. The original snapshot of the volume is maintained by storing the changeable data blocks in the data pool.

delta resync

A disaster recovery solution in which TrueCopy and Universal Replicator systems are configured to provide a quick recovery using only differential data stored at an intermediate site.

device

A physical or logical unit with a specific function.

device emulation

Indicates the type of logical volume. Mainframe device emulation types provide logical volumes of fixed size, called logical volume images (LVIs), which contain EBCDIC data in CKD format. Typical mainframe device emulation types include 3390-9 and 3390-M. Open-systems device emulation types provide logical volumes of variable size, called logical units (LUs), that contain ASCII data in FBA format. The typical open-systems device emulation type is OPEN-V.

differential data

Changed data in the primary volume not yet reflected in the secondary volume of a copy pair.

disaster recovery

A set of procedures to recover critical application data and processing after a disaster or other failure.

disk adapter (DKA)

The hardware component that controls the transfer of data between the drives and cache. A DKA feature consists of a pair of boards.

disk controller (DKC)

The hardware component that manages front-end and back-end storage operations. The term DKC can refer to the entire storage system or to the controller components.

DKA

See *disk adapter (DKA)*.

DKC

See *disk controller (DKC)*.

DKCMAIN

disk controller main. Refers to the microcode or software for the storage system.

DP-VOL

Dynamic Provisioning virtual volume. A virtual volume that has no memory space that is used by Dynamic Provisioning.

DRU

Hitachi Data Retention Utility

Dynamic Provisioning (HDP)

An approach to managing storage. Instead of "reserving" a fixed amount of storage, it removes capacity from the available pool when data is actually written to disk.

E

emulation

The operation of a storage system to emulate the characteristics of a different storage system. For device emulation, the mainframe host recognizes the logical devices on the storage system as 3390-x devices. For controller emulation, the mainframe host recognizes the control units (CUs) on the storage system as 2105 or 2107 controllers.

The storage system operates the same as the storage system being emulated.

extended consistency group (EXCTG)

Universal Replicator for Mainframe journals in which data consistency is ensured. Journal registration in an EXCTG is required if you are performing copy operations between multiple primary and secondary systems.

external volume

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

F

FC

Fibre Channel; FlashCopy

free capacity

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

H

HDP

Hitachi Dynamic Provisioning. See *Dynamic Provisioning*.

HDT

Hitachi Dynamic Tiering

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

Operational modes that provide enhanced compatibility with supported host platforms. Used with Fibre Channel ports on RAID storage systems.

I

I/O

input/output

I/O mode

I/O actions on the primary volume and secondary volume of a global-active device pair.

in-system replication

The original data volume and its copy are located in the same storage system. ShadowImage in-system replication provides duplication of logical volumes; Thin Image in-system replication provides "snapshots" of logical volumes that are stored and managed as virtual volumes (V-VOLs).

See also *remote replication*.

initial copy

An initial copy operation is performed when a copy pair is created. Data on the primary volume is copied to the secondary volume before any updates are processed.

internal volume

A logical volume whose data resides on drives that are physically located within the storage system. See also *external volume*.

J

JNLG

See *journal group (JNLG)*.

journal group (JNLG)

In a Universal Replicator system, journal groups manage data consistency between multiple primary volumes and secondary volumes. See also *consistency group (CTG)*.

journal volume

A volume that records and stores a log of all events that take place in another volume. In the event of a system crash, the journal volume logs are used to restore lost data and maintain data integrity.

In Universal Replicator, differential data is held in journal volumes until you copy it to the S-VOL.

L

LBA

logical block address

LDEV

See logical device.

LDKC

See *logical disk controller (LDKC)*.

leaf volume

A layer-2 secondary volume in a ShadowImage cascade configuration. The primary volume of a layer-2 pair is called a node volume. See also *cascade configuration*.

license key

A specific set of characters that unlocks an application and allows it to be used.

local copy

See *in-system replication*.

logical device (LDEV)

An individual logical device (on multiple drives in a RAID configuration) in the storage system. An LDEV might or might not contain any data and might or miight not be defined to any hosts. Each LDEV has a unique identifier, or address, within the storage system. The identifier is composed of the logical disk controller (LDKC) number, control unit (CU)

number, and LDEV number. The LDEV IDs within a storage system do not change.

An LDEV formatted for use by mainframe hosts is called a logical volume image (LVI). An LDEV formatted for use by open-system hosts is called a logical unit (LU).

logical disk controller (LDKC)

A group of 255 control unit (CU) images in the RAID storage system that is controlled by a virtual (logical) storage system within the single physical storage system. For example, the Hitachi Universal Storage Platform V storage system supports two LDKCs, LDKC 00 and LDKC 01.

logical unit (LU)

A volume, or LDEV, created in an open storage system, or configured for use by an open-systems host, for example, OPEN-V.

logical unit (LU) path

The path between an open-systems host and a logical unit.

logical unit number (LUN)

A unique management number that identifies a logical unit (LU) in a storage system. A logical unit can be an end user, a file, a disk drive, a port, a host group that is assigned to a port, an application, or virtual partitions (or volumes) of a RAID set.

Logical unit numbers (LUNs) are used in SCSI protocols to differentiate disk drives in a common SCSI target device, such as a storage system. An open-systems host uses a LUN to access a particular LU.

logical volume (LV)

See *volume*.

logical volume image (LVI)

An LDEV that is configured for use by mainframe hosts (for example, 3390-3).

LU

See *logical unit (LU)*.

LV

logical volume. See *volume*.

M

main control unit (MCU)

A storage system at a primary, or main, site that contains primary volumes of remote replication pairs. The main control unit (MCU) is configured to send remote I/O instructions to one or more storage systems at the secondary, or remote, site, called remote control units (RCUs). RCUs contain the secondary volumes of the remote replication pairs. See also remote control unit (RCU).

main site

See *primary site*.

Mb

megabit

MB

megabyte

Mbps

megabits per second

MBps

megabytes per second

MCU

See main control unit.

MF, M/F

mainframe

MIH

missing interrupt handler

mirror

In Universal Replicator, each pair relationship in and between journal groups is called a "mirror." Each pair is assigned a mirror ID when it is created. The mirror ID identifies individual pair relationships between journal groups.

modify mode

The mode of operation of Device Manager - Storage Navigator that allows changes to the storage system configuration. See also *view mode*.

MP

microprocessor

MU

mirror unit

N

node volume

A layer-2 primary volume in a ShadowImage cascade configuration. The secondary volume of a layer-2 pair is called a leaf volume. See also *cascade configuration*.

NUM

number

O

OPEN-V

A logical unit (LU) of user-defined size for use by open-systems hosts.

OPEN-x

A logical unit (LU) of fixed size (for example, OPEN-3, OPEN-9) that is used primarily for sharing data between mainframe and open-systems hosts using Hitachi Cross-OS File Exchange.

P

P-VOL

See primary volume.

pair

Two logical volumes in a replication relationship in which one volume contains original data to be copied and the other volume contains the copy of the original data. The copy operations can be synchronous or asynchronous, and the pair volumes can be located in the same storage system (in-system replication) or in different storage systems (remote replication).

pair status

Indicates the condition of a copy pair. A pair must have a specific status for specific operations. When a pair operation completes, the status of the pair changes to a different status determined by the type of operation.

parity group

See *RAID group*.

PG

parity group. See *RAID group*.

pool

A set of volumes that are reserved for storing Hitachi Thin Image data or Dynamic Provisioning write data.

pool volume (pool-VOL)

A logical volume that is reserved for storing snapshot data for Thin Image operations or write data for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, or active flash for mainframe.

A logical volume that is reserved for storing snapshot data for Thin Image operations or write data for Dynamic Provisioning, Dynamic Tiering, or active flash.

PPRC

Peer-to-Peer Remote Copy

primary site

The physical location of a storage system that contains original data to be replicated and that is connected to one or more storage systems at a remote or secondary site via remote copy connections. A primary site can also be called a “main site” or “local site”.

The term "primary site" is also used for host failover operations. In that case, the primary site is the location of the host on which the production applications are running, and the secondary site is the location of the host on which the backup applications that run when the applications at the primary site have failed.

primary volume (P-VOL)

The volume in a copy pair that contains the original data to be replicated. The data on the P-VOL is duplicated synchronously or asynchronously on the secondary volume (S-VOL).

The following Hitachi products use the term P-VOL: Thin Image, Copy-on-Write Snapshot, ShadowImage, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, and High Availability Manager.

See also *secondary volume*.

R

R/W

read/write

RAID

redundant array of inexpensive disks

RAID group

A redundant array of inexpensive drives (RAID) that have the same capacity and are treated as one group for data storage and recovery. A RAID group contains both user data and parity information, which allows the user data to be accessed in the event that one or more of the drives within the RAID group are not available. The RAID level of a RAID group determines the number of data drives and parity drives and how the data is "striped" across the drives. For RAID1, user data is duplicated within the RAID group, so there is no parity data for RAID1 RAID groups.

A RAID group can also be called an array group or a parity group.

RAID level

The type of RAID implementation. RAID levels include RAID 0, RAID 1, RAID 2, RAID 3, RAID 4, RAID 5 and RAID 6.

RCU

See *remote control unit (RCU)*.

remote control unit (RCU)

A storage system at a secondary, or remote, site that is configured to receive remote I/O instructions from one or more storage systems at the primary, or main, site. See also main control unit.

remote site

See *secondary site*.

resync

resynchronize

RMI

Remote Method Invocation

root volume

A layer-1 primary volume in a ShadowImage cascade configuration. The secondary volume of a layer-1 pair is called a node volume. See also *cascade configuration*.

RTC

real-time clock

RTO

recovery time objective

S

S#

serial number

S/N

serial number

s/w

software

SC

storage control

SCDS

source control dataset

SCI

state change interrupt

scripting

The use of command line scripts, or spreadsheets downloaded by Configuration File Loader to automate storage management operations.

SCSI

Small Computer System Interface. A standard that defines I/O buses primarily intended for connecting storage systems and devices to hosts through host bus adapters.

secondary site

The physical location of the storage system that contains the primary volumes of remote replication pairs at the primary site. The storage system at the secondary site is connected to the storage system at the primary site via remote copy connections. The secondary site can also be called the "remote site". See also *primary site*.

secondary volume (S-VOL)

The volume in a copy pair that is the copy of the original data on the primary volume (P-VOL). The following Hitachi products use the term "secondary volume": Thin Image, Copy-on-Write Snapshot, ShadowImage, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, and High Availability Manager.

See also *primary volume*.

service information message (SIM)

Messages generated by a RAID storage system when it detects an error or service requirement. SIMs are reported to hosts and displayed on Device Manager - Storage Navigator.

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

SIz

Hitachi ShadowImage® for Mainframe

size

Generally refers to the storage capacity of a memory module or cache. Not usually used for storage of data on disk or flash drives.

SLU

See *subsidiary logical unit*.

SM

shared memory

snapshot

A point-in-time virtual copy of a Hitachi Thin Image primary volume (P-VOL). The snapshot is maintained when the P-VOL is updated by storing pre-updated data (snapshot data) in a data pool.

SNMP

See *Simple Network Management Protocol*.

space

Generally refers to the storage capacity of a data drive (for example, hard disk drive, flash drive).

SSB

sense byte

SSID

See *storage subsystem identifier*.

storage subsystem identifier (SSID)

In a mainframe environment, SSIDs are used for reporting information from the control unit (CU) image to the mainframe operating system. An SSID is assigned to each group of 64 or 256 volumes to define one or four SSIDs per CU image. The user-specified SSIDs are assigned during storage system installation and must be unique to all connected host operating environments.

subsidiary logical unit (SLU)

An LU used for the conglomerate LUN structure, a SCSI architecture model. An SLU is an LU that stores actual data. You can use a DP-VOL or snapshot data (or a V-VOL allocated to snapshot data) as an SLU. All host access to SLUs is through the administrative logical unit (ALU). An SLU is called a virtual volume (VVol) in vSphere. See *administrative logical unit*.

T

T10 PI

See *T10 Protection Information*.

TC

Hitachi TrueCopy®

TCz

Hitachi TrueCopy® for Mainframe

total capacity

The aggregate amount of storage space in a data storage system.

U

UR

Hitachi Universal Replicator

URz

Hitachi Universal Replicator software for Mainframe

V

V

version; variable length and de-blocking (mainframe record format)

V-VOL

See *virtual volume*.

V-VOL management area

Contains the pool management block and pool association information for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, and Dynamic Tiering for Mainframe, and Thin Image operations. The V-VOL management area is created automatically when additional shared memory is installed.

VB

variable length and blocking (mainframe record format)

view mode

The mode of operation of Device Manager - Storage Navigator that allows viewing only of the storage system configuration. See also *modify mode*.

virtual device (VDEV)

A group of logical devices (LDEVs) in a RAID group. A VDEV typically consists of some fixed volumes (FVs) and some free space. The number of fixed volumes is determined by the RAID level and device emulation type.

Virtual LVI/LUN

A custom-size volume whose size is defined by the user using Virtual LVI/LUN. Also called a custom volume (CV).

virtual volume (V-VOL)

A logical volume in a storage system that has no physical storage space. Hitachi Thin Image uses V-VOLs as secondary volumes of copy pairs. In Hitachi Dynamic Provisioning, V-VOLs are referred to as DP-VOLs.

VOL, vol

See *volume (VOL or vol)*.

volume (VOL or vol)

A logical device (LDEV), or a set of concatenated LDEVs in the case of LUSE, that has been defined to one or more hosts as a single data storage unit. An open-systems volume is called a logical unit (LU), and a mainframe volume is called a logical volume image (LVI).

volume pair

See *copy pair*.

W

write order

The order of write I/Os to the primary volume (P-VOL) of a copy pair. The data on the secondary volume (S-VOL) is updated in the same order as on the P-VOL, particularly when there are multiple write operations in one update cycle. This feature maintains data consistency at the secondary volume. Update records are sorted in the cache at the remote system to ensure proper write sequencing.

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Hitachi Data Systems

Corporate Headquarters
2845 Lafayette Street
Santa Clara, California 95050-2639
U.S.A.
www.hds.com

Regional Contact Information

Americas
+1 408 970 1000
info@hds.com

Europe, Middle East, and Africa
+44 (0) 1753 618000
info.emea@hds.com

Asia Pacific
+852 3189 7900
hds.marketing.apac@hds.com

Contact Us
www.hds.com/en-us/contact.html

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