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Hitachi Virtual Storage Platform

Hitachi ShadowImage® User Guide

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MK-90RD7024-13

Contents

Preface

This document provides information for setting up and operating Hitachi ShadowImage® on the Hitachi Virtual Storage Platform (VSP) storage system.

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

This preface includes the following information:

Intended audience

This document is intended for system administrators, HDS representatives, and authorized service providers who are involved in installing, configuring, and operating the Hitachi Virtual Storage Platform storage system.

This document assumes the following:

- The user has a background in data processing and understands RAID storage systems and their basic functions.
- The user is familiar with the Hitachi Virtual Storage Platform storage system and has read the *Hitachi Virtual Storage Platform User and Reference Guide*.
- The user is familiar with the Storage Navigator software for VSP and has read the *Hitachi Storage Navigator User Guide*.

Product version

This document revision applies to Hitachi Virtual Storage Platform microcode 70-06-2*x* or later.

Document revision level

Revision	Date	Description
MK-90RD7024-00	October 2010	Initial release
MK-90RD7024-01	December 2010	Supersedes and replaces MK-90RD7024-00.
MK-90RD7024-02	January 2011	Supersedes and replaces MK-90RD7024-01.
MK-90RD7024-03	April 2011	Supersedes and replaces MK-90RD7024-02.
MK-90RD7024-04	August 2011	Supersedes and replaces MK-90RD7024-03.
MK-90RD7024-05	November 2011	Supersedes and replaces MK-90RD7024-04.
MK-90RD7024-06	March 2012	Supersedes and replaces MK-90RD7024-05.
MK-90RD7024-07	June 2012	Supersedes and replaces MK-90RD7024-06.
MK-90RD7024-08	November 2012	Supersedes and replaces MK-90RD7024-07.
MK-90RD7024-09	January 2013	Supersedes and replaces MK-90RD7024-08.
MK-90RD7024-10	July 2013	Supersedes and replaces MK-90RD7024-09
MK-90RD7024-11	April 2014	Supersedes and replaces MK-90RD7024-10
MK-90RD7024-12	September 2014	Supersedes and replaces MK-90RD7024-11
MK-90RD7024-13	March 2016	Supersedes and replaces MK-90RD7024-12.

Changes in this revision

- Updated System requirements on page 2-2.
- Updated prerequisites in Pair creation on page 5-2.

Referenced documents

Hitachi Virtual Storage Platform documentation:

- *Command Control Interface User and Reference Guide*, MK-90RD7010
- *Hitachi Copy-on-Write Snapshot User Guide*, MK-90RD7013
- *Hitachi Compatible FlashCopy® V2 User Guide*, MK-90RD7017
- *Hitachi Virtual Storage Platform Performance Guide*, MK-90RD7020
- *Hitachi Virtual Storage Platform Provisioning Guide for Open Systems*, MK-90RD7022
- *Hitachi TrueCopy® User Guide*, MK-90RD7029
- *Hitachi Universal Replicator User Guide*, MK-90RD7032
- *Hitachi Thin Image User Guide*, MK-90RD7179
- *Business Continuity Manager User Guide*, MK-94RD247

Document organization

The following table provides an overview of the contents and organization of this document. Click the chapter title in the left column to go to that chapter. The first page of each chapter provides links to the topics in that chapter.

Chapter/Appendix Title	Description
Chapter 1, ShadowImage overview on page 1-1	Provides an overview of Hitachi ShadowImage.
Chapter 2, Requirements and planning on page 2-1	Describes system requirements and recommendations for planning a ShadowImage system.
Chapter 3, Sharing ShadowImage volumes on page 3-1	Discusses requirements, recommendations, and restrictions for using ShadowImage with other Hitachi software.
Chapter 4, Performing configuration operations on page 4-1	Provides information and instructions for configuring a ShadowImage system.
Chapter 5, Performing pair operations on page 5-1	Provides instructions for performing ShadowImage pair operations.
Chapter 6, Monitoring and maintaining the system on page 6-1	Provides information and instructions for checking ShadowImage's operational status.
Chapter 7, Troubleshooting on page 7-1	Provides information and instructions for troubleshooting ShadowImage.

Chapter/Appendix Title	Description
Appendix A, Interface support for SI operations and options on page A-1	Lists operations and the user interfaces that support them.
Appendix B, ShadowImage GUI reference on page B-1	Describes the ShadowImage windows and dialog boxes in Storage Navigator.
Appendix C, Configuration operations (secondary window) on page C-1	Provides information and instructions for configuring a ShadowImage system using the previous Storage Navigator GUI, which is shown in a secondary window.
Appendix D, Pair operations (secondary window) on page D-1	Provides information and instructions for performing ShadowImage operations using the previous Storage Navigator GUI, which is shown in a secondary window.
Appendix E, Monitoring and maintaining the system (secondary window) on page E-1	Provides information and instructions for checking ShadowImage's operational status using the previous Storage Navigator GUI, which is shown in a secondary window.
Appendix F, ShadowImage GUI reference (secondary window) on page F-1	Describes the ShadowImage windows and dialog boxes in Storage Navigator as seen in the previous Storage Navigator GUI, which is shown in a secondary window.

Document conventions

This document uses the following typographic conventions:

Convention	Description
Bold	Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click **OK**.
Italic	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy *source-file target-file* **Note:** Angled brackets (< >) are also used to indicate variables.
`screen/code`	Indicates text that is shown on screen or entered by the user. Example: `# pairdisplay -g oradb`
< > angled brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: `# pairdisplay -g <group>` **Note:** Italic font is also used to indicate variables.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing.

Convention	Description
	{ a | b } indicates that you must choose either a or b.
Underline	Indicates the default value. Example: [a | b]

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

Icon	Meaning	Description
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Note	Calls attention to important and/or additional information.
	Caution	Warns the user of adverse conditions and/or consequences, such as disruptive operations.
	WARNING	Warns the user of severe conditions and/or consequences, such as destructive operations.

Convention for storage capacity values

Physical storage capacity values, such as disk drive capacity, are calculated based on the following values:

Physical capacity unit	Value
1 KB	1,000 bytes
1 MB	$1{,}000^2$ bytes
1 GB	$1{,}000^3$ bytes
1 TB	$1{,}000^4$ bytes
1 PB	$1{,}000^5$ bytes
1 EB	$1{,}000^6$ bytes

Logical storage capacity values, such as logical device capacity, are calculated based on the following values:

Logical capacity unit	Value
1 KB	1,024 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

Logical capacity unit	Value
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes
1 block	512 bytes

Accessing product documentation

The Hitachi Virtual Storage Platform user documentation is available on the HDS Support Portal: https://portal.hds.com. Please check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

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://portal.hds.com

Comments

Please send us your comments on this document: doc.comments@hds.com. Include the document title, number, and revision, and refer to specific sections and paragraphs whenever possible. All comments become the property of HDS.

Thank you!

1

ShadowImage overview

ShadowImage (SI) uses local mirroring technology to create and maintain a full copy of any volume in the storage system.

With SI software you can create one or more copies of a data volume within the same storage system. You can use SI copies as backups, with secondary host applications, for data mining, for testing, and other uses — while business operations continue without stopping host application I/O to the production volume.

This guide provides instructions for planning, configuring, operating, maintaining, and troubleshooting an SI system.

- ☐ 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 P-VOL volume (P-VOL).
- Identify another volume to contain the copy. This becomes the secondary volume (S-VOL).
- Associate the P-VOL and S-VOLs.
- Perform the initial copy.

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

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

- S-VOL data is consistent and usable. It is available for read/write access by secondary host applications.
- Changes to the P-VOL and S-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, as circumstance dictates.

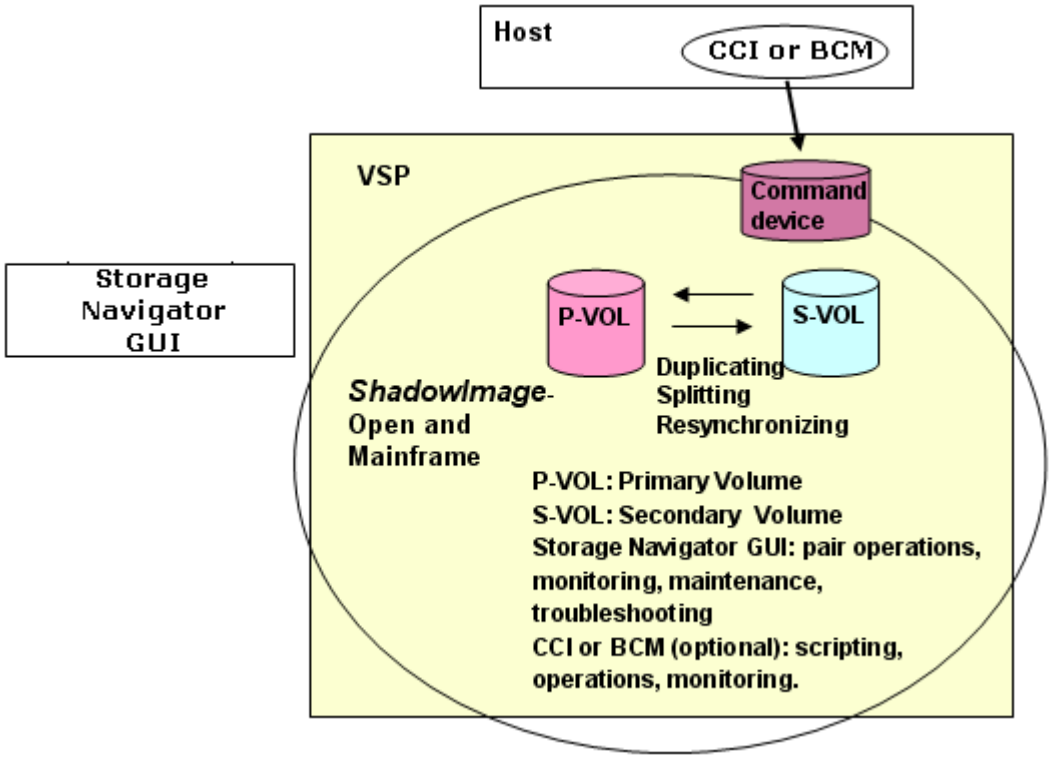
Note: In Storage Navigator (SN), the source volume is called "P-VOL" and the destination volume is called "S-VOL".

Hardware and software components

A typical configuration consists of a Hitachi Virtual Storage Platform storage system, a host connected to the storage system, SI software, a P-VOL, a S-VOL or volumes, and interface tools for operating SI.

Interface tools include the SN graphical user interface (GUI) and Command Control Interface software (CCI).

The following shows a typical configuration.



Volume pairs (primary volumes and secondary volumes)

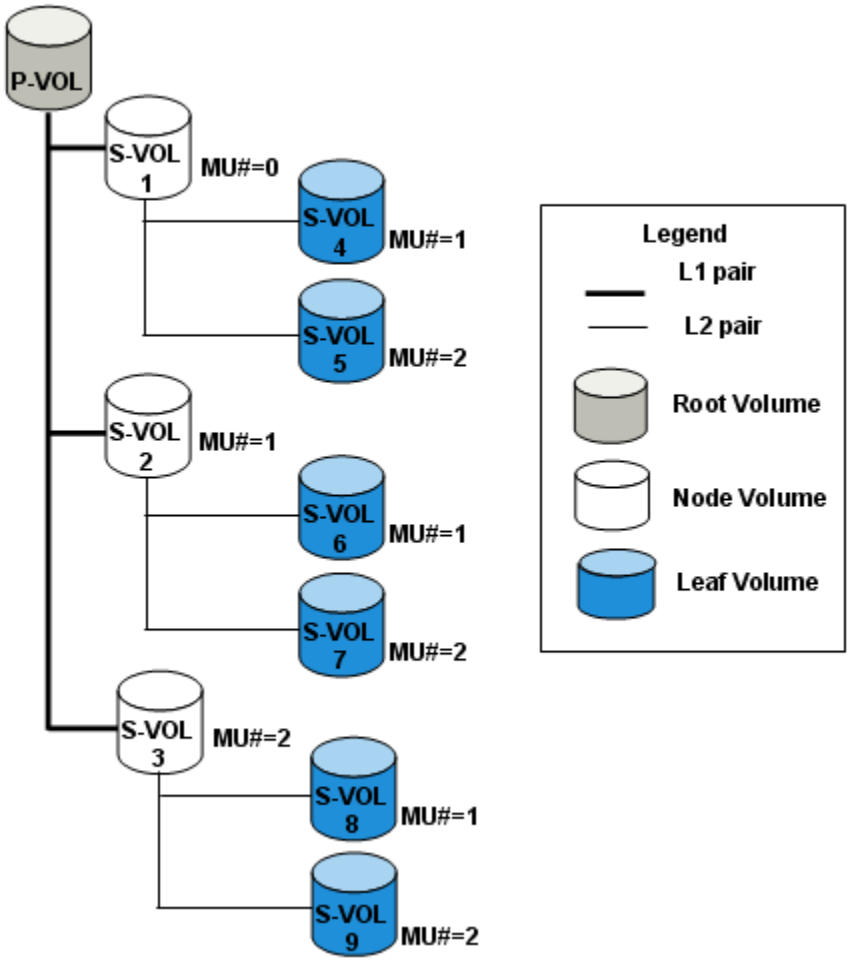
A pair consists of the P-VOL and secondary data volume. Each P-VOL can be paired with up to three S-VOLs. Thus, you can create three pairs using one P-VOL.

During most operations, the P-VOL remains available to the host for I/O operations. Updating the P-VOL regularly copies the new data, the differential data, to the S-VOL. Because S-VOLs are updated asynchronously, the P-VOL and S-VOLs may not be identical. S-VOLs become available for host access only after you split or delete the pair, and all updates to the S-VOL complete only when the pair is split. If the pair is deleted, pending updates to the S-VOL are not completed.

Cascaded pairs

You can pair each SI S-VOL with a second level S-VOL. You can pair a first level (L1) S-VOL with two second level (L2) S-VOLs. Thus, up to nine S-VOLs can be available for one P-VOL.

L2 pairs are referred to as “cascaded pairs”.



- The P-VOL of the L1 pair is the "root volume".
- An S-VOL of the L1 pair is a "node volume".
- A P-VOL of an L2 pair is an L1 S-VOL — a node volume.
- An S-VOL of an L2 pair is a "leaf volume".

You can use SI cascaded pairs as TrueCopy (TC) pairs. A distinction is not made in TC between node and leaf volumes. Both are considered as S-VOLs.

Storage Navigator GUI

With the SN GUI, you:

- Enable the SI license key.
- Configure the storage system.
- Perform copy operations.
- Perform monitoring, maintenance, and troubleshooting.

You perform SI operations using the new version of the SN GUI. You are also able to use the previous version, if you choose to do so. Procedures describing operations in the previous version are found in the appendixes.

The SN GUI communicates with the storage system's service processor (SVP) over defined TCP/IP connections. SN is LAN-attached to the storage system.

Command Control Interface and consistency groups

With Command Control Interface (CCI) you use a command line interface for running most of the same operations as are performed with SN. Pair commands are issued directly from the host. Commands can also be automated using scripts.

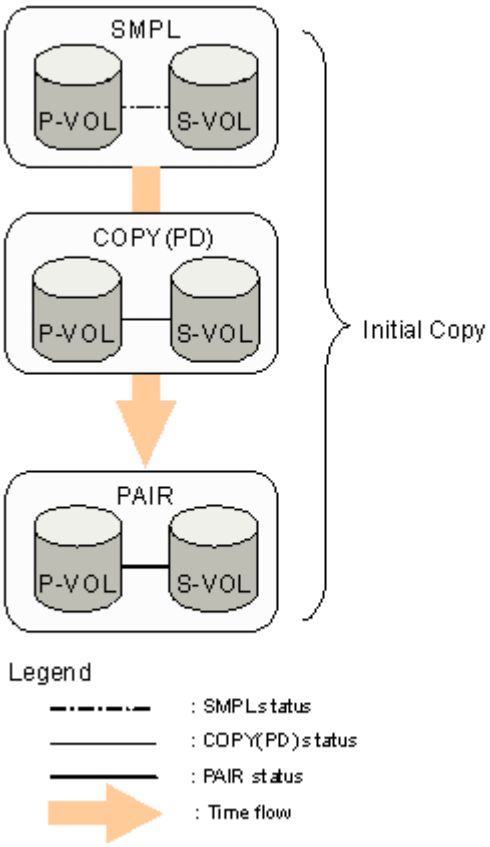
Using CCI, you can specify multiple pairs as a consistency group. With a consistency group, you perform tasks on multiple pairs at the same time. This also changes the pair status for all the pairs in a group.

Initial and update copy operations

Creating a pair causes the storage system to create an initial copy. The storage system asynchronously copies updates received by the P-VOL to the S-VOL.

Initial copy

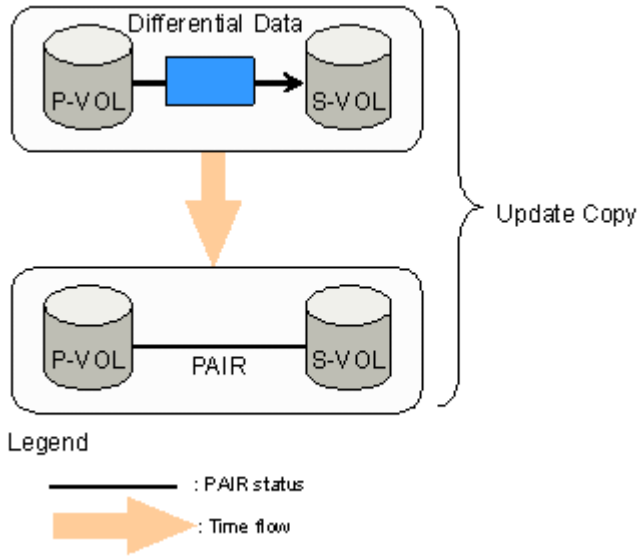
Creating a pair causes the storage system to start the initial copy and copies all the data in the P-VOL to the S-VOL. Before the pair is created, the pair's status is "SMPL". While the initial copy is in progress, the status is "COPY(PD)/COPY". When the initial copy is complete, the volumes are paired ("PAIR" status).



A P-VOL continues receiving updates from the host during the initial copy. When the initial copy is completed, update copy operations start.

Update copy

I/O sent to the P-VOL that is paired ("PAIR" status) is marked as differential data and stored in bitmaps for transfer to the S-VOL. Update copy operations are performed periodically by the storage system. 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.



Though the volumes are paired ("PAIR" status), data in the P-VOL and S-VOLs may not be the same because update copying occurs asynchronously, and therefore later data exists in the P-VOL. You can ensure that P-VOL and S-VOLs data are the same at a certain point in time, by splitting pair.

Also, data in the P-VOL and the data in the S-VOL may not be the same if a copy operation is completed without host I/O. As mentioned above, the P-VOL and S-VOLs can be made the same by splitting the pair.

2

Requirements and planning

This chapter describes system requirements and recommendations for planning an SI system.

System requirements

The following table shows minimum requirements for SI.

Item	Requirement
SI license capacity	Based on purchased capacity. For more information, see License capacity requirements on page 2-3.
License key	Must be installed. For more information about installation, see the *Hitachi Storage Navigator User Guide*.
RAID level	RAID 1, RAID 5, RAID 6
SN	If you are using the previous version of SN, which is shown in a secondary window, you must be in Modify mode to perform pair operations.
CCI	Requires a command device when used in In-Band mode, though not for Out-of-Band mode. For more information, see the *Command Control Interface User and Reference Guide*.
Pair volumes	• Number of P-VOLs per S-VOL: one • Number of S-VOLs per P-VOL: For L1 pairs, a maximum of three S-VOLs per P-VOL. For L2 pairs, a maximum of two S-VOLs per P-VOL. (For information on pair-layers, see Cascaded pairs on page 1-3). • Volume capacity: The P-VOL and S-VOLs must be the same size in blocks. If the capacity is displayed in gigabytes, 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, or for a secondary window, look at the **Capacity (blocks)** area of the **Detail** window. • Supported emulation types: Supported emulation types are the same as the ones for SMPL. The emulation type of the P-VOL and S-VOLs must be the same. However, you can create a pair from an intermediate volume and a normal volume if the two volumes are of the same type (such as 3390-3 and 3390-3A/3390-3B). • Supported volume types: - Internal system volumes. - External volumes. Universal Volume Manager (UVM) license required. - Custom-sized volumes. VLL required. Pair volumes must have same capacity and emulation type. - LUSE volumes require LUSE license. SI S-VOLs must have the same size and structure as the P-VOL. For example, if the P-VOL is a LUSE volume in which volumes of 1 GB, 2 GB, and 3 GB are combined in this order, the S-VOL must also be a

Item	Requirement
	LUSE volume with volumes of 1 GB, 2 GB, and 3 GB combined in the same order. • MU number (mirror unit number): - For an L1 pair, use 0, 1, or 2. - For an L2 pair, use 1 or 2. • Sharing volumes with other software products is supported. See Chapter 3, Sharing ShadowImage volumes on page 3-1. • The following cannot be used as pair volumes: - Universal Replicator (UR) journal volumes. - Virtual volumes (except Dynamic Provisioning volumes). - Pool volumes.
Maximum number of pairs	Per storage system: 16,384 pairs (when one S-VOL per P-VOL). Actual number is based on amount of additional shared memory. See Planning number of pairs on page 2-4 for further information. Maximum number of pairs decreases if LUSE volumes are used.
Consistency groups	• You can configure up to 256 consistency groups in a storage system, including SI, SIz, Thin Image (HTI), and Copy-on-Write Snapshot (SS) consistency groups. **Note:** SI, SIz, HTI, and SS pairs cannot co-exist in the same consistency group. • You can define up to 8,192 SI pairs in a consistency group. **Note:** LUSE volumes that contain *n* LDEVs should be counted as *n* volumes. For more information, see the *Provisioning Guide for Open Systems*. • A number (0–FF) is assigned to each consistency group. You specify a consistency group number when you create pairs. If you do not specify a number, the storage system automatically assigns it. - Consistency group numbers 00 to 7F (or 0 to 127) that you can use for SI, SIz, HTI, and SS. Consistency group numbers 80 to FF (or 128 to 255) are exclusively used for HTI and SS.

License capacity requirements

The total capacity of pair volumes must be less than the maximum volume capacity licensed to you. After operations begin, you should be aware of capacity requirements in order to keep volumes' total size within purchased capacity.

- P-VOLs, S-VOLs, and volumes are reserved for use as S-VOLs must have licensed capacity.
- SS P-VOLs and pool volumes require the SI license capacity.

- If you are using a volume for multiple purposes, the capacity of the volume is counted only once. You do not need to multiply the capacity by the number of purposes for which it is used.
- If you are using a Dynamic Provisioning volume as an SI P-VOL or S-VOL (or as a reserved volume), the capacity of the Dynamic Provisioning pool allocated to the volume is added to the SI license capacity. The reason is because Dynamic Provisioning volumes are not updated in real time. As a result, some write requests may cause excess data, which is saved in the pool.

When your SI volumes exceed license capacity, you are allowed to use the volumes for additional 30 days. After that, you cannot perform SI operations except to delete pairs.

For more information, see the *Hitachi Storage Navigator User Guide*.

Planning pair volumes

You must create volumes for P-VOLs and S-VOLs prior to creating pairs. For more information about the system requirements for pair volumes, see System requirements on page 2-2. Also, you can use the following options:

- Before creating a pair, you can reserve a volume as an S-VOL. This ensures that an I/O does not occur in the reserved volume before creating the pair. You can only use reserved volumes as S-VOLs.
- If you use CCI, you can place a group of pairs in a consistency group. Using the consistency group, you can perform pair operations on all the pairs in the group at the same time, including consistency group pair-split operations.

  For more information about setting up consistency groups and performing pair operations, see the *Command Control Interface User and Reference Guide*.

Planning number of pairs

You can calculate the number of system resources required for an SI pair. With this information you can calculate the maximum number of pairs allowed on your system.

Differential tables (tables managing differential bitmaps) and pair tables are required to create pairs. You must supply an adequate number of tables to handle all the pairs you plan to create.

The number of differential and pair tables that are present in the system depends on additional shared memory that is installed. Therefore, you must ensure that you have sufficient additional shared memory to handle the number of pairs.

Number of differential tables, pair tables, and volumes per additional shared memory

The following table shows the number of differential and pair tables and the number of volumes allowed per additional shared memory. The maximum number of pairs is half the number of volumes shown, when P-VOLs and S-VOLs are in a one-to-one relationship.

For example, if additional shared memory is not installed, since the number of volumes is 16,384, then the number of pairs you can create is 8,192. This example assumes one S-VOL per P-VOL. If there are more S-VOLs than P-VOLs, then the number of allowed pairs decreases.

However, for Extension 1 and Extension 2, the maximum number of pairs is 16,384, regardless of the total number of system volumes.

Additional shared memory	Number of diff. tables	Number of pair tables	Number of system volumes
Base (No additional shared memory)	26,176	8,192	16,384
Extension 1	104,768	16,384	65,536
Extension 2	209,600	16,384	65,536

You can determine the maximum number of pairs that can be created on your system by calculating the number of differential and pair tables your system needs to create SI pairs. This number must be equal to or less than the difference of the total number of differential and pair tables in the storage system, minus the number of tables being used by the other products (for example, Hitachi Compatible FlashCopy®).

The following software products also use differential tables:

- SIz
- Compatible FlashCopy®
- Compatible FlashCopy® SE
- Volume Migration
- SS

The following software products also use pair tables:

- SIz
- Volume Migration (using migration plans)

Note: You can use CCI's 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 differential tables and pair tables

Calculations in the following sections assume that you are only using SI in the system.

The emulation type of your volumes affects the number of differential and pair tables.

To calculate the number of differential and pair tables for emulation types other than OPEN-V

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

* See the following table.

** Number of slots that can be managed by a differential table

Round up the total number to the nearest whole number. For example, if the number of the cylinders of the divided volume is 2,403,360 KB, the calculation of the total number of the differential tables is as follows:

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

Rounding up 2.4545 to the nearest whole number changes it to 3. In this example, the total number of the differential tables for one pair is 3. Because one pair table is used for up to 36 differential tables, the total number of the pair tables for a pair in this example is 1.

To calculate the number of differential and pair tables for OPEN-V

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

* Number of the slots that can be managed by a differential table

Round up the total number to the nearest whole number. For example, if the number of the cylinders of the divided volume is 3,019,898,880 KB, the calculation of the total number of the differential tables is as follows.

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

Rounding up 576.9014 to the nearest whole number changes it to 577. In this example, the total number of the differential tables for one pair is 577. Because one pair table is used for up to 36 differential tables, the total number of the pair tables for a pair is 17. (Only OPEN-V can use more than one pair table per pair.)

The following table shows control cylinders per emulation type.

Emulation type	Number of control cylinders
OPEN-3	8 (5,760KB)
OPEN-8, OPEN-9	27 (19,440KB)
OPEN-E	19 (13,680KB)

Emulation type	Number of control cylinders
OPEN-K	9 (6,480KB)
OPEN-L	7 (5,040KB)
OPEN-V	0 (0KB)

If the volume is divided by VLL, use the volume capacity after the division.

Note: You cannot perform VLL operations on OPEN-L volumes.

Having determined the number of differential and pair tables required per pair on your storage system, you can now calculate the maximum number of pairs.

Calculating maximum number of pairs

Finding the number of pairs that can be created on your system depends on whether you use LUSE volumes or not. Two calculations are provided below, one without LUSE, and one with LUSE.

To calculate the maximum number of pairs allowed on your system without LUSE volumes

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): Required number of differential tables per pair (per previous calculation).
- (β): Number of differential tables available in the system (see Number of differential tables, pair tables, and volumes per additional shared memory on page 2-5).
- (γ): The required number of pair tables per pair (per previous calculation).
- (δ): The number of pair tables available in the system (see Number of differential tables, pair tables, and volumes per additional shared memory on page 2-5).

For example, if you are to create 10 pairs of OPEN-3 volumes and 20 pairs of OPEN-V volumes in a storage system that has 26,176 differential tables, you can use the equation as follows:

If the emulation type is OPEN-3 and the capacity of the volume is 2,403,360 kB, 3 differential tables and a pair table is required for a pair. If the emulation type is OPEN-V and the capacity of the volume is 3,019,898,880 kB, 577 differential tables and 17 pair tables are required for a pair.

If you apply these numbers in equation:

3 x 10 + 577 x 20 = 11,570 less-than-or-equal-to 26,167 and also

1 x 10 + 17 x 20 = 350 less-than-or-equal-to 8,192

Thus, 10 pairs of OPEN-3 volumes and 20 pairs of OPEN V volumes can be created.

To calculate the maximum number of pairs allowed on your system with LUSE volumes

Σ[Σ {(α) x (the number of the volumes that forms LUSE volumes)} x (the number of SI pairs)] ≤ (β)

and also

Σ[Σ {(γ) x (the number of the volumes that forms LUSE volumes)} x (the number of SI pairs)] ≤ (δ)

where:

- (α): Required number of differential tables that forms a LUSE volume. When you use LUSE volumes, each volume forming the LUSE volume uses the differential tables. For example, if you create an SI pair using LUSE volumes, which are created by combining two OPEN-V volumes, you need differential tables for two OPEN-V pairs.
- (β): Number of differential tables available in the system (see Number of differential tables, pair tables, and volumes per additional shared memory on page 2-5).
- (γ): The required number of pair tables for each volume that forms a LUSE volume.
- (δ): The number of pair tables available in the system (see Number of differential tables, pair tables, and volumes per additional shared memory on page 2-5).

For example, if you are to create 10 pairs of LUSE volumes consisting respectively of three OPEN-3 volumes in a storage system that has 26,176 differential tables, you can use the equation condition as follows:

When the emulation type is OPEN-3, and if the capacity of the volume is 2,403,360 kB, the number of differential tables required for a pair is 3, and the number of pair tables required for a pair will be 1.

If you apply this number to the above-mentioned equation:

```
(3 x 3) x 10 = 90 <= 26,176
```

and also

```
(1 x 3) x 10 = 30 <= 8,192
```

Therefore, you can see that 10 SI pairs, which are formed by three OPEN-3, volumes can be created.

Organizing volumes into P-VOLs and S-VOLs

Before creating pairs, you must prepare volumes for SI. The following table provides an example of volume information to prepare volumes.

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

Planning for performance

Pair operations affect I/O performance on the storage system. The following information is provided to help calibrate your system:

- Performance versus number of pairs. Compare the importance of performance with the number of pairs and copy pace (rate at which data is copied).
  - Assigning multiple S-VOLs to a P-VOL uses more system resources and lowers performance.
  - The slower the copy pace, the less impact on I/O performance; a fast pace has a greater impact on performance. (You assign copy pace while creating, splitting, and resynchronizing pairs.)
- Load sharing on parity groups.
  - A parity group should contain an even distribution of P-VOLs and S-VOLs, rather than a concentration of one or the other.

    - If you plan to perform multiple pair operations simultaneously, place the pairs in different parity groups.
    - For copy pace, specify **Slower** when you create, split, or resynchronize.
    - If you plan to perform a copy operation on multiple pairs on the same parity group, perform the operation on one pair at a time.
    - If the system is overloaded, increase parity groups, cache, channel adapters (CHAs), and/or disk adapters (DKAs). Assign S-VOLs to newly installed parity groups.
- When using multiple software products simultaneously. If you are using more than one software product at the same time, ensure that your storage system is configured for optimal performance, such as sufficient cache. Contact the Hitachi Data Systems customer support. Concurrent use affects the performance and the operation of the other software products.
- When using AIX host servers. Best performance results when P-VOLs are located on one AIX host server and paired S-VOLs on another. The problem with using one AIX host server for both P-VOLs and S-VOLs is that during the paircreate or pairresync operation, the P-VOL and S-VOLs have the same PVID. If the host server reboots when this is the case, it can mis-identify the volumes and identify the S-VOL as the P-VOL after rebooting.
- Preparing for resynchronization by Quick Restore. During a quick restore operation, in which the contents of the P-VOL and S-VOLs are swapped, the RAID levels, HDD types, and Cache Residency Manager settings of the two volumes are also exchanged. To avoid performance impact, consider the following:
    - Both pair volumes should have the same RAID level and HDD type before performing the quick restore operation. You can resume the original RAID levels after the quick restore by again splitting the pair and performing the quick restore.
    - Set the same Cache Residency Manager settings (locations) for the P-VOL and S-VOLs before the quick restore operation.

      Alternatively, you can release Cache Residency Manager settings before the quick restore operation, then reset them when the operation is completed.

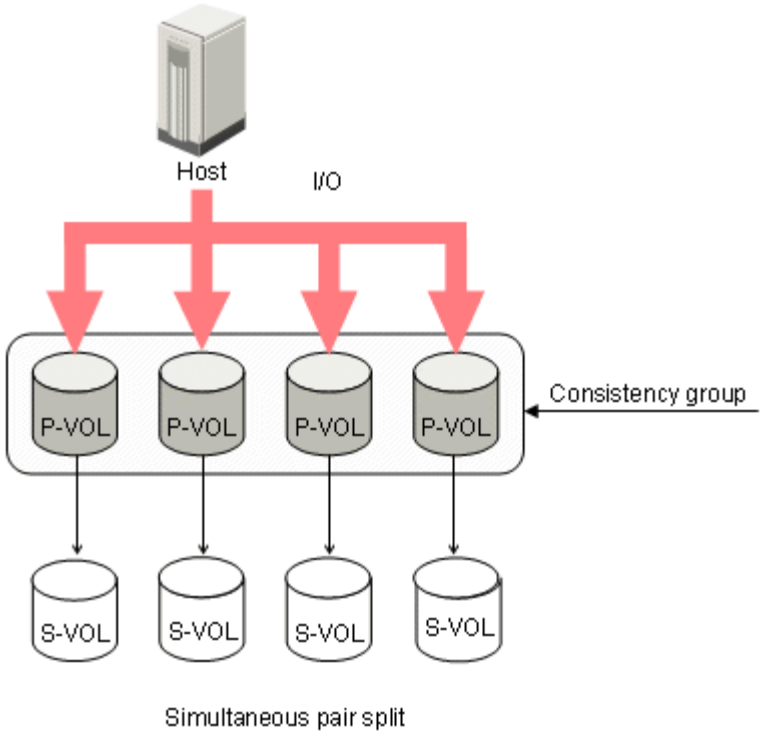
      For more information about settings, see the *Hitachi Virtual Storage Platform Performance Guide*.

Caution: Do not perform the Quick Restore when the P-VOL and S-VOLs are in different CLPRs, otherwise the two volumes will be reversed when the operation completes.

Consistency group pair-split

With a consistency group, you perform tasks and change the pair status on a group of pairs. This allows you to copy data from the P-VOLs in the

consistency group to the S-VOLs simultaneously. The S-VOLs will contain the same data as the P-VOLs when the operation is performed.



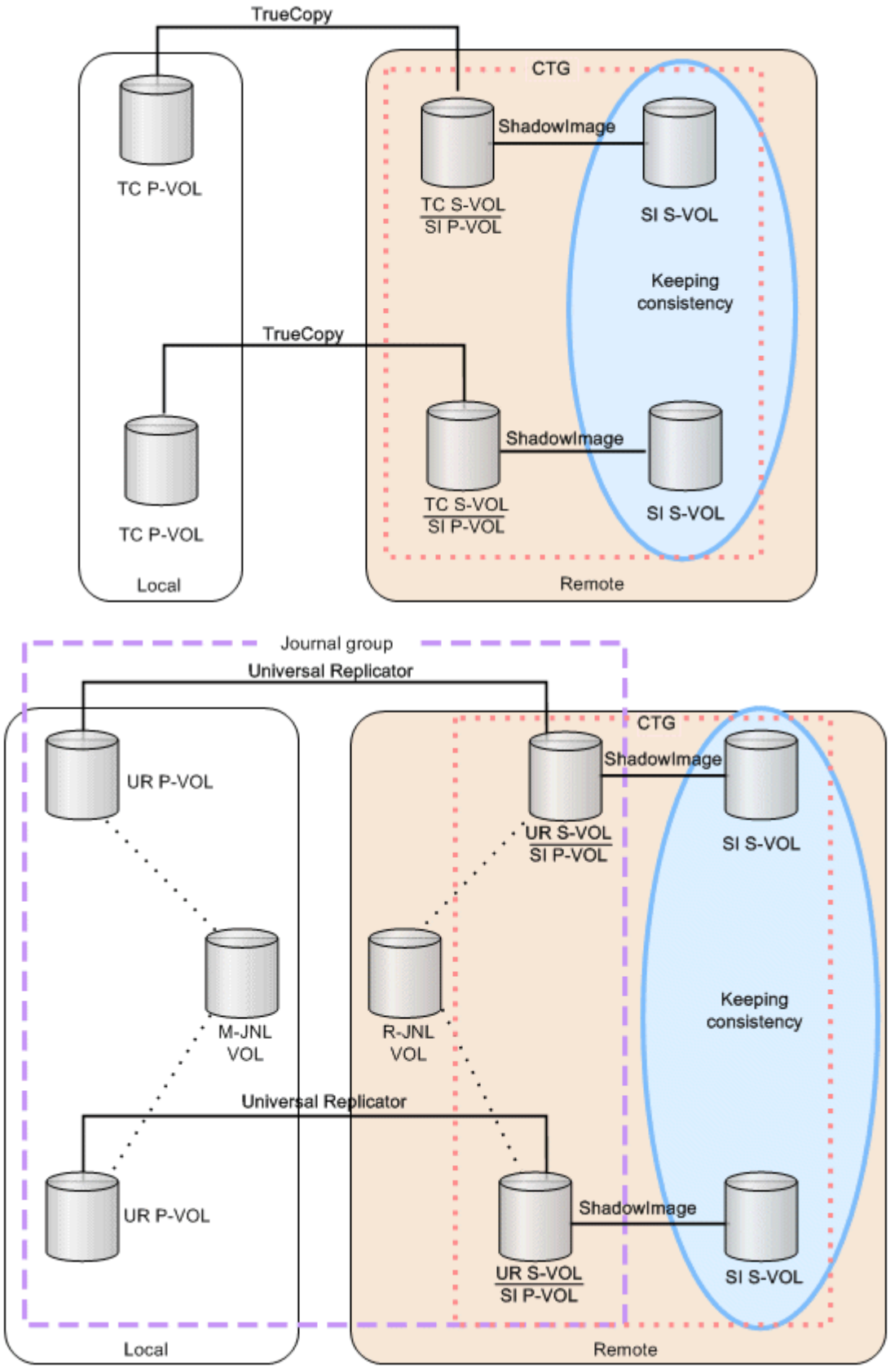
Simultaneous pair split

The following is a list of requirements and restrictions:

- CCI is required to run this and all operations on the pairs in the consistency group. If you have performed pair operations using the SN after creating pairs using CCI, you cannot use consistency group pair-split.
- Pairs in the CCI copy group must be in an SI consistency group.
- You can use consistency group pair-split when SI P-VOLs are shared with UR or TC S-VOLs. For more information, see Consistency group pair-split for shared volumes on page 2-11.

Consistency group pair-split for shared volumes

If you share SI P-VOLs in a storage system with TC or UR S-VOLs, you can use consistency group pair-split to keep the SI S-VOLs consistent. The following illustrations show consistency group pair-split with TC and with UR.


TrueCopy
CTG
ShadowImage
TC P-VOL
TC S-VOL
SI P-VOL
SI S-VOL
Keeping
consistency
TrueCopy
ShadowImage
TC P-VOL
TC S-VOL
SI P-VOL
SI S-VOL
Local
Remote
Journal group
Universal Replicator
CTG
ShadowImage
UR P-VOL
UR S-VOL
SI P-VOL
SI S-VOL
M-JNL
VOL
R-JNL
VOL
Keeping
consistency
Universal Replicator
UR P-VOL
ShadowImage
UR S-VOL
SI P-VOL
SI S-VOL
Local
Remote

The following takes place when you use consistency group pair-split with shared UR volumes:

1. UR restore journal data created before the split time is restored to UR S-VOLs (SI P-VOLs).
2. Restore journal operations are suspended when UR detects restore journal data with a time stamp later than the split time. After the UR suspension, the SI split operations run.
3. When SI split operations are completed, UR resumes the suspended restore journal operations.

Requirements, restrictions, and recommendations for shared volumes

The following is a list of the requirements, restrictions, and recommendations for using consistency group pair-split with shared TC or UR volumes:

- CCI is required.
- You must share the SI P-VOLs with the UR or TC S-VOLs.
- The SI pairs must be registered in the same SI consistency group to ensure consistent backup operations.
- If you are sharing SI P-VOLs in a storage system with UR or TC S-VOLs, to prevent the consistency group pair-split from ending abnormally, ensure the status of all UR or TC pairs in the consistency group is the same, "PAIR" or "PSUS".
- You can perform one split operation per SI consistency group.
- UR pairs must belong to the same journal group. If multiple journal groups are registered in one SI consistency group, consistent backup cannot be ensured on SI S-VOLs.
- With UR, three split operations can be performed per UR journal (equivalent to three SI consistency groups).

Consistency group pair-split and supported pair statuses

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

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

The status of the pairs in the consistency group that have a status other than PAIR	Can you perform a consistency group pair-split?	Status after you perform a consistency group pair-split
COPY(PD)/COPY	YES	PSUS

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

Notes:

1. If you share the UR S-VOL and the SI P-VOL, the command may end normally after you perform a consistency group pair-split. Ensure the status of the pairs within the consistency group 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 consistency group pair-split based on status of the SI pairs in the consistency group:

- Example 1

  The are six SI pairs in a consistency group. 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 consistency group pair-split, and doing so changes the status of all of the pairs in the consistency group to "PSUS".
- Example 2

  There are two SI pairs in a consistency group 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 consistency group pair-split.

- Example 3

  The are six SI pairs in a consistency group. 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 consistency group pair-split ends abnormally and the status of all of the pairs in the consistency group remains the same.

3

Sharing ShadowImage volumes

You can share SI volumes with other Hitachi software product volumes. This topic discusses requirements, recommendations, and restrictions for sharing volumes.

- Cache Residency Manager
- Thin Image and Copy-on-Write Snapshot
- Data Retention Utility
- Dynamic Provisioning and Dynamic Tiering
- High Availability Manager
- LUN Manager
- Open Volume Management
- Resource Partition Manager
- TrueCopy
- Universal Replicator
- Universal Volume Manager
- Volume Migration

Cache Residency Manager

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

Note: For important information about the operation and volumes with Cache Residency Manager settings, see the bullet on Quick Restore in Planning for performance on page 2-9.

Thin Image and Copy-on-Write Snapshot

You can share SI volumes with HTI and SS volumes. You can assign shared pairs to consistency groups, though not to the same consistency group.

The following table shows how you can share volumes.

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

1. An HTI or SS P-VOL in RCPY status cannot be used by SI. For more information, see the following tables.
2. The SI pair must be created before the HTI or SS pair.

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

Sharing HTI or SS primary volumes with SI primary volumes

The following table shows the pair operations allowed when the P-VOL is shared with an HTI or SS P-VOL.

SI operation	HTI or SS pair status					
	COPY[1]	PAIR, PFUL	PSUS, PFUS	COPY[2]	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
Restore a pair (pairresync -restore)	YES	YES[3]	YES	YES	NO	YES
Restore a pair[4]	NO	NO	NO	NO	NO	NO

SI operation	HTI or SS pair status					
	COPY[1]	PAIR, PFUL	PSUS, PFUS	COPY[2]	RCPY	PSUE
(pairresync -restore)						
Suspend a pair operation (pairsplit -E)	YES	YES	YES	YES	YES	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES

1. COPY status during initial copy.
2. COPY status during resynchronization.
3. After executing the pairsplit command on the HTI or SS pair, you must confirm that all pairs in the HTI or SS consistency group are in "PSUS" status before performing the SI operation. This ensures that all snapshot data is consistent with P-VOL data, and therefore is ready to use in the SI operation.
4. When the host accesses the HTI or SS S-VOL, HTI or SS P-VOL data may be used. Therefore you cannot perform a Quick Restore to swap the SI P-VOL and S-VOLs.

Sharing the HTI or SS primary volume with the SI secondary volume

The following table shows the pair operations that are supported when the SI S-VOL is shared with an HTI or SS P-VOL.

SI operation	HTI or SS pair status					
	COPY[1]	PAIR, PFUL	PSUS, PFUS	COPY[2]	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
Restore a pair (pairresync -restore)	YES	YES [3]	YES	YES	NO	YES
Quick Restore a pair[4] (pairresync -restore)	NO	NO	NO	NO	NO	NO
Suspend a pair operation (pairsplit -E)	YES	YES	YES	YES	NO	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES	YES

1. COPY status during initial copy.
2. COPY status during resynchronization.
3. After running the **pairsplit** command on the HTI or SS pair, you must confirm that all pairs in the HTI or SS consistency group are in "PSUS" status before performing the SI operation. This ensures

SI operation	HTI or SS pair status					
	COPY[1]	PAIR, PFUL	PSUS, PFUS	COPY[2]	RCPY	PSUE

that all snapshot data is consistent with P-VOL data, and therefore is ready to use in the SI operation.

4. When the host accesses the HTI or SS S-VOL, HTI or SS P-VOL data may be used. Therefore you cannot perform a Quick Restore to swap the SI P-VOL and S-VOLs.

Data Retention Utility

Access attributes and ShadowImage operations

You can create SI pairs using volumes for which you set access attributes with Data Retention Utility. However, depending on the access attribute, SI pair operations and reserve attribute change operations cannot be performed. The following tables show whether SI pair operations and reserve attribute change operations can be performed for volumes for which access attributes are set with Data Retention Utility.

You can also set access attributes for SI P-VOLs, S-VOLs, and reserve volumes. For SI pair operations and reserve attribute change operations after access attribute setting, see the following tables.

Note: The Data Retention Utility access attributes of volumes do not change as a result of SI operations. Even though the Quick Restore operation reverses the P-VOL and S-VOL, the access attributes of the P-VOL and S-VOL are not reversed.

The following table shows volume access attribute and SI pair operations.

Volume access attributes specified for the SI pair		SI operations		
P-VOL	S-VOL	Create, Split, Suspend, Resync (forward)	Resync (reverse)	Delete
Read/Write	Read/Write	YES	YES	YES
Read Only, Protect, S-VOL Disable	Read/Write	YES	NO	YES
Read/Write, Read Only, Protect, S-VOL Disable	Read Only, Protect, S-VOL Disable	NO	NO	YES

The following table shows access attributes and SI reserve attribute change operations.

Volume access attributes specified by SI	SI reserve attribute change operation	
	Setting reserve attribute	Removing reserve attribute
Read/Write	YES	YES
Read Only, Protect, S-VOL Disable	NO	YES

ShadowImage pair statuses and access attribute settings

Depending on the SI pair status, you may not be able to set access attributes for SI P-VOL or SI S-VOL using Data Retention Utility.

For SI reserve volumes, you can set all of the following Data Retention Utility access attributes:

- Read/Write
- Read Only
- Protect
- S-VOL Disable

The following table shows whether access attributes can be set for SI pairs.

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

Dynamic Provisioning and Dynamic Tiering

You can share Hitachi Dynamic Provisioning (HDP) and Hitachi Dynamic Tiering software (HDT) volumes with SI P-VOLs and S-VOLs. You can also use HDP and HDT volumes with SI reserved volumes. The following restrictions apply:

- You should share HDP and HDT volumes with both the SI P-VOL and S-VOLs, rather than one or the other.
- If you share an HDP or HDT volume with only the P-VOL, or only the S-VOL, you cannot perform the Quick Restore operation.

  To perform the Quick Restore, both P-VOL and S-VOLs must be shared with HDP or HDT volumes.

  Also, sharing an HDP or HDT volume with only the S-VOL is not recommended for the Quick Restore because the S-VOL consumes the same amount of the pool capacity as the P-VOL.
- You cannot perform SI pair operations while doing the following:
  - Increasing HDP volume capacity
  - Initializing the HDP pool
- The maximum size of HDP or HDT volume that you can use as an SI P-VOL, S-VOL, and reserve volume is 4 TB (4398046511104 bytes).

Caution: You cannot use TB, GB, or MB specifications for SI volumes. If you want to create a 4 TB P-VOL, secondary, or reserve volume, do not use the terabyte specification; instead *only* use the block specification.

The block-size equivalent to 4 TB is 8589934592 blocks.

- Peforming an SI paircreate or pairresync operation while zero pages are being reclaimed (including operations by Writesame, Unmap, and Rebalance) results in the zero-page reclamation being interrupted.
- SI pair creation might be rejected if the Unmap command operation is in progress with system option mode 905 ON. Wait a while and then retry the operation. If the operation still fails, set system option mode 905 to OFF and retry again.

High Availability Manager

You can share the SI P-VOL with the High Availability Manager (HAM) S-VOL. However, you cannot share other HAM volumes.

- You cannot share the HAM P-VOL with SI.
- You cannot share the HAM quorum disk with SI.

SI pair operations are limited according to the HAM pair status. The following table shows the pair operations that are allowed.

SI operation	HAM pair status				
	COPY	PAIR	PSUE	PSUS	SSWS
Create a pair (paircreate)	YES	YES	YES	YES	YES
Create and split a pair (paircreate -split)	YES	YES	YES	YES	YES
Split a pair (pairsplit)	YES	YES	YES	YES	YES
Resynchronize a pair (pairresync)	YES	YES	YES	YES	YES
Restore a pair (pairresync -restore)	NO	NO	YES	YES	YES
Quick Restore a pair (pairresync -restore)	NO	NO	YES	YES	YES
Interrupt a pair operation (pairsplit -E)	YES	YES	YES	YES	YES
Delete a pair (pairsplit -S)	YES	YES	YES	YES	YES

Note: Write processing to the HAM P-VOL requires more time generally, but especially when SI pair status is "PSUS(SP)", during which copy processing occurs.

For more information on sharing HAM volumes with SI, see the *Hitachi High Availability Manager User Guide*.

LUN Manager

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

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

Open Volume Management

You can use both LUSE and Virtual LUN volumes as SI volumes.

With LUSE volumes, the P-VOL and S-VOLs must have the same configuration (the same LU capacity and the same number of LUs).

With Virtual LUN volumes, the P-VOL and S-VOLs must have the same capacity.

Resource Partition Manager

You can specify volumes in a Resource Partition Manager resource group as SI P-VOLs and S-VOLs. However, ensure the resource group is assigned to one of your user groups. The resource group must be assigned to a user group for which your user account has privileges.

For more information about Resource Partition Manager, see the *Provisioning Guide for Open Systems*

TrueCopy

You can share TC volumes with SI volumes.

- You can share SI P-VOLs and S-VOLs with TC P-VOLs and S-VOLs. However, you cannot share an SI S-VOL with a TC S-VOL.
- When you share an SI P-VOL with a TC S-VOL, the write operation on the TC P-VOL takes more time. This is especially true when the SI pair is in the "PSUS(SP)" status because of the copying time needed for the SI pair.
- You can use both L1 and L2 pairs with TC volumes. Both node and leaf S-VOLs are considered S-VOLs by TC.
- You can perform the Quick Restore operation on an SI pair when the TC pair is suspended.
- The SI P-VOL can be shared with TC volumes in a 3 data center configuration. For more information, see Sharing volumes in a 3-TC/UR DC cascade configuration on page 3-17.
- You can use the consistency group pair-split operation on SI pairs whose volumes are shared with TC S-VOLs. For more information, see Consistency group pair-split for shared volumes on page 2-11.

For more information about sharing SI and TC volumes, see the section on sharing volumes with SI in the *Hitachi TrueCopy® User Guide*.

Universal Replicator

You can share UR volumes with SI volumes.

- You can share SI P-VOLs with UR P-VOLs and S-VOLs.
- You cannot share SI S-VOLs with UR S-VOLs.
- You cannot share SI pair volumes with UR journal volumes.
- You can use both L1 and L2 pairs with UR volumes. Both node and leaf S-VOLs are considered S-VOLs by UR.
- You cannot perform the Quick Restore operation on the SI pair when the UR pair is suspended.
- You can share SI volumes with UR volumes in a 3 UR data center configuration. For more information, see Sharing volumes in 3-UR data center configurations on page 3-9.

- You can share the SI P-VOL with UR and TC volumes in a 3 UR/TC data center configuration. For more information, see Sharing volumes in a 3-TC/UR DC cascade configuration on page 3-17.
- You can use the consistency group pair-split operation on SI pairs whose volumes are shared with UR S-VOLs. For more information, see Consistency group pair-split for shared volumes on page 2-11.

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

Sharing volumes in 3-UR data center configurations

You can share SI pair volumes with UR volumes in the following 3-UR data center (3DC) configurations:

- Multi-target
- Delta-resync
- Cascade

These sections describe the configurations and supported SI operations.

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

Sharing volumes in a 3-UR DC multi-target configuration

You can share SI volumes with UR volumes in 3 DC multi-target configurations. You can share the SI P-VOL and S-VOLs with UR volumes, as shown in the following figure.

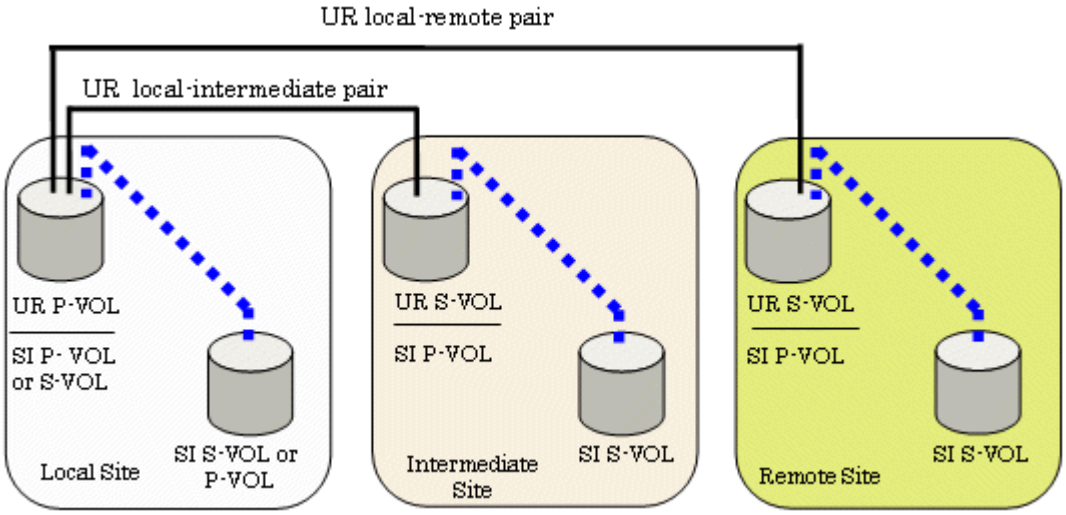


Figure 3-1 SI volumes in a 3-UR DC multi-target configuration

In these configurations, SI pair operations are dependent on the pair status of the UR local-intermediate pair and the local-remote pair.

The following table shows the supported SI operations when the P-VOL is shared with UR P-VOL.

UR local-intermed. pair status	UR intermed.-remote pair status	SI operations		
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy,	Resync -- Quick Restore
PAIR, COPY(PD)/ COPY*, and PSUS/SSWS	PAIR or COPY(PD)/COPY	YES	NO	NO
PAIR or COPY(PD)/ COPY	PSUS/SSWS	YES	NO	NO
PSUS/SSWS	PSUS/SSWS	YES	YES	NO
* You cannot perform SI operations if the status for both UR pairs is "COPY".				

The following table shows the supported SI operations when the S-VOL is shared with UR P-VOL.

UR local-intermed. pair status	UR intermed.-remote pair status	SI operations				
		Create	Split	Suspend, Delete	Resync	
					Normal Copy, Quick Resync, Reverse Copy	Quick Restore
PAIR, COPY(PD)/ COPY*, or PSUS/SSWS	PAIR or COPY(PD)/ COPY*	NO	NO	YES	NO	NO
PAIR or COPY	PSUS/SSWS	NO	NO	YES	NO	NO
PSUS/SSWS	PSUS/SSWS	NO	YES	YES	YES	NO
* You cannot perform SI operations if the status for both UR pairs is "COPY(PD)/COPY".						

The following table shows the supported SI operations when the P-VOL is shared with UR S-VOL (intermediate or remote site).

UR* pair status	SI operations	
	Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
PAIR or COPY(PD)/COPY	YES	NO
PSUS/SSWS	YES	YES
* **Note:** • If the SI P-VOL is shared with the intermediate site's UR S-VOL, then check UR status for the local-intermediate pair.		

UR* pair status	SI operations	
	Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
• If the SI P-VOL is shared with the remote site's UR S-VOL, then check UR status for the local-remote pair.		

Sharing volumes in 3-UR DC delta resync (multi-target) configuration

The following figure shows multi-target with delta resync configurations that include SI volumes.

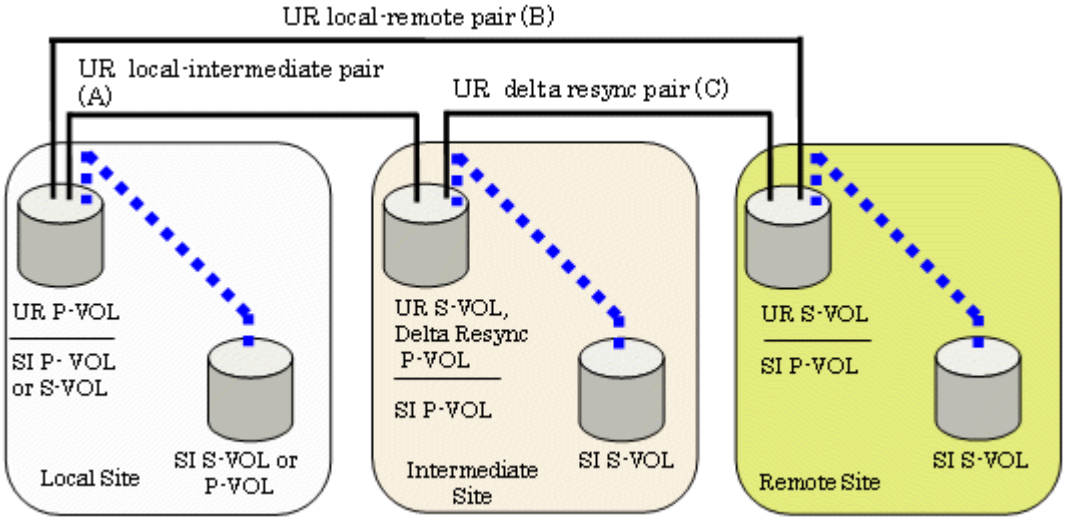


Figure 3-2 SI volumes in a delta resync (multi-target) configuration

Supported operations for SI pairs on the local and remote sites (related to the non-delta resync UR pairs) are the same as those shown in the tables in Sharing volumes in a 3-UR DC multi-target configuration on page 3-9.

Supported operations for SI pairs at the intermediate and remote sites (related to the delta resync pair), and UR status requirements, are shown in the following table. They are the same whether you perform the SI operation at the intermediate or remote site.

UR A or B[1], pair status	UR C[2] pair status	SI operations	
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
PAIR, COPY(PD)/ COPY, or PSUS/SSWS	HOLD or HLDE	YES	NO

1. Local-intermediate pair, or local-remote pair
2. Delta resync pair

Sharing volumes in a 3-UR DC cascade configuration

You can share SI volumes with UR volumes in 3 DC cascade configurations. You can share SI P-VOL and S-VOLs with UR volumes, as shown in the following figure.

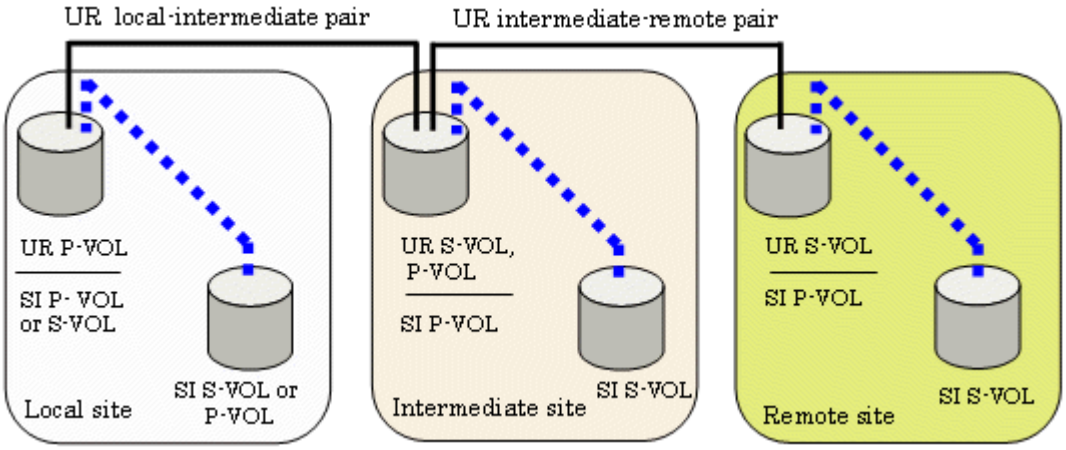


Figure 3-3 SI volumes in a 3-UR DC cascade configuration

When associated with these configurations, SI pair operations are dependent on the pair status of the UR local-intermediate pair and the local-remote pair.

The following table shows the SI operations that you can perform when the P-VOL is shared with UR P-VOL at local site.

UR local-intermed. pair status	SI operations	
	Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync--Reverse Copy and Quick Restore
PAIR or COPY(PD)/COPY	YES	NO
PSUS/SSWS	YES	YES

The following table shows the SI operations that you can perform when the S-VOL is shared with UR P-VOL at local site.

UR local-intermed. pair status	SI operations			
	Pair create	Pair split	Suspend, Delete	Resync - all types
PAIR	NO	NO	YES	NO
COPY(PD)/COPY	NO	NO	YES	NO
PSUS/SSWS	NO	YES	YES	YES

The following table shows the SI operations that you can perform when the P-VOL is shared with UR S-VOL/P-VOL at intermediate site.

UR local-intermed. pair status	UR intermed.-remote pair status	SI operations		
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy,	Resync -- Quick Restore
PAIR, COPY(PD)/ COPY*, and PSUS/SSWS	PAIR or COPY(PD)/COPY	YES	NO	NO
PAIR or COPY(PD)/ COPY	PSUS/SSWS	YES	NO	NO
PSUS/SSWS	PSUS/SSWS	YES	YES	NO
* You cannot perform SI operations if the status for both UR pairs is "COPY(PD)/COPY".				

The following table shows the SI operations that you can perform when the P-VOL is shared with UR S-VOL at remote site.

UR intermed.-remote pair status	SI operations	
	Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
PAIR or COPY(PD)/COPY	YES	NO
PSUS/SSWS	YES	YES

Sharing volumes in a 3-UR DC delta resync (cascade) configuration

The cascade delta resync configuration with shared SI volumes is shown in the following figure. You can share SI P-VOLs with the delta resync P-VOL and the S-VOL.

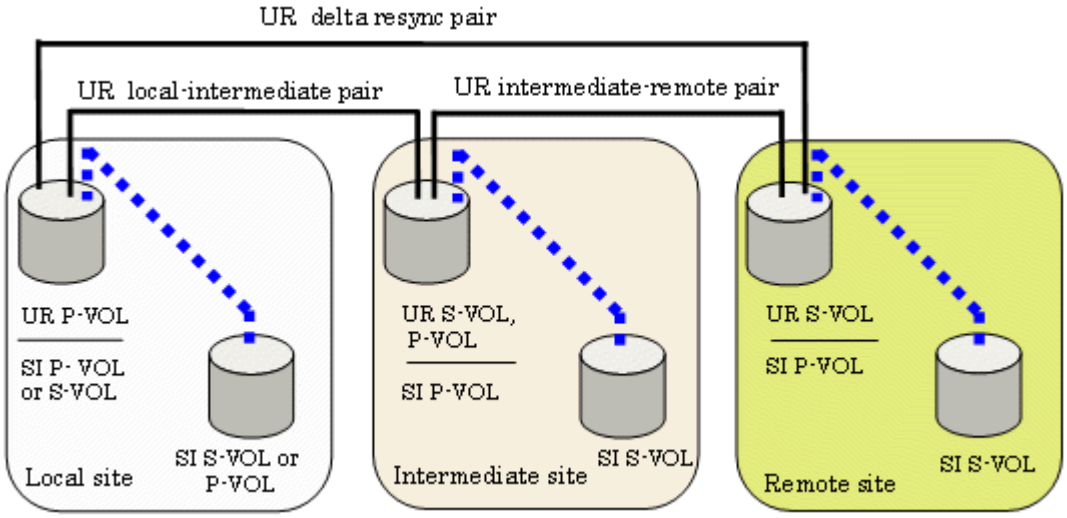


Figure 3-4 SI volumes in a delta resync (cascade) configuration

When a delta resync pair is part of the 3 DC cascade configuration, supported operations for SI pairs are dependent on the UR pairs.

The following table shows the SI operations that you can perform when the P-VOL is shared with the UR P-VOL/delta resync at the local site.

UR local-intermed. pair status	UR delta resync pair status	SI operations	
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
PAIR, COPY, or PSUS/ SSWS	HOLD or HLDE	YES	NO

The following table shows the SI operations that you can perform when the S-VOL is shared with the UR P-VOL/delta resync P-VOL at the local site.

UR local-intermed. pair status	UR delta resync pair status	SI operations		
		Pair create, Pair split	Suspend, Delete	Resync -- All types
PAIR, COPY, or PSUS/SSWS	HOLD or HLDE	NO	YES	NO

The following table shows the SI operations that you can perform when the P-VOL is shared with the UR S-VOL/P-VOL at the intermediate site.

UR local-intermed. pair status	UR intermed.-remote pair status	SI operations		
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy,	Resync -- Quick Restore
PAIR, COPY*, and PSUS/SSWS	PAIR or COPY	YES	NO	NO
PAIR or COPY	PSUS/SSWS	YES	NO	NO
PSUS/SSWS	PSUS/SSWS	YES	YES	NO
* You cannot perform SI operations if the status for both UR pairs is "COPY(PD)/COPY".				

The following table shows the SI operations that you can perform when the P-VOL is shared with the UR S-VOL/delta resync S-VOL at the remote site.

UR intermed.-remote pair status	UR delta resync pair status	SI operations	
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy, Quick Restore
PAIR, COPY, or PSUS/SSWS	HOLD or HLDE	YES	NO

Sharing volumes in 3-UR/TC data center configurations

You can share SI pair volumes with UR and TC volumes in the following 3-UR/TC DC configurations:

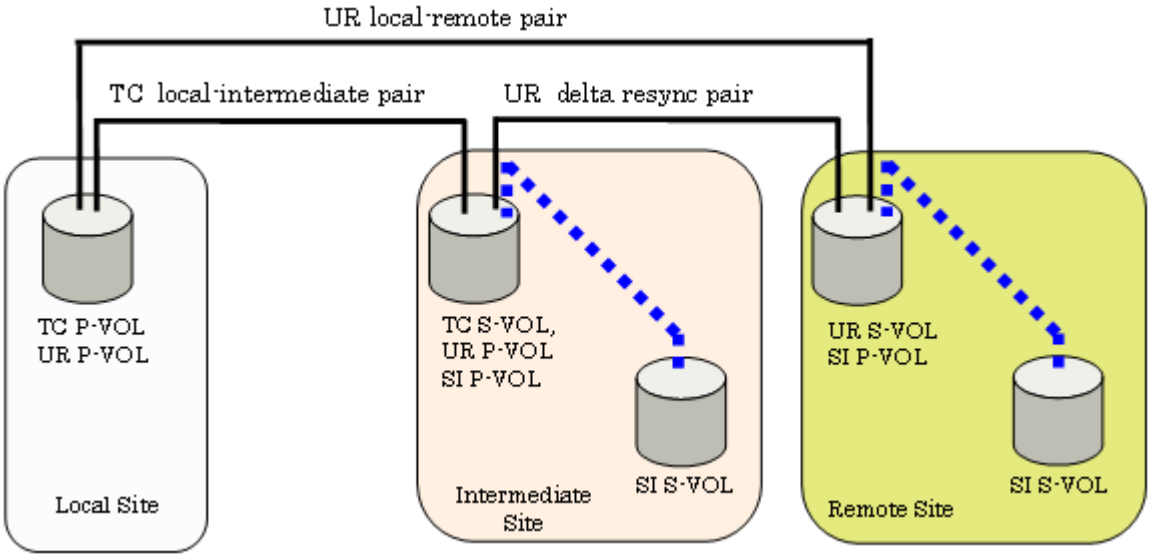
- Multi-target
- Cascade
- Delta-resync

These sections describe the configurations and supported SI operations.

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

Sharing volumes in 3-UR/TC DC multi-target and delta resync configurations

You can share SI P-VOL with TC and UR volumes at the intermediate and remote sites in 3DC multi-target and delta resync configurations, as shown in the following figure.



The SI operations that you can perform depend on the pair status of the other pairs.

The following table shows supported SI operations at the intermediate site.

TC local-intermed. pair status	UR delta resync pair status	SI operations		
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy,	Resync -- Quick Restore
PAIR or COPY(PD)/ COPY	HOLD	YES	NO	NO
PAIR or COPY(PD)/ COPY	HLDE	YES	NO	NO
PSUS/ SSWS	HOLD	YES	YES	NO
PSUS/ SSWS	HLDE	YES	YES	NO

The following table shows supported SI operations at the remote site.

UR local-remote pair status	UR delta resync pair status	SI operations		
		Create, Split, Suspend, Delete, Resync--Normal Copy, Quick Resync	Resync -- Reverse Copy,	Resync -- Quick Restore
PAIR or COPY(PD)/ COPY	HOLD	YES	NO	NO
PSUS/ SSWS	HOLD	YES	YES	NO

Sharing volumes in a 3-TC/UR DC cascade configuration

You can share SI P-VOL with TC and UR pairs at the intermediate site in 3DC cascade configurations, as shown in the following figure.

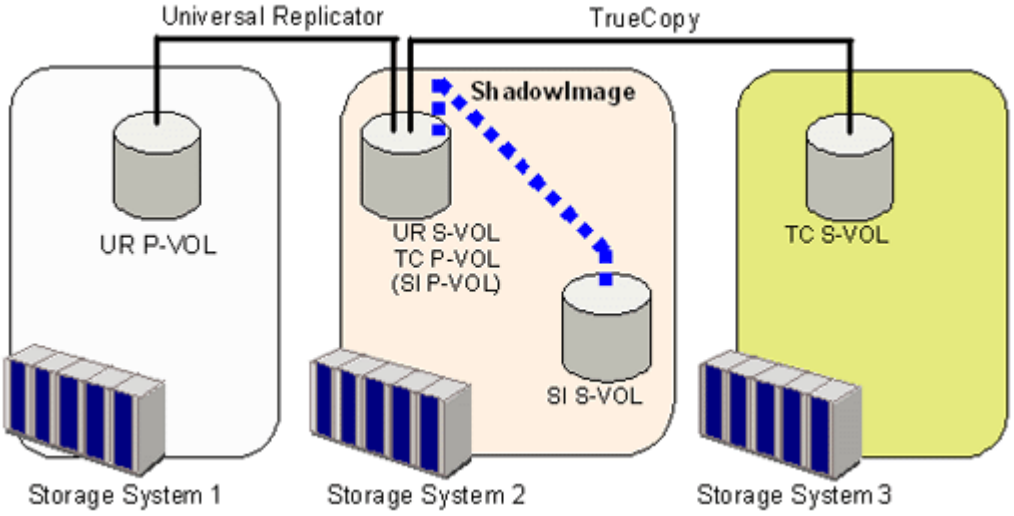


Figure 3-5 UR, TC, and SI Shared Volume Configuration 1

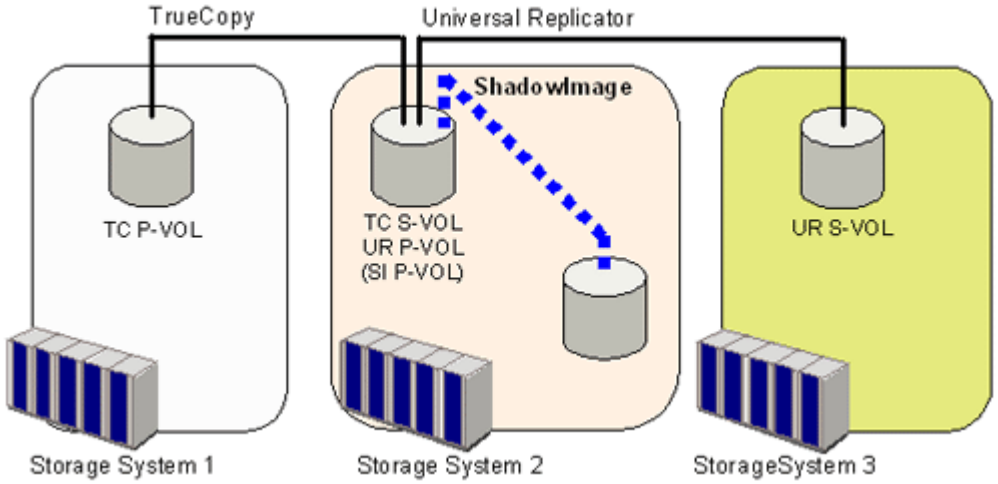


Figure 3-6 UR, TC, and SI Shared Volume Configuration 2

You can perform all SI operations, with the following exceptions, in the intermediate site, irrespective of TC pair status. The UR delta resync pair's status must be HOLD or HLDE:

- You can perform Reverse Copy only when the TC and UR pair status is "PSUS", "PSUE", or "SSWS".
- You cannot perform the Quick Restore.

Universal Volume Manager

If you use SI with UVM, you can create pairs to use the external volumes.

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

Volume Migration

You can assign the following SI volumes to Volume Migration migration volumes:

- L1 P-VOL with up to two S-VOLs.
- L2 P-VOL with one S-VOL.
- Reserved volumes.

To assign or reserve SI volumes to Volume Migration migration volumes, complete the following:

1. Delete the SI pairs.
2. Unreserve the reserved SI S-VOLs.
3. Assign the SI volumes to Volume Migration migration volumes.

You cannot use SI volumes for destination volumes.

You cannot use migration, destination, and reserved volumes of Volume Migration for SI pair operations. To perform SI operations, you must first release the Volume Migration volumes.

You can assign SI volumes as Volume Migration volumes, with the following restrictions:

- If the SI S-VOL is paired with three T-VOLs, you must delete the pair before migrating the volumes with Volume Migration.
- If you want to assign SI volumes as destination volumes of a migration using Volume Migration, or reserve SI volumes for Volume Migration, you must delete the SI volumes or un-reserve them before using Volume Migration.
- If you assign a SI S-VOL that is paired with three T-VOLs as a migration volume, or assign SI volumes to volumes other than Volume Migration migration volumes, the command is rejected.
- If you split a SI pair in which the volumes are assigned as migration volumes, migration of those volumes is canceled.

4

Performing configuration operations

This chapter provides instructions for configuring SI.

Configuration workflow

Setup for SI consists of the following operations. You must have Storage Administrator (Local Copy) role to perform SI operations.

- Setting up primary and secondary volumes on page 4-2.
- Reserving secondary volumes on page 4-2. (Optional.)
- System options that affect performance on page 4-3. (Optional.)

Setting up primary and secondary volumes

The P-VOL and S-VOLs must be set up prior to making copies. Ensure that the volumes you plan to use meet the requirements for pair volumes in Planning pair volumes on page 2-4.

Reserving secondary volumes

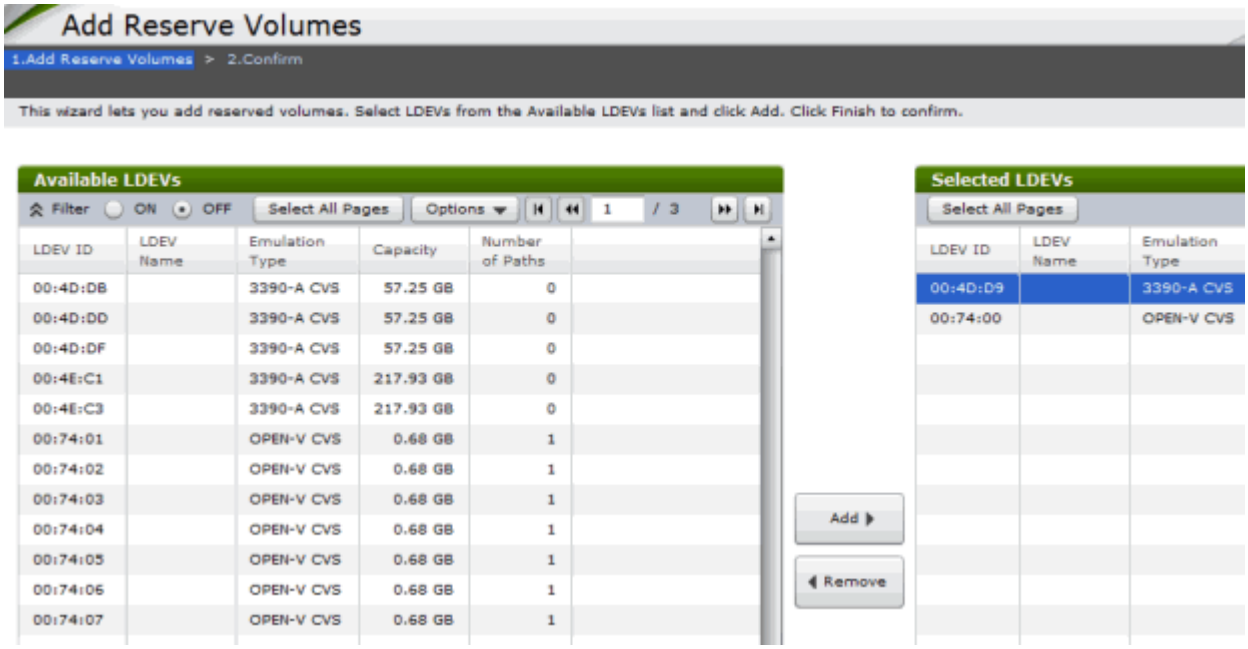
This is an optional feature that allows you to reserve SMPL volumes for use as S-VOLs. The storage system rejects write I/Os to reserved volumes (except in "PSUS" status).

Prerequisite information

Volumes must be:

- In SMPL status
- Unreserved and unpaired

1. In the tree, click **Replications > Local Replications**, then click the **Reserve Volumes** tab.
2. In the **Reserve Volumes** tab, click **Add Reserve Volumes**.
3. In the **Add Reserve Volumes** window/**Available LDEVs** table, select the **LDEV** you want for a reserved volume and click **Add**. This action moves the LDEV to the **Selected LDEVs** table.



4. Click **Finish**.
5. In the **Confirm** window, enter a **Task Name** then click **Apply**.

Related information

- Removing reserve attribute from a volume on page 6-10

System options that affect performance

You can enable and disable the following options that affect performance. (To go directly to the procedure, see Setting performance options on page 4-4).

- **Swap&Freeze**. Alters the behavior of the quick restore operation. With Swap&Freeze, update copy operations are suppressed when the quick restore is completed and the pair is in "PAIR" status. Differential data is not copied to the new S-VOL. Use the Swap&Freeze option when you want to keep S-VOLs unchanged after the quick restore operation.
- **Host I/O Performance**. Increases I/O performance while suppressing copy processing. However, be aware that enabling this option results in a longer copy time, slowing copy processing.
- **Copy Threshold**. Temporarily stops copy operations when the workload on the storage system is heavy. This is done to minimize degradation to host I/O performance during peak periods. The option performs only when workload is heavy; the Host I/O Performance option suppresses copy operations at all times regardless of workload level.

  When the Copy Threshold Option is enabled, it is effective for all of the following software:

  - SI

- SIz
- Compatible FlashCopy®
- HTI
- SS
- Volume Migration

Note: Your service representative must enable the Copy Threshold option.

- **Copy Pace** options. Reduce the effect on host server I/O performance by suppressing copy processing in "PAIR" status. The system uses this option when pairs are in "PAIR" status only. This option does not have an effect if the pair is in other statuses.

  You can choose from three levels of processing-suppression/performance-improvement:

  - **Copy Pace Ext. None** (usable since program version 70-03-01-xx/xx). This is the most effective option—stops copy processing.

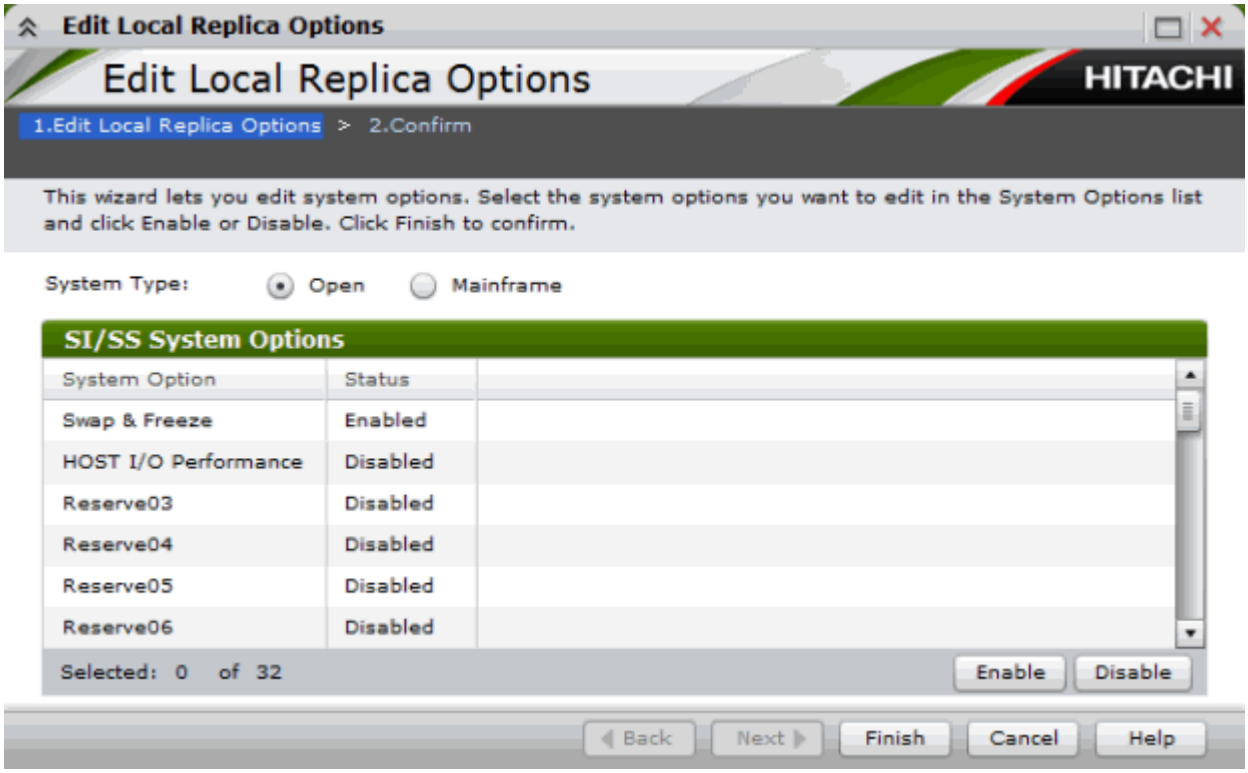
    Note: With this option, synchronization when a pair is split tends to be slower, which prolongs the time that the pair is in process of Quick Split ("PSUS(SP)/PSUS" status) or in the process of Steady Split ("COPY(SP)/COPY" status). If this poses a problem, complete one of the following:

    - Minimize the time that the pair is in "PAIR" status so that synchronization at the pair split does not require so much time.
    - Use one of the other Copy Pace options.

  - **Copy Pace Ext. Slower2**—2nd most effective
  - **Copy Pace Ext. Slower1**—3rd most effective

Setting performance options

1. In the tree, click **Replications > Local Replications**.
2. In the **Local Replications** window, click **Edit Local Replica Options**.
3. In the **Edit Local Replica Options** window, for **System Type**, select **Open**.



4. In the **System Options** list, select the option you want and click **Enable**. You may need to scroll down to the option you want. Copy Threshold must be enabled by your service representative.
5. Click **Finish**.
6. In the **Confirm** window, enter a **Task Name** then click **Apply**.

5

Performing pair operations

This chapter provides instructions for performing SI pair operations using SN. Also included is an operation for splitting pairs by consistency group, using CCI.

Pair operations workflow

A typical workflow for performing pair operations consists of the following. You must have Storage Administrator (Local Copy) role to perform SI operations.

- Check pair status on page 5-2. Each operation requires a pair to have a specific status. You also check pair status to ensure that an operation completed successfully.
- Pair creation on page 5-2, in which the S-VOL becomes a duplicate of the P-VOL. You can create a pair and immediately split it so that you can access the S-VOL.
- Suspending pair creation on page 5-9.
- Pair split on page 5-9, which separates the P-VOL and S-VOLs and allows use of S-VOL data by secondary applications.
- Splitting pairs in a consistency group on page 5-12, which allows you to split pairs in a consistency group at a specified time.
- Pair resynchronization on page 5-13, in which the S-VOL is again updated from the P-VOL.
- Pair deletion on page 5-16 in which the pair relationship between the pair volumes is ended, though the data remains.

Check pair status

Every pair operation requires the pair to have a specific status. When you want to perform a pair operation, check pair status to ensure that you can proceed successfully.

- For pair status definitions and instructions for finding pair status, see Monitoring the system on page 6-2.
- You should also check whether an operation is possible given the status of related L1 and L2 pairs. For information, see Status for L1, L2 pairs and operations permitted on page 6-5.

Pair creation

When you create the initial copy, data in the P-VOL is copied to the S-VOL. During the operation, the P-VOL can receive updates from the host. After the initial copy is completed, the updated data in the P-VOL—differential data—is copied to the S-VOL periodically (update copy).

You can create the pair and immediately split it so that you can have instant access to the S-VOL. Instructions are included in the procedure.

You can create cascaded pairs; instructions are included for L1 and L2 pairs.

Related information

- Prerequisite information for creating pairs on page 5-3

- Creating pairs on page 5-5

Prerequisite information for creating pairs

- Make sure that your volumes are set up for pairing. For more information, see Planning pair volumes on page 2-4.
- Volumes should be in SMPL status. However, for L1 and L2 pairs, check the status. For more information on the L1 and L2 permitted statuses, see Status for L1, L2 pairs and operations permitted on page 6-5.
- When creating an L1 pair and an L2 pair at the same time, specify **Non Split** as the **Split Type**. Doing this prevents failure, since using another split type can result in the split operation for the L2 pair to begin before the pair status changes to "PSUS".
- If the P-VOL is already paired with other S-VOLs, before creating the new pair, check the permitted status of existing S-VOLs. For more information, see Status of unaffected S-VOLs, operations permitted on page 6-7.
- Because pair creation affects performance on the host, observe the following:
  - Create a pair when I/O load is light.
  - Limit the number of pairs that you create simultaneously.
- When you create a pair, the S-VOL's LDEV is allocated to the same processor blade to which the P-VOL's LDEV is allocated.
- The paircreate operation overwrites all existing data on the S-VOL. The user is responsible for backing up data on the S-VOLs before creating pairs.
- If you use BEDs supporting encryption, you can create an SI pair by using an encrypted volume and a non-encrypted volume. For example, you can create the pair specifying an encrypted volume as the P-VOL and a non-encrypted volume as the S-VOL. In this case, data in the encrypted P-VOL becomes non-encrypted data in the S-VOL.
- In the **Create Pairs** wizard, specify pair configuration settings that require additional explanation.

  For more information on setting up pair configurations, see On creating L1 and L2 pairs with different topologies on page 5-4.
- If you are using one of its volumes as an HTI P-VOL, first create the SI pair.

  If an MU number is not available, complete the following:

  a. Delete the HTI pair that has an MU number between 0 and 2.
  b. Create the SI pair.
  c. Create the HTI pair.
- The P-VOL and S-VOLs must be the same size in blocks. If the capacity is displayed in gigabytes, a small difference between P-VOL and S-VOL capacity might not be displayed.

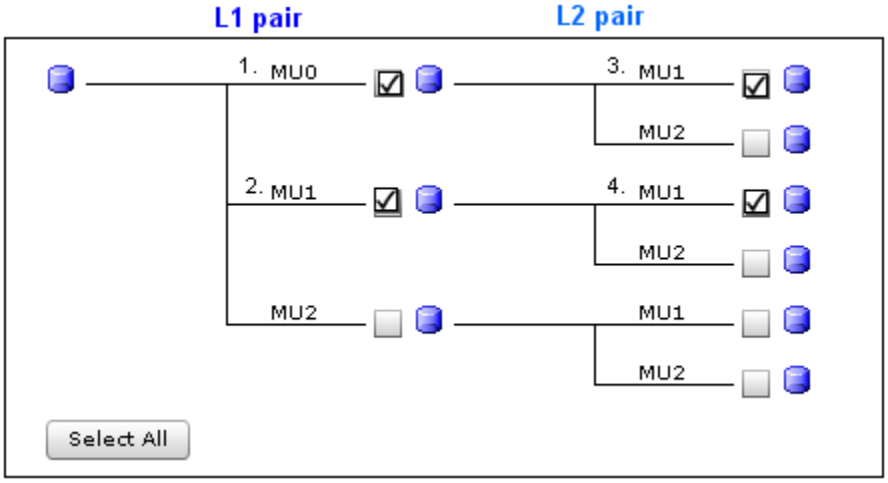
To view the capacity in blocks, click **Options > Capacity Unit > block** in the **Logical Devices** window, or for a secondary window, look at the **Capacity (blocks)** area of the **Detail** window.

On creating L1 and L2 pairs with different topologies

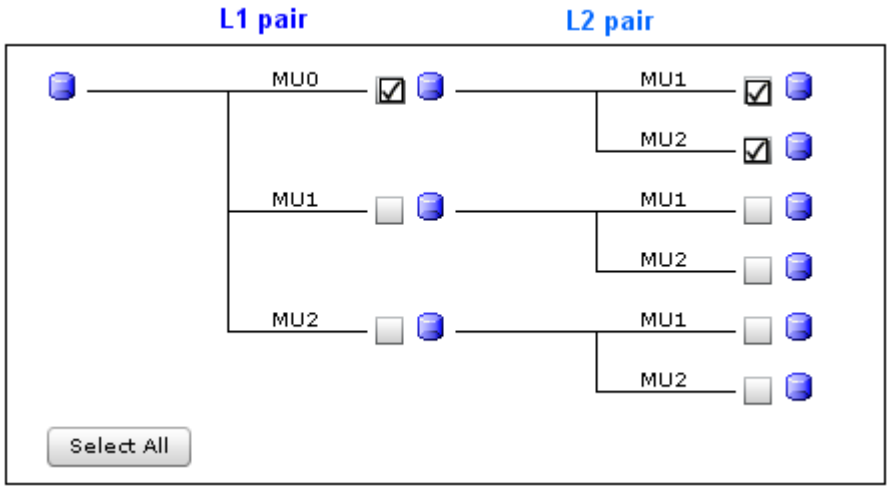
You begin the **Create Pairs** wizard by specifying L1 and L2 pair topology in the **Select Pair Configuration** window. Though you may be performing the operation for more than one P-VOL, you specify pair topology only once, and this topology applies to all P-VOLs in the operation.

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

To change L1 and L2 pair configuration, you begin by setting the topology for the pair with the largest topology. The following figure shows an example of the P-VOL with the largest topology, of all the pairs being created in an operation.



To change a pair's L1 and L2 combination from the preceding topology to the one shown in the following figure, for example, you would continue through the **Create Pairs** wizard to the **Select Secondary Volumes** window.

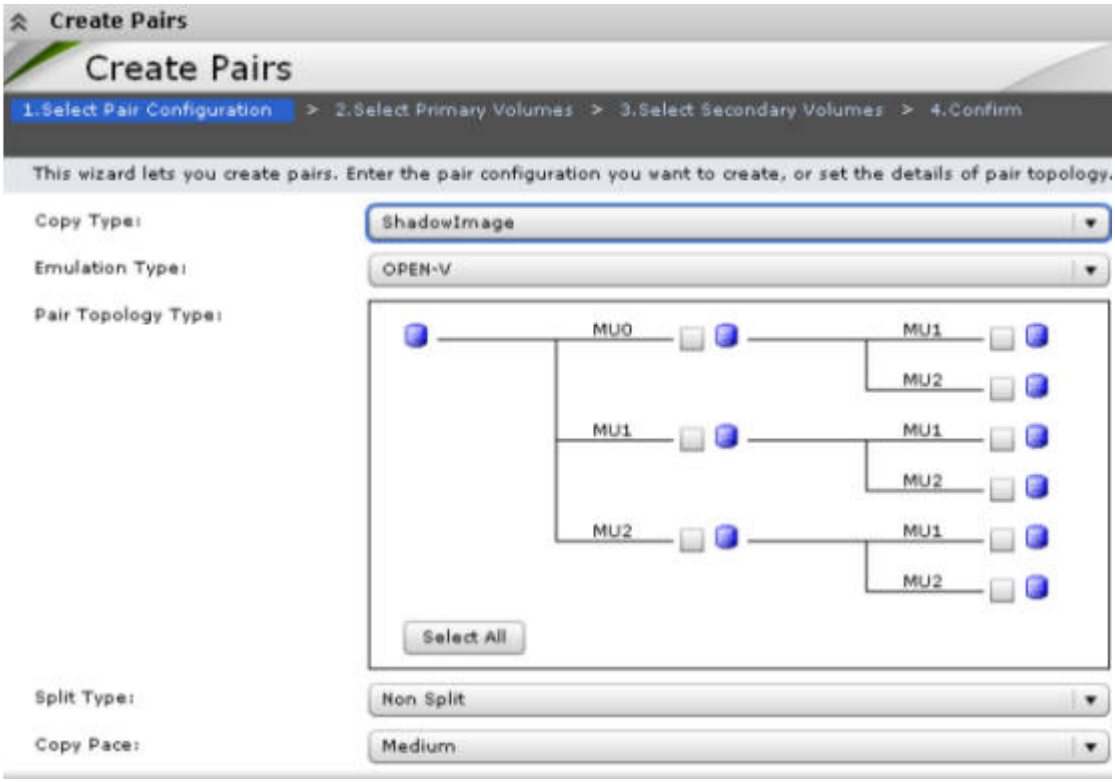


In the **Select Secondary Volumes** window, after pairing S-VOLs with P-VOLs, in the **Selected Pairs** table you would select the line with the S-VOLs whose configuration you want to modify, and then click **Edit MU Number**. In the **Edit MU Number** dialog box, you would specify "0" for the L1, and "2" for the L2. This has the effect of moving the *number-4* L2 S-VOL to be paired with the *number-1* L1 volume (with MU#0), as intended.

You can also refine a pair's topology by removing unwanted volumes. To do this, click **Remove** in the **Select Secondary Volumes** window.

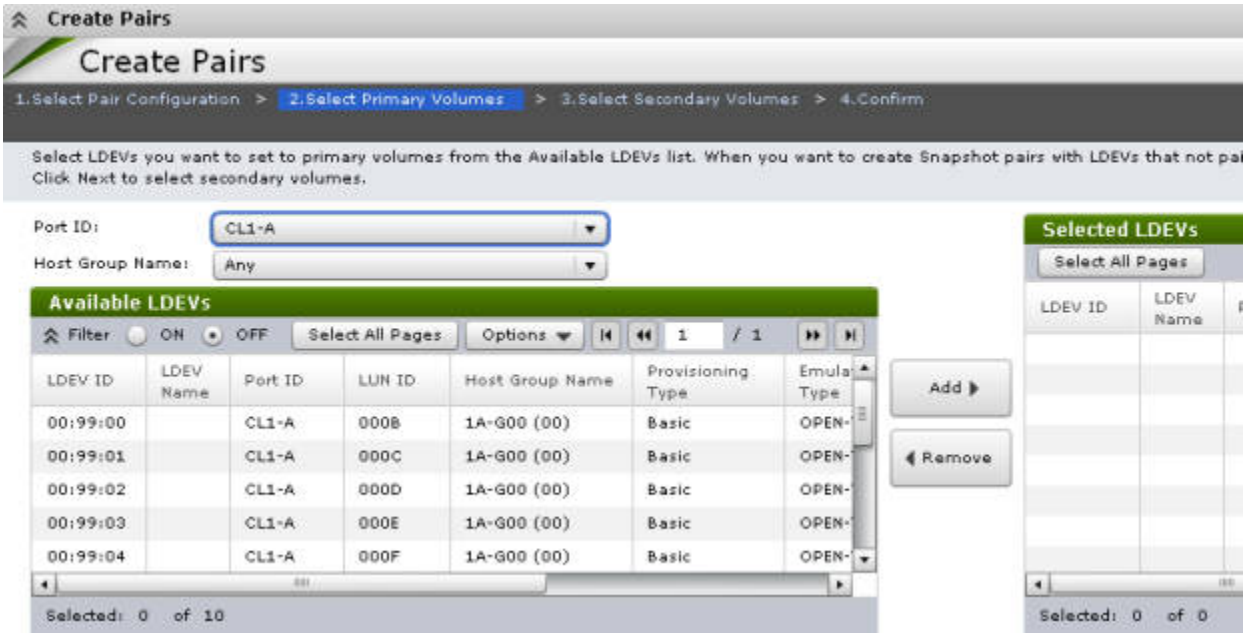
Creating pairs

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, click **Create Pairs**.
3. In the **Select Pair Configuration** window of the **Create Pairs** wizard, select the **Copy Type**, **ShadowImage**.



4. Select the **Emulation Type**.
5. In **Pair Topology Type**, select the boxes that matches your configuration.

   For more information, see On creating L1 and L2 pairs with different topologies on page 5-4.
6. In **Split Type**, you have the option of splitting the pair once it is created. Select one of the following:
   - **Non Split**: Does not split the new pair.
   - **Quick Split**: The new 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.
   - **Steady Split**: Splits the new pair after all differential data is copied to the S-VOL.
7. In **Copy Pace**, select the pace at which data is to be copied, **Slower**, **Medium**, or **Faster**. Processing speed and system performance are affected by the pace you select; you see slower speed and better performance with **Slower**, faster speed but more impact to performance with **Faster**.
8. Click **Next**.
9. In the **Select Primary Volumes** window, in the **Available LDEVs** table, select an LDEV to be a P-VOL, then click **Add**. The LDEV is moved to the **Selected LDEVs** table. You can make multiple selections.



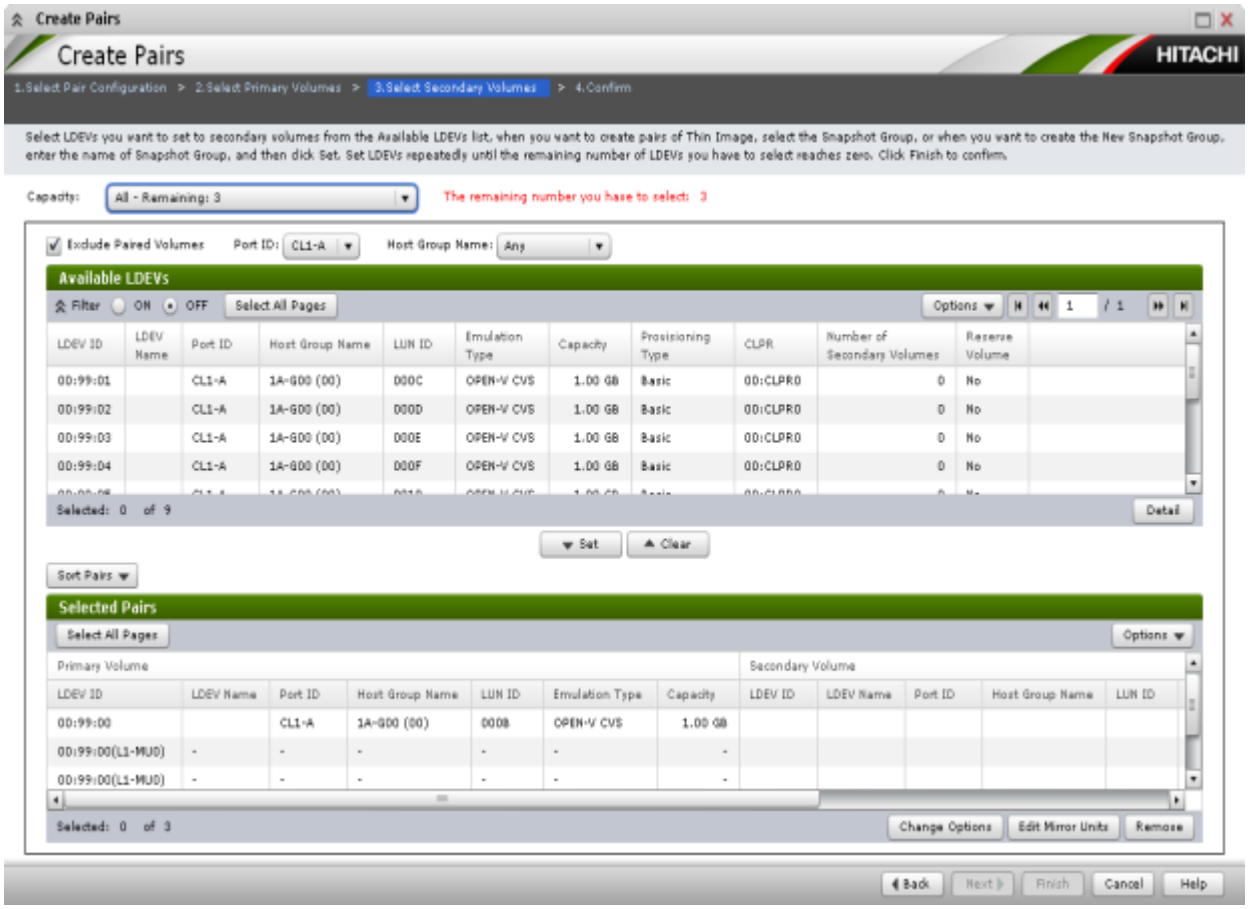
10. Click **Next**.
11. In the **Select Secondary Volumes** window, assign LDEVs as S-VOL to the P-VOL LDEV (or LDEVs) selected in the **Select Primary Volumes** window.

    Complete the following:

    - If you specified a P-VOL, select a secondary **LDEV ID** in the **Available LDEVs** table, and click **Set**. Repeat this step to assign additional S-VOLs.
    - If you specified more than one P-VOL, select an **LDEV ID** in the **Available LDEVs** table, then select a P-VOL **LDEV ID** in the **Selected Pairs** table, and click **Set**.

      Repeat this step as many times as needed to make all your pairings.

      By not selecting a P-VOL in the **Selected Pairs** table, the S-VOL you select and set is assigned to P-VOLs in order from the first line of the table.



- To sort the **Available LDEVs** and **Selected Pairs** tables according to the capacity, click **Capacity** near the top of the window.
- **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.
- **Sort** in the middle-left allows you to sort the **Selected Pairs** table.
- **Change Options** in the middle-right allows you to change **Split Type** and **Copy Pace** (applies to all new pairs).
- To change MU numbers, complete the following:

  a. Select the desired primary/secondary line in the **Selected Pairs** table.

  b. Click **Edit Mirror Unit** near the bottom-right which results in a modified pair topology after specifying S-VOL. For more information on changing a pair's topology, see On creating L1 and L2 pairs with different topologies on page 5-4.
- To remove a line from the **Selected Pairs** table, select the line and click **Remove**. The pair topology changes.

12. Click **Finish**.
13. In the **Confirm** window, type a **Task Name** then click **Apply**.

After creating the pair, if you do not see the number of pairs and other information you expect to see in the **Summary** tab of the **Local**

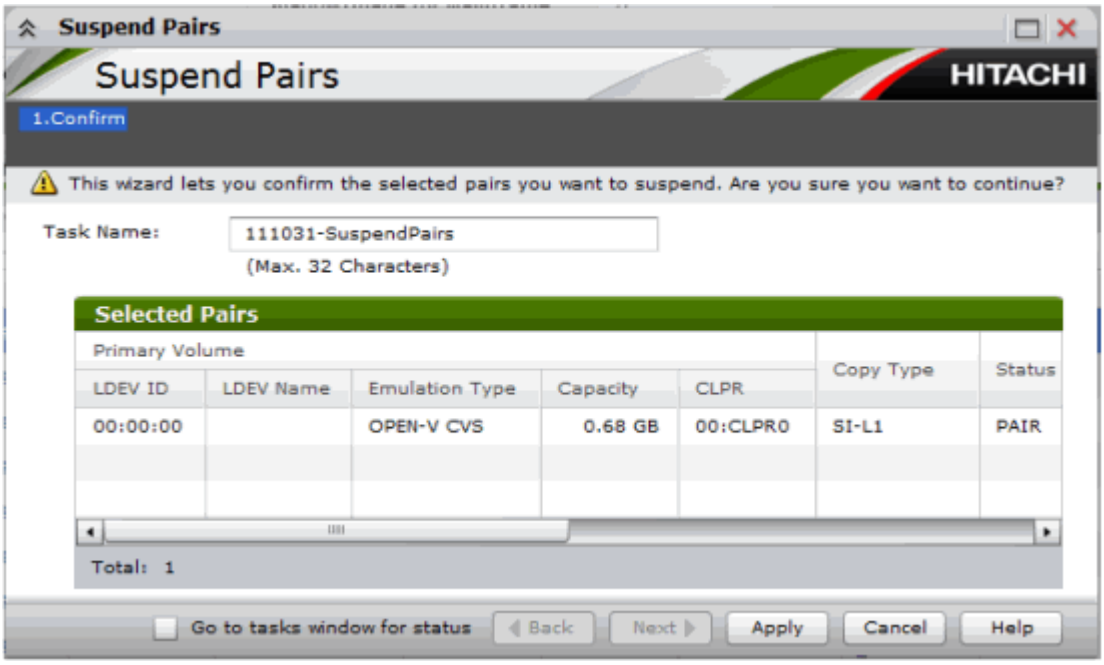
Replications window, the system is working and requires more time. Wait a little longer, then click **File/Refresh**.

Suspending pair creation

You can suspend a pair create operation (initial copy). When this is done, pair status changes to "PSUE". The S-VOL continues accepting write I/O operations from the P-VOL and marks the entire P-VOL track as difference data. Resynchronizing a suspended pair change the pair status to "COPY(RS)/COPY" and copies the entire P-VOL to the S-VOL. Resynchronizing a suspended pair takes the same time as the initial copy operation.

The storage system automatically suspends a pair when it detects an error condition related to an update copy operation, or when it cannot keep the pair mirrored.

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, select the pair you want to suspend, and click **More Actions > Suspend Pairs**.
3. In the **Suspend Pairs** window, type a **Task Name** and click **Apply**.



Pair split

Host updates to the P-VOL and periodic copying to the S-VOL continue until the pair is split. After the pair is split, updates continue to the P-VOL but are not copied to the S-VOL; data in the S-VOL is ensured at the time of the split. Update data that accrues during the split is stored in differential bitmaps until it is copied to the S-VOL during resynchronization.

The P-VOL and S-VOL are synchronized when the pair status changes from "PSUS(SP)/PSUS" or "COPY(SP)/COPY" to "PSUS".

Related information

- Types of split operations on page 5-10
- Prerequisite information for splitting pairs on page 5-10
- Splitting pairs on page 5-11
- Splitting pairs in a consistency group on page 5-12

Types of split operations

The following options are available when splitting a pair:

- **Non split**, which does not split the pair.
- **Steady split**, which copies all differential data to the S-VOL and then splits the pair.
- **Quick split**, in which the pair is immediately split, so that the S-VOL is immediately available for read and write I/O. Remaining differential data is copied to the S-VOL in the background.
- **Consistency group pair-split**, in which all pairs in a consistency group are split simultaneously. You can use this method with CCI.

  For split operations with CCI, both Quick Split and Steady Split are available.

  For more information, see *Command Control Interface User and Reference Guide*.

Prerequisite information for splitting pairs

- Pair status must be one of the following:
  - "PAIR" when splitting an existing pair.
  - "SMPL", when creating and immediately splitting an L1 pair.
  - To split an L1 pair that has L2 pairs, check Status for L1, L2 pairs and operations permitted on page 6-5.
  - "PSUS" for the L1 pair when splitting, or creating and immediately splitting, an L2 pair.
- The P-VOL and S-VOL are synchronized when pair status changes from "COPY(SP)/COPY" or "PSUS(SP)/PSUS" to "PSUS".
- To ensure that the data in the P-VOL matches data in the S-VOL after the pair split, stop write operations from the host server to the P-VOL before running the operation.
- For a split operation to complete faster on an existing pair, stop host access to the P-VOL before starting the split.

Related information

- PSUS, performance, and SOM 459 on page 5-11

- Status for L1, L2 pairs and operations permitted on page 6-5

PSUS, performance, and SOM 459

Performance can be affected for pairs that are in "PSUS(SP)/PSUS" or "COPY(SP)/COPY" status depending on the following:

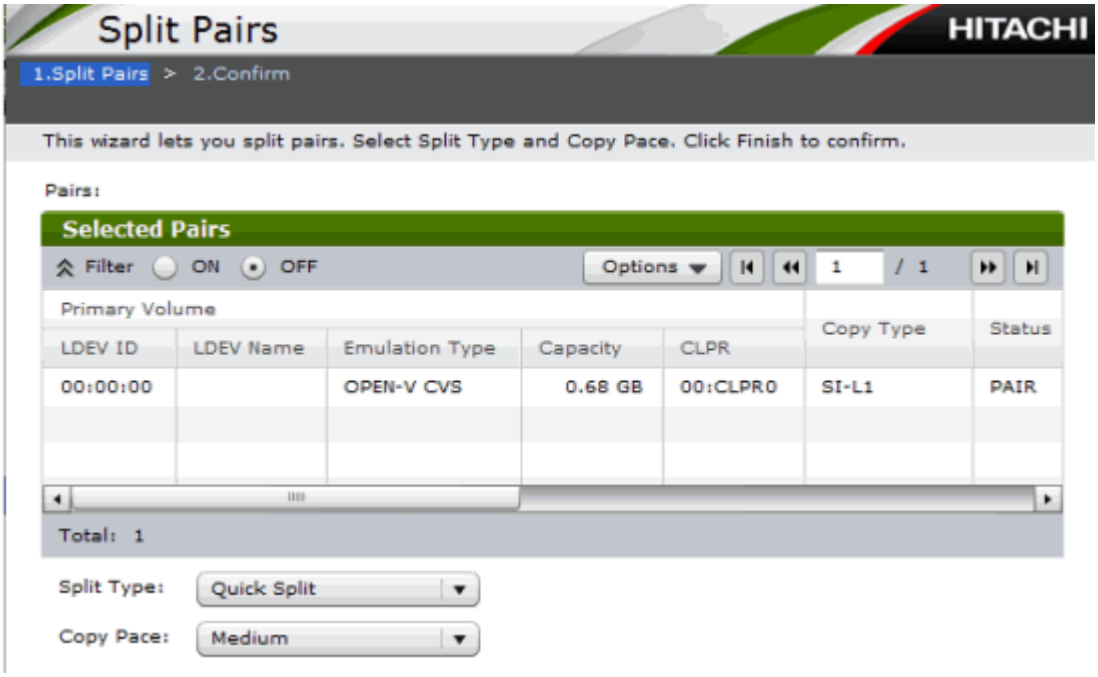
- Whether system option mode 459 is enabled.
- Whether the S-VOL is an external or internal volume.
- Whether the S-VOL is a volume in a Hitachi Dynamic Provisioning pool.

The following table shows the affects of these conditions.

System option mode 459	S-VOL*	PSUS(SP)/PSUS or COPY(SP)/COPY status
OFF	Internal volume	Pair status changes to "PSUS(SP)/PSUS" after differential data is copied to the cache in the storage system
	External volume	
ON	Internal volume	
	External volume	Pair status changes to "PSUS" after differential data is copied to the cache in the storage system and destage to the external storage system has completed.
* If the S-VOL is a DP-VOL, this indicates whether the top pool volume allocated to the S-VOL is internal or external.		

Splitting pairs

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, select the pair you want to split, then click **Split Pairs**.
3. In the **Split Pairs** window, select a **Split Type**.
   Values: **Quick Split** or **Steady Split**
   For more information, see Types of split operations on page 5-10.



4. In **Copy Pace**, select the pace at which data is to be copied.
   Values: **Slower**, **Medium**, or **Faster**.
   Processing speed and system performance are affected by the pace you select; you see slower speed and better performance with **Slower**, faster speed but more impact to performance with **Faster**.
5. Click **Finish**.
6. In the **Confirm** window, type a **Task Name** then click **Apply**.

Splitting pairs in a consistency group

Use consistency group pair-split to simultaneously split all the pairs in a consistency group.

Prerequisite information

For requirements and restrictions, see Consistency group pair-split on page 2-10.

For more information about splitting pairs, see Splitting pairs in a consistency group on page D-8. For more information about troubleshooting consistency group pair-split and the consistency group pair-split option, see Troubleshooting consistency group pair-split on page 7-12.

1. Use the consistency group pair-split feature in CCI to define a consistency group for the SI pairs that you are splitting.
2. Specify the consistency group pair-split option, then create the pairs.
3. Ensure that all SI pairs in the consistency group are in “PAIR” or “COPY(PD)/COPY” status.
4. Split the pairs in the consistency group.
   The pairs are split simultaneously.

Note: You cannot maintain SI S-VOL consistency if you are sharing an SI P-VOL with UR S-VOLs and you have included SI pairs in a status other than "PAIR" or "COPY(PD)/COPY" in the consistency group.

Pair resynchronization

You resynchronize a pair that is split or suspended by the system. Resynchronizing updates the S-VOL so that it is again paired with the P-VOL.

Caution: Resynchronizing the pair does not guarantee that P-VOL data is the same as S-VOL data. Data in the two volumes is the same only if the P-VOL is offline and the pair has been split ("PSUS" status).

Related information

- Types of resync operations on page 5-13
- Prerequisite information for resynchronizing on page 5-14
- Resynchronizing pairs on page 5-15

Types of resync operations

You can resynchronize pairs from P-VOL to S-VOL and from S-VOL to P-VOL. The types of resync operation follow, with requirements and restrictions:

- **Normal Copy**. Forward full resync, from P-VOL to S-VOL.
  - The P-VOL is accessible to hosts for both read and write operations.
  - The S-VOL is inaccessible to hosts.
  - After performing a Quick Split, wait 20 seconds before a Normal Copy resynchronization, otherwise the operation might end abnormally.
- **Quick Resync**. Forward resync from P-VOL to S-VOL but does not data copy. The status changes to "PAIR" but does not resynchronize the data to the S-VOL.
  - Differential data is copied to the S-VOL during update copying.
  - The P-VOL is accessible to hosts for read and write operations.
  - Data in the P-VOL and S-VOL might not be the same after a Quick Resync even when there a host I/O is not present during the operation. Split the pair to ensure that data is the same.
  - After performing a Quick Split, wait 20 seconds before a Quick Resync resynchronization, otherwise the operation might end abnormally.
- **Reverse Copy**. Reverse full resync from S-VOL to P-VOL.
  - The P-VOL is inaccessible to hosts.
  - All differential data is updated to the P-VOL.
  - Pairs sharing the same P-VOL must be in "PSUS" or "PSUE" status.
  - If the pair shares a volume with TC or UR, you must suspend the TC or UR pair to perform the Reverse Copy or Quick Restore operation.

- You cannot create a TC or UR pair with a volume shared by SI during the Reverse Copy or Quick Restore operation.
- When the Reverse Copy or Quick Restore is in progress, you cannot create, split, or resync any pair sharing the same P-VOL. However, the pairs can be deleted or suspended.
- Reverse Copy cannot be used for the following:
  - SI L2 pair
  - ShadowImage for Mainframe (SIz) pair when the P-VOL is shared with an FCv2/FCSE volume

- **Quick Restore**, P-VOL and S-VOL are swapped. NO data is copied, and the pair is placed in "PAIR" status. Differential data is copied to the S-VOL during update copy operations.
  - Differential data is copied during update copying.
  - The P-VOL and S-VOL are inaccessible during this operation. When the operation completes, the P-VOL is accessible.
  - Pairs sharing the same P-VOL must be in "PSUS" or "PSUE" status.
  - When there is a small amount of differential data between P-VOL and S-VOL, the Reverse Copy operation may complete faster than the Quick Restore operation.
  - Performing LDEV maintenance during the Quick Restore process increases the time for the operation to complete.
  - If the pair shares a volume with TC or UR, you must suspend the TC or UR pair to perform the Reverse Copy or Quick Restore operation.
  - You cannot create a TC or UR pair with a volume shared by SI during the Reverse Copy or Quick Restore operation.
  - When the Reverse Copy or Quick Restore operation is in progress, you cannot create, split, or resync any pair sharing the same P-VOL. However, the pairs can be deleted or suspended.
  - Quick Restore cannot be used for the following:
    - An SI L2 pair
    - When a quick format is being performed on either pair volume
    - A pair in which one volume is a DP-VOL, though not both
    - When the SI S-VOL is shared with an HTI or SS volume

Prerequisite information for resynchronizing

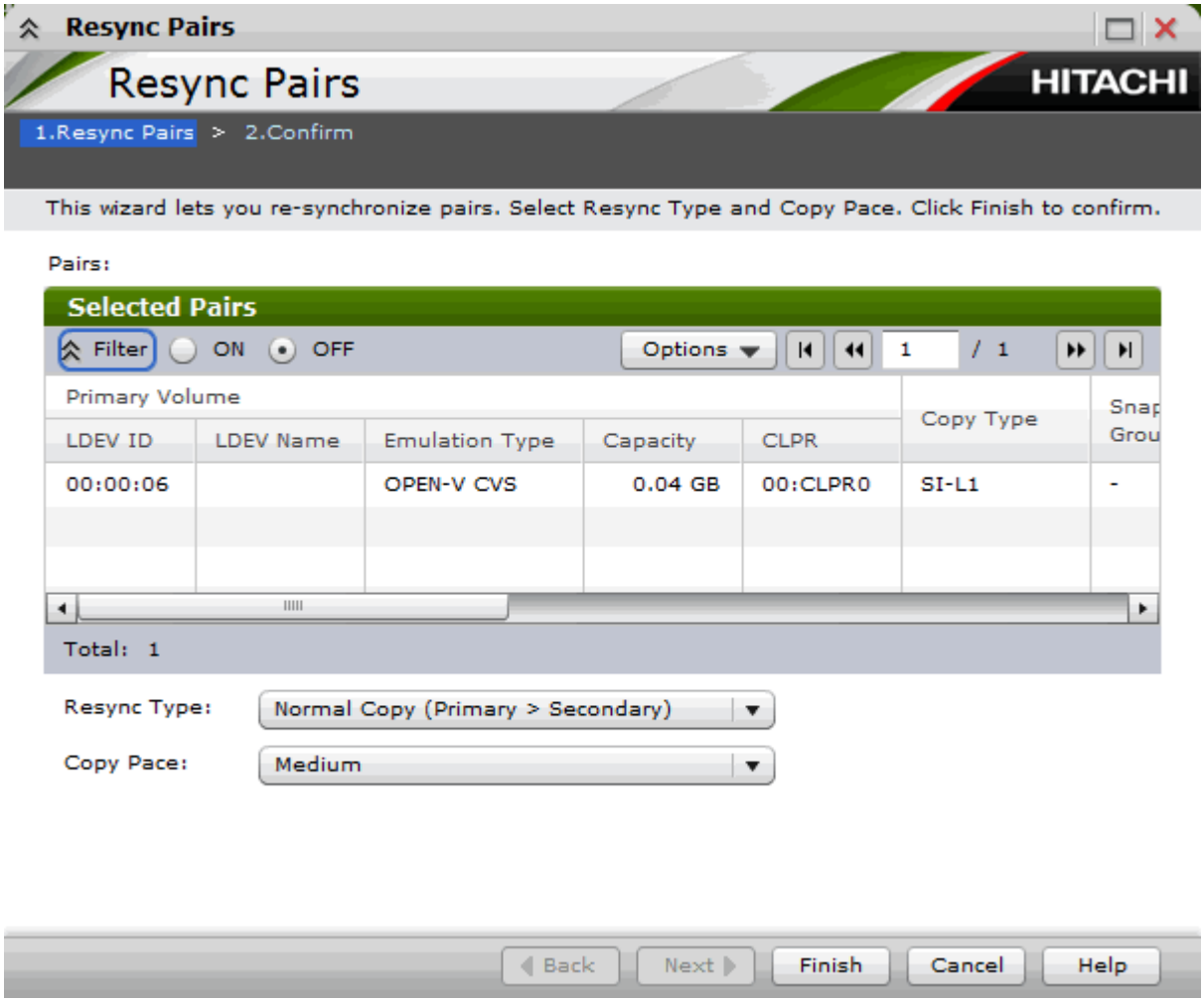
- For Normal Copy and Quick Resync, the S-VOL must be offline.
- For Reverse Copy and Quick Restore, the P-VOL must be offline.
- For Normal Copy or Quick Resync, the pair must be in "PSUS", "PSUE", or "PSUS(SP)/PSUS" status.
- For Reverse Copy or Quick Restore, the pair must be in "PSUS" status.
- The pairresync normally takes less time when the pair is in "PSUS" status than when it is in "PSUE". This is because the amount of differential data accumulated for a split pair is usually much less than the total amount of

data in the P-VOL, which must be copied in full when the pair was suspended by the storage system.

- To keep the P-VOL and S-VOL unsynchronized when performing a Quick Restore, enable the Swap&Freeze option prior to performing the operation. Update copy operations are then suppressed when the Quick Restore is completed, and the pair is in "PAIR" status.
- If a pair consists of encrypted volumes and a non-encrypted volume, and the Quick Restore is run, the P-VOL and S-VOL encryption statuses are reversed.
- With a Quick Restore, SN can show outdated information. Click **Refresh View** to ensure the most up-to-date information.

Resynchronizing pairs

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, select the pair you want to resynchronize, then click **Resync Pairs**.
3. In the **Resync Pairs** window, select a **Resync Type**.
   For more information, see Types of resync operations on page 5-13.



4. Select a **Copy Pace**, which is the rate that data is to be copied.
   Values: **Slower**, **Medium**, or **Faster**.
   Processing speed and system performance are affected by the pace you select; you see slower speed and better performance with **Slower**, faster speed but more impact to performance with **Faster**.
5. Click **Finish**.
6. In the **Confirm** window, type a **Task Name** and click **Apply**.

Note: The following concerns possible post-resync conditions:

- Make sure that pair status changes to "PAIR" before attempting any other operation.
- If the reverse or quick restore operation ends abnormally, the pair status changes to "PSUE". In this case, the P-VOL is read/write-enabled for all hosts, but the data is not guaranteed. The S-VOL remains write-disabled and data is not guaranteed. The status of other pairs sharing the same P-VOL does not change.

Pair deletion

You can delete a pair when you do not need it. When you delete a pair, the P-VOL and S-VOL return to their SMPL state, though their data remains intact. After deletion, both volumes are available for use in another pair.

Note: If the pair status changes to "SMPL", the status is not shown in SN.

Related information

- Prerequisite information for deleting pairs on page 5-16
- Deleting pairs on page 5-17

Prerequisite information for deleting pairs

- The P-VOL and S-VOL must be synchronized. Before deleting, wait until all write I/O operations to the P-VOL are completed, set the P-VOL offline, then split the pair.
- Pair deletion cannot be performed when the pair status is "PSUS(SP)/ PSUS".
- When a pair is created, the processor blade allocated to the P-VOL's LDEV is also allocated to the S-VOL's LDEV. When a pair is deleted, the processor blade that was originally allocated to the S-VOL's LDEV is allocated to it again. If the original processor blade was removed, another processor blade is allocated.
- Deleting a pair first changes the status of the volumes to "SMPL(PD)" then to "SMPL". "SMPL" status is not shown in SN.

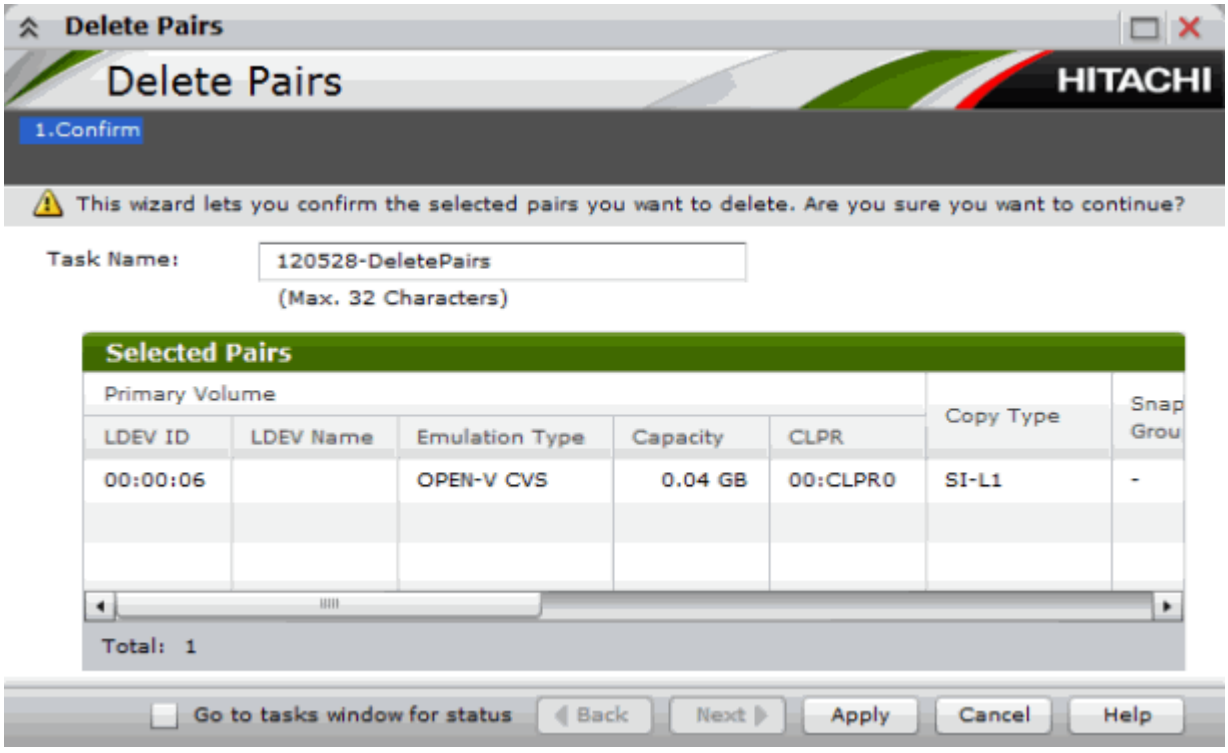
To distinguish between "SMPL" and "SMPL(PD)" volumes, run the CCI **pairdisplay** and **Inqraid** commands. The **pairdisplay** command shows status but cannot distinguish between "SMPL" and "SMPL(PD)"; and the **Inqraid** shows whether a volume is being used by SI.

- If the result of the **pairdisplay** command is "SMPL", and the result of the **Inqraid** command is the P-VOL or S-VOL, then SI is still using the pair and status is "SMPL(PD)".
- If the result of the **pairdisplay** command is "SMPL", and the result of the **Inqraid** command is not the P-VOL or S-VOL, then SI is not using the volumes. Therefore, status is confirmed as "SMPL".

- After deleting a pair, wait 10 seconds—until volume status changes from "SMPL(PD)" to "SMPL"—before performing tasks such as a pair operation or event waiting. If you do not wait 10 seconds, the operation might end abnormally.

Deleting pairs

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, select the pair you want to delete, and click **More Actions > Delete Pairs**.
3. In the **Delete Pairs** window, type a **Task Name** and click **Apply**.



After performing the pairdelete operation, if you do not see the number of pairs and other information you expect to see in the **Summary** tab of the **Local Replications** window, the system is working and requires more time. Wait a little longer, then click **File/Refresh**.

6

Monitoring and maintaining the system

This chapter provides information and instructions for monitoring and maintaining the SI system.

- Monitoring the system
- Maintaining the system

Monitoring the system

Monitoring helps you keep track of pairs and volumes and their current and past conditions. Monitoring should be an ongoing activity. This topic provides information for the following:

- Monitoring pair activity, status on page 6-2. Status definitions, permitted operations for each status, and permitted operations for L1 and L2 pairs are included.
- Monitoring pair, volume details on page 6-7.
- Monitoring synchronous rates on page 6-8.
- Monitoring consistency groups on page 6-8.
- Monitoring reserve volumes on page 6-8.
- Monitoring a pair's operation history on page 6-8.

Monitoring pair activity, status

Monitoring the SI system is necessary to maintain your pairs.

Each operation requires a specific status or statuses. When you want to perform a pair command, first check the pair's status.

Pair-status changes when an operation is performed. Check status to see that pairs are operating correctly and that status is changing to the appropriate state during and after the operation.

Monitoring should be repeated frequently. Email notifications of problems in pair operations can be set up using SN.

1. In the tree, click **Replications > Local Replications**.
2. In the **Pairs** tab, locate the pair whose status you want to review.
3. Review pair status in the **Status** column.

You can view license information in the **Summary** section.

You can view more details for a selected pair by clicking **More Actions > View Pair Properties**. For more information about the fields, see Monitoring pair, volume details on page 6-7.

Related information

- Pair status definitions on page 6-3
- CCI pair status names on page 6-4
- Status, pair operations permitted on page 6-4
- Status for L1, L2 pairs and operations permitted on page 6-5
- Status of unaffected S-VOLs, operations permitted on page 6-7

Pair status definitions

Pair status descriptions are provided in the following table. Click **Refresh View** for the most current data.

(For the CCI status names, see CCI pair status names on page 6-4.

SN Status	Description	P-VOL access	S-VOL access
SMPL	The volume is not assigned to a pair. The storage system accepts read/write for "SMPL" volumes that are not reserved. **Note:** If the volume is in "SMPL" status, the status is not shown in SN.	N/A	N/A
SMPL(PD)	The pair is being deleted. Pair operations are not allowed in this status. Upon deletion, the status changes to "SMPL".	Read/write disabled[1]	Read/write disabled
COPY(PD)/ COPY	The paircreate initial copy is in progress.[2] The storage system accepts read/write to the P-VOL but stops write operations to the S-VOL.	Read/write enabled	Read only
PAIR	The initial copy operation is complete and the volumes are paired. The storage system performs update copy operations from P-VOL to S-VOL. The P-VOL and S-VOL in "PAIR" status may not be identical.	Read/write enabled	Read only
COPY(SP)/ COPY	The pair is in the process of Steady Split. Any remaining differential data is copied to the S-VOL.[2] When this is completed, the pair is split and the data in the S-VOL is identical to data in the P-VOL at the time of the split.	Read/write enabled	Read only
PSUS(SP)/ PSUS	The pair is in the process of Quick Split. P-VOL differential data is copied to the S-VOL in the background.[2] Pairs cannot be deleted.	Read/write enabled	Read/write enabled
PSUS	The pair is split. The storage system stops performing update copy operations. Write I/Os are accepted for S-VOL. The storage system keeps track of updates to split P-VOLs and S-VOL, so that the pair can be resynchronized quickly.	Read/write enabled	Read/write enabled
COPY(RS)/ COPY	The pairresync operation is in progress. The storage system does not accept write I/Os for S-VOL.[2] When a split pair is resynchronized, the storage system copies only P-VOL differential data to the S-VOL. When a suspended pair is resynchronized, the storage system copies the entire P-VOL to the S-VOL.	Read/write enabled	Read only
COPY(RS-R)/ RCPY	The reverse pairresync operation is in progress. The storage system copies only S-VOL differential data to the P-VOL. No update copy operations are performed during Reverse Copy or Quick Restore.[2] Write I/O operations to S-VOL are rejected.	Read/write disabled	Read only
PSUE	The pair is suspended by the storage system. The storage system continues accepting read and write I/Os to the P-VOL. Update copy operations are stopped to a S-VOL. The storage system marks the entire P-VOL as differential data, resulting in entire P-VOL being copied to the S-VOL when the pair is resynchronized.	Read/write enabled	Read only

SN Status	Description	P-VOL access	S-VOL access
1. Read/write enabled if status before transition to SMPL(PD) is Read/write. 2. Starting time of the copy depends on the numbers of pairs and the storage system environment.			

CCI pair status names

Some CCI pair status names are different than the SN status names. The following shows the corresponding names.

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	Primary volume: PSUS Secondary volume: SSUS
COPY(RS)/COPY	COPY
COPY(RS-R)/RCPY	RCPY
PSUE	PSUE

Status, pair operations permitted

A pair's status shows whether a desired operation can be performed. Each operation requires a specific status, or is permitted for multiple possible statuses.

Supported operations and statuses are shown in the following tables.

Pair Status	Pair operation					
	Create pairs	Split pairs	Resync pairs (forward)	Resync pairs (reverse)	Suspend pairs	Delete pairs
SMPL(PD)	NO	NO	NO	NO	NO	N O
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

Pair Status	Pair operation					
	Create pairs	Split pairs	Resync pairs (forward)	Resync pairs (reverse)	Suspend pairs	Delete pairs
PSUS	YES	NO	YES	YES	YES	YES
COPY(RS)/ COPY	YES	NO	NO	NO	YES	YES
COPY(RS-R)/ RCPY	YES	NO	NO	NO	YES	YES
PSUE	YES	NO	YES	NO	NO	YES

Related information

- Status for L1, L2 pairs and operations permitted on page 6-5
- Status of unaffected S-VOLs, operations permitted on page 6-7

Status for L1, L2 pairs and operations permitted

When you have cascaded pairs, the operations that you can perform depend on pair status for both layers. The ability to perform an operation depends on the following:

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

Supported operations and statuses are shown in the following tables.

L2 Pair Status	L1 pair operation				
	Create pairs	Split pairs	Resync 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

L1 Pair Status	L2 pair operation				
	Create pairs	Split pairs	Resync 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	YES	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. L2 pairs can only be resynchronized in Normal Copy or Quick Resync mode. You cannot restore (Reverse Copy or Quick Restore) the pair.
2. To split L2 pairs, the L1 pair must be split ("PSUS" status).

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

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

The following table shows leaf volume 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

Status of unaffected S-VOLs, operations permitted

The pair operations you can perform depend on the pair's status, but also on the status of unaffected S-VOLs. The following table shows which operations can be performed, given the status of S-VOLs related to the P-VOL in other pairs.

Status of unaffected S-VOLs	Pair operation					
	Create pairs	Split pairs	Resync pairs (forward)	Resync pairs (reverse)	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	YES	NO	NO	NO	YES	YES
PSUE	YES	YES	YES	YES	YES	YES

Monitoring pair, volume details

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

1. Select the pair in **Local Replications** then click **More Actions > View Pair Properties**

Related information

- View Pair Properties window on page B-11

Monitoring synchronous rates

You can check on the percentage of synchronized data between the P-VOL and S-VOL.

1. Select the pair in **Local Replications** then click **More Actions > View Pair Synchronous Rate**.

Clicking **Refresh View** shows the latest synchronous rate. If you close the window, information in the **Local Replications** window may not be the latest. Click **Refresh View** again.

Related information

- View Pair Synchronous Rate window on page B-13

Monitoring consistency groups

You can check the number of consistency groups and the details and individual properties for consistency groups.

- View the number of consistency groups in the **Summary** section of the **Local Replications** window.
- View a list of consistency groups with status and number of pairs on the **Consistency Groups** tab in the **Local Replications** window.
- View a consistency group's properties by clicking the **CTG ID** link on the **Consistency Groups** tab in the **Local Replications** window.

Related information

- Local Replications window on page B-4

Monitoring reserve volumes

You can see the number of reserve volumes and a list of the individual reserve volumes and their details.

- View the number of reserve volumes in the **Summary** section of the **Local Replications** window.
- View a list of reserve volumes and their details on the **Reserve Volumes** tab in the **Local Replications** window.

Related information

- Local Replications window on page B-4

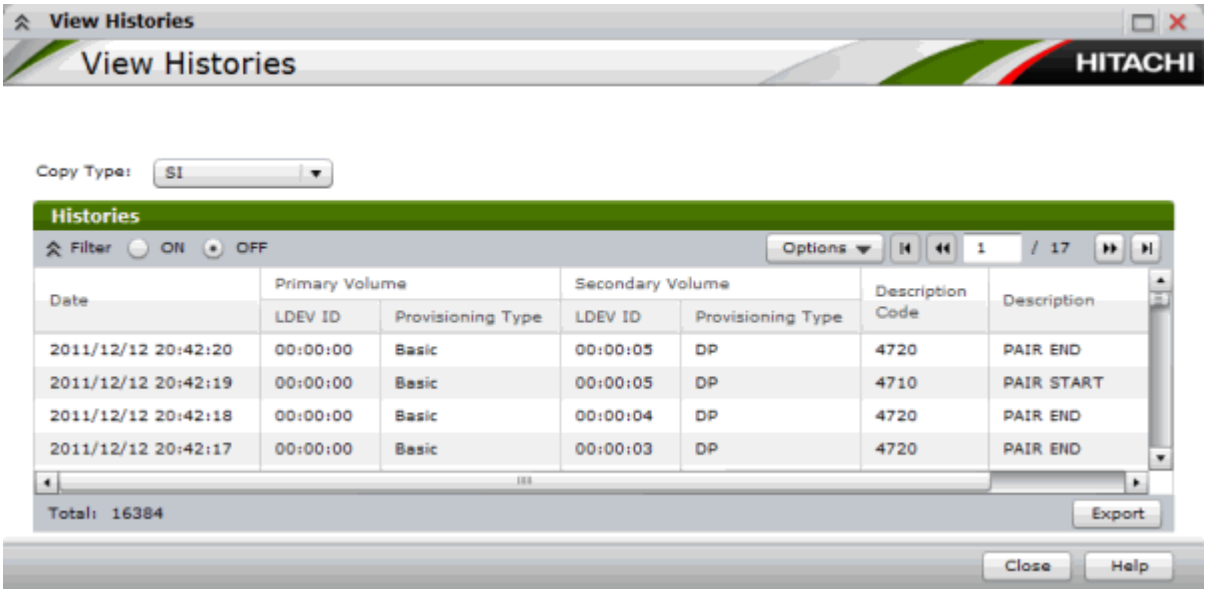
Monitoring a pair's operation history

You can review the operations that have been performed on a pair using the **View History** window.

Prerequisite information

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

1. In the tree, click **Replications > Local Replications**.
2. Click **View Histories**.
3. In the **View Histories** window, select **SI** from the **Copy Type** list.



4. The **Description** column shows the operation that was run. The following table shows a list of the codes.

Code	Description	Explanation
4710	PAIR START	Initial copy began.
4720	PAIR END	Initial copy completed and pair status changed to "SMPL".
4730	PSUS START	Pair split operation began.
4740	PSUS END	Pair split completed and pair status changed to "PSUS".
4750	COPY(SP)/COPY START COPY(RS-R)/RCPY START	Pair resync operation began.
4760	COPY(SP)/COPY END COPY(RS-R)/RCPY END	Pair resync operation completed and pair status changed to "PAIR".
4780	SMPL(PD) DELETE	The pair was deleted and status changed to "SMPL".
4790	PSUE SUSPEND	The pair was suspended and pair status has changed to "PSUE".
47D0	COPY ABNORMAL END	The copy has terminated abnormally for reasons other than above.
47E9	INITIALIZE START	Initialization processing has begun.

Code	Description	Explanation
47EA	INITIALIZE END	Initialization processing has terminated normally.
47EB	INITIALIZE ENDED ABNORMAL	Initialization processing has terminated abnormally.

Related information

- View Histories window on page B-14

Maintaining the system

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

Related information

- Removing reserve attribute from a volume on page 6-10
- Pair operations during system, device maintenance on page 6-10e

Removing reserve attribute from a volume

You can remove the reserve attribute from a volume.

Prerequisite information

- The volume is not assigned to a pair (“SMPL” status).

1. In the tree, click **Replications > Local Replications**.
2. Click **Reserve Volumes** tab.
3. In the **Remove Reserve Volumes** window, select the volume and click **Remove Reserve Volumes**.
4. Enter a **Task Name** and click **Apply**.

Pair operations during system, device maintenance

The following recommendations are provided for performing pair operations when maintenance on VSP and related devices is underway. Review the following to check whether pairs and pair operations are affected when maintenance is performed on physical and logical devices.

- If VSP cache maintenance is performed during a period of high I/O usage, one or more pairs may suspend. Reduce the I/O load before performing cache maintenance.
- Physical devices that contain LDEVs used by SI can be maintained independently of pair operations and pair status. Maintenance does not affect SI.

- If a physical device failure occurs, pair status is not affected because of the RAID architecture.
- If a physical device failure requires the storage system to utilize dynamic sparing or automatic correction copy, pair status is not be affected.
- If an LDEV failure occurs, the storage system suspends the pair.
- Maintenance is restricted for LDEVs used by a pair. However, the format operation is allowed even when pair is suspended ("PSUE" status).
- Maintenance is also restricted for LDEVs in which the Reserve attribute is set for a volume.

  To maintain these LDEVs, suspend or delete the pair, and/or remove the reserve attribute.

7

Troubleshooting

This topic provides SI troubleshooting information.

- ShadowImage Troubleshooting
- Troubleshooting with CCI
- Calling the Hitachi Data Systems customer support

ShadowImage Troubleshooting

This topic provides instructions for troubleshooting in SI.

Operation and display troubleshooting

The following table provides operation and display troubleshooting information for SI pairs.

Error	Corrective action
SN hangs, or SI operations do not function properly.	• Make sure all SI requirements and restrictions are met. • Make sure the storage system is powered on and fully functional. • Check all input values and parameters to make sure that you entered the correct information in the SI windows (such as P-VOL and S-VOL IDs).
The volume pairs are not showing correctly.	Make sure the correct volumes are selected.
An SI error message is displayed in SN during an operation.	Click **Tasks** in the Storage Systems tree and select the failed task to check the message. If you are using the previous SN GUI, which is shown in a secondary window, complete the following: 1. Select the failed volume in the **Preview** list in the **Pair Operation** window. 2. Right-click to show the menu. 3. Click **Error Detail**. For the list of error codes and corrective actions, see *Hitachi Storage Navigator Messages*.
Pair status is incorrect (or unexpected).	The pair may have been suspended or deleted from the UNIX/PC server host using CCI. If not, VSP detected an error condition during SI operations. Check the SN error log. If necessary, call the Hitachi Data Systems customer support for assistance.

Troubleshooting pinned tracks

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

Troubleshooting extended copy times

The following table describes the causes for bottlenecks that result in long copy time.

Cause	Response
A processor whose MP usage rate exceeds 80% exists within the processor blade to which the P-VOL and S-VOL are allocated.	Reexamine the configuration. For information about checking the MP usage rate, see the *Hitachi Virtual Storage Platform Performance Guide*.
The Host I/O Performance option is enabled.	Disable the option. For more information about disabling, see System options that affect performance on page 4-3.
The S-VOL's HDD or external storage performance is lower than the P-VOL's.	Make sure the configuration of the S-VOL's HDD or external storage is the same as the P-VOL's.
The S-VOL's HDD or external storage has an error.	Check the error and make the necessary correction.
The P-VOL's HDD or external storage has an error.	Check the error and make the necessary correction.

Troubleshooting with CCI

This topic provides troubleshooting information for operations performed using CCI. The following describes CCI error codes and instructions for using them. Also, see Troubleshooting consistency group pair-split on page 7-12.

When using CCI, you can identify the cause of an error by referring to either of the following:

- The log displayed in the CCI window.
- The error code in the CCI operation log file. The default location for this file is:
  `/HORCM/log*/curlog/horcmlog_HOST/horcm.log`
  where `*` = instance number, and, `HOST` = host name

1. Do one of the following:
   - If you are using the CCI-window log, locate the error code you are investigating. An example error code in the CCI-window log is:
     ```
     It was rejected due to SKEY=0x05,
     ASC=0x20,SSB=0xB9E1,0xB901 on Serial#(64015)
     ```
   - If using the operation log file, locate the error code you are investigating. An example error code in the log file is:
     ```
     11:06:03-37897-10413- SSB = 0xb9a0,2089
     ```
2. Locate the SSB1 and SSB2 codes. In both examples above, these codes appear to the right of the equal symbol (=).
   - The **SSB1 code** consists of the alpha-numeric characters which are the last four digits *on the left of the comma* (,). Examples:
     `B9E1` in the CCI-window log
     `b9a0` in the operation log file

- The **SSB2 code** consists of the alphanumeric characters which are last four digits *on the right of the comma* (,). Examples:
  0xB901 in the CCI-window log
  2089 in the operation log file

3. In the following table, locate the description of the SSB1/SSB2 error code combination.

For errors not described in the table, call the Support Center.

Note: (For SIz) Some related software names in the following table refer to the mainframe version. For example, it may be inferred that Universal Replicator or UR can be replaced with Universal Replicator for Mainframe or URz.

The following table describes CCI error codes.

SSB2 code	Description
-	Error occurred in SI pair operation.
200D	The pair operation was rejected because the Dynamic Provisioning or Dynamic Tiering V-VOL you specified was not associated with a pool.
201B	The consistency group pair-split was rejected because the UR pair was not in "PAIR" status, split ("PSUS" status), or suspended ("PSUE" status). The UR S-VOL was the SI P-VOL included in the consistency group on which the consistency group pair-split was performed.
2026	The quick restore operation was rejected because the cache mode of the P-VOL you specified was different from the cache mode of the external S-VOL.
2036	The pair operation was rejected because the volume you specified as a P-VOL was a quorum disk.
2037	The pair operation was rejected because the volume you specified as an S-VOL was a quorum disk.
2043	The volume you specified as a P-VOL was a volume using two mirrors included in the 3-UR DC multi-target, cascade, or delta resync configuration. The operation was rejected because the volume was used in the delta resync pair or as an UR pair volume.
2044	The volume you specified as an S-VOL was a volume using two mirrors included in the 3-UR DC multi-target, cascade, or delta resync configuration. The operation was rejected because the volume was used in the delta resync pair or as an UR pair volume.
2047	The pair operation was rejected because the current microcode version does not support the P-VOL capacity you specified.
2048	The pair operation was rejected because the current microcode version does not support the S-VOL capacity you specified.
205B	The Paircreate operation was rejected because the MU number you specified was in use.
2060	The volume you specified as a P-VOL was a volume of a UR pair. The pair operation was rejected because the status of the UR pair was invalid.

SSB2 code	Description
2061	The volume you specified as an S-VOL was a volume of a UR pair. The pair operation was rejected because the status of the UR pair was invalid.
2067	The volumes you specified for the pair were shared by TC and UR. The quick restore or reverse copy operation was rejected because the TC or UR pair was not split ("PSUS" status).
2068	The pair operation was rejected because the P-VOL or S-VOL you specified was being shredded.
2072	The pair operation was rejected for one of the following reasons: • The P-VOL was also an HTI or SS pool volume. • The P-VOL was also an HTI or SS secondary volume, or V-VOL. • The P-VOL was also an HTI or SS P-VOL, and one of the following conditions was also true. - While the HTI or SS pair was restored, the create, split, or resync pair operation was performed on the SI pair. - The SI quick restore operation was performed. - A consistency group was defined for SI. - After the MU number used by an HTI or SS pair was specified, the create, split, or resync pair operation was performed on the SI pair.
2073	The pair operation was rejected for one of the following reasons: • The S-VOL was also an HTI or SS pool volume. • The S-VOL was also an HTI or SS secondary volume, or V-VOL. • The S-VOL was an HTI or SS S-VOL pair, and one of the following conditions was also true. - The HTI or SS pair was being restored. - The SI quick restore operation was performed. - A create pair operation was performed on the SI pair.
2078	Because the P-VOL you specified was also a UR P-VOL for delta resync, one of the following errors occurred: • The reverse copy operation was rejected because the UR pair was not split ("PSUS" status). • The quick restore operation was rejected.
2079	The pair operation was rejected because the P-VOL you specified was also a UR P-VOL for delta resync.
2086	The pair operation was rejected because the initialization process was being performed.
2089	The quick restore operation was rejected because the volume you specified as a P-VOL was undergoing quick format
208A	The quick restore operation was rejected because the volume you specified as an S-VOL was undergoing quick format.
2093	The volume you specified as a P-VOL was a TC S-VOL. The split operation was rejected because the status of the TC pair was not Suspend.

SSB2 code	Description
2094	The volume you specified as a P-VOL was a TC S-VOL. The Split operation was rejected because the consistency time of the consistency group is not equal to the consistency time of the TC pair.
2097	The quick restore operation was rejected because of one of the following: • The P-VOL was also a Dynamic Provisioning V-VOL, but the S-VOL was a normal volume. • The P-VOL was a normal volume, but the S-VOL also a Dynamic Provisioning V-VOL.
209B	The quick restore operation was rejected because the emulation type of only one of the volumes in the pair was OPEN-0V.
209C	The quick restore operation was rejected because the updated information about storage system configuration was being backed up.
209E	The pair operation was rejected because the volume you specified as the P-VOL was a FICON® Data Migration volume.
20A0	The pairs you specified contain the TC asynchronous volumes. The quick restore operation was rejected because the CLPRs of the P-VOL and S-VOL for the pair you specified were different.
20A2	The create pair operation was rejected because the P-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL whose capacity was increasing.
20A3	The create pair operation was rejected because the S-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL whose capacity was increasing.
20A9	The pair operation was rejected because the consistency group number you specified was being used by HTI or SS.
20AA	The pair operation was rejected because the volume you specified as the P-VOL was an HDP or HDT V-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 an HDP or HDT V-VOL and the Unmap command operation was in progress with system option mode 905 ON.
20B0	The pair operation was rejected because the volume you specified as the P-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL and its capacity was increasing.
20B1	The pair operation was rejected because the volume you specified as the S-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL and its capacity was increasing.
20B4	The pair operation was rejected because the volume you specified as the P-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL, which was not associated with a pool.
20B5	The pair operation was rejected because the volume you specified as the S-VOL was a Dynamic Provisioning or Dynamic Tiering V-VOL, which was not associated with a pool.
20B7	The pair operation was rejected because you did not define an LU path to the volume you specified as the P-VOL.

SSB2 code	Description
20B8	The pair operation was rejected because you did not define an LU path to the volume you specified as S-VOL.
20D0	The P-VOL rejected the paircreate operation because the DP pool is initializing in the Dynamic Provisioning or Dynamic Tiering V-VOL.
20D1	The S-VOL rejected the paircreate operation because the DP pool is initializing in the Dynamic Provisioning or Dynamic Tiering V-VOL.
20DE	The pair operation was rejected because the volume you specified as the P-VOL is an external volume that is mapped for online data migration.
20E9	The pair operation was rejected because the volume you specified as the P-VOL was a S-VOL for an existing pair, and the volume you specified as the S-VOL was the P-VOL for another existing pair.
20DF	The pair operation was rejected because the volume you specified as the S-VOL is an external volume that is mapped for online data migration.
22F6	The pair operation was rejected because the volume you specified as the P-VOL was a Compatible FlashCopy® S-VOL.
22F7	The pair operation was rejected because the volume you specified as the S-VOL was a Compatible FlashCopy® P-VOL or S-VOL.
22F9	The Quick Restore or the Reverse Copy operation was rejected because the volume you specified as the S-VOL was a Compatible FlashCopy® P-VOL or S-VOL.
2301	The pair operation was rejected because shared memory is not allocated or SI is not installed.
2302	The pair operation was rejected because the volume you specified as the P-VOL or S-VOL was not the top volume of the LUSE volume.
2306	The pair operation was rejected because the LBA size of the P-VOL you specified was not the same as the size of the S-VOL you specified.
2309	The create pair operation was rejected because the number of pairs exceeded the maximum number of pairs.
230A	The create pair operation was rejected because the volume you specified as the S-VOL was the P-VOL of the SI pair whose MU number is 0.
230B	The pair operation was rejected because the pair was being suspended or deleted.
2310	One of the following occurred: • The create pair operation was rejected because the consistency group number you specified had already been used for L1 pair. • The create pair operation was rejected because the consistency group number you specified had already been used for L2 pair. • The create pair operation was rejected because the volume specified as the P-VOL was the S-VOL of the pair which was being Quick Split. • The quick restore operation was rejected because the VLL setting of the P-VOL was different from that of the S-VOL. • The pair operation was rejected because the P-VOL and S-VOLs you specified were a Compatible FlashCopy® pair.

SSB2 code	Description
	• The quick restore or reverse copy operation was rejected because the pair of the P-VOL and S-VOLs you specified are suspended ("PSUE" status). • The quick restore or reverse copy operation was rejected because the P-VOL and the S-VOL you specified was the L2 pair. • The consistency group pair-split was rejected because some of the pairs in the consistency group were being resynchronized, split, or were already suspended. • The pair operation 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	The pair operation was rejected because the volume you specified as the S-VOL was online to the host.
2314	The create pair operation was rejected because the volume you specified as the S-VOL was the S-VOL of another pair that was split ("PSUS" status).
231F	The quick restore or reverse copy operation was rejected because the P-VOL of the pair you specified was online to the host.
2322	The pair operation was rejected because the necessary shared memory was not installed, or initialization was not completed.
2324	The pair operation was rejected because the number of slots of the volume you specified as the P-VOL exceeded the upper limit.
2325	The pair operation was rejected because the number of slots of the volume you specified as the S-VOL exceeded the upper limit.
2326	The create pair operation was rejected because the volume you specified as the P-VOL had already had three S-VOLs.
2327	The create pair operation was rejected because the node volume specified as the P-VOL had already had two S-VOLs.
2328	The pair operation was rejected because the pair configuration exceeded the number of the layers of the cascade configuration.
2329	The pair operation was rejected because the volume you specified as the S-VOL was the S-VOL of an existing pair.
232A	The create pair operation was rejected because pairs that would exceed the license capacity were going to be created.
232F	The pair operation was rejected because the volume you specified as the P-VOL was allocated as the destination of the Volume Migration.
2331	The pair operation was rejected due to one of the following causes. • The volume you specified as the P-VOL was a reserved volume. • The volume you specified as the P-VOL was the volume for Volume Migration. • The capacity of the P-VOL and the S-VOL you specified was not the same.
2332	The create pair operation was rejected because the volume you specified as the P-VOL had already had three S-VOLs.

SSB2 code	Description
2333	The pair operation was rejected because the volume you specified as the P-VOL was not the P-VOL of the existing pair.
2334	One of the following occurred: • The pair operation was rejected because the volume you specified as the P-VOL had an emulation type that could not be handled by CCI. • The consistency group pair-split was rejected because the volume you specified as the P-VOL was an intermediate volume.
2335	The pair operation was rejected because the volume you specified as the S-VOL had an emulation type that could not be handled by CCI.
2336	The pair operation was rejected because the emulation type for the P-VOL you specified was different from the emulation type of the S-VOL.
2337	The pair operation was rejected because of one of the following reasons: • The volume you specified as the P-VOL is an intermediate volume. • The number of volumes you specified for P-VOLs combined as a LUSE volume differs from that for S-VOLs. • You specified only P-VOLs for the LUSE volume. • You specified only S-VOLs for the LUSE volume.
233A	The pairresync was rejected because the volume you specified as the P-VOL was not a SI P-VOL.
233B	The pair operation was rejected because the volume you specified as the S-VOL was a root volume.
233C	The pair operation was rejected because the volume you specified as the S-VOL was a node volume, and the volume you specified as the P-VOL was not the P-VOL for the S-VOL you specified.
233D	The pairsplit was rejected because the P-VOL and S-VOLs you specified were a L2 pair, and the L1 pair was not split (“PSUS” status).
233E	The pair operation was rejected because the volume you specified as the P-VOL was used as a TC P-VOL.
233F	The pair operation was rejected because the volume you specified as the S-VOL was the TC P-VOL, and the pair was not split (“PSUS” status) or suspended (“PSUE” status).
2342	The pair operation was rejected because the volume you specified as the S-VOL was the destination of the Volume Migration.
2343	The create pair operation was rejected because the volume you specified as the S-VOL had already been an S-VOL.
2344	The pair operation was rejected because the volume you specified as the S-VOL for SI pair operations was not an S-VOL.
2346	The volume you specified as an S-VOL was a TC P-VOL. The pair operation was rejected because the status of the TC pair was invalid.
2347	The volume you specified as an S-VOL was a TC S-VOL. The pair operation was rejected because the status of the TC pair was invalid.
234A	The pair creation for the cascade configuration was rejected because the volume you specified as the S-VOL was an intermediate volume.

SSB2 code	Description
234B	The pair operation was rejected because the volume you specified as the S-VOL was the volume of the Volume Migration.
2350	The pair operation was rejected because the P-VOL and the S-VOL you specified for SI pair operations was not a pair.
2351	The pair operation was rejected because the volume you specified as the P-VOL and the volume you specified as the S-VOL was the same one.
2352	The Quick Restore operation or the Reverse Copy operation was rejected because the P-VOL and S-VOLs you specified was online to the host.
2353	The deletion operation was rejected because the P-VOL and S-VOLs you specified was being Quick Split.
2354	The pairresync operation was rejected because the P-VOL and S-VOLs was being split by using Steady Split.
2357	The pair creation was rejected because the volume you specified as the S-VOL was the P-VOL of the splitting pair, or the P-VOL of the pair where the Reverse Copy operation or Quick Restore operation is being performed.
2358	The pairresync operation was rejected because the volume you specified as the S-VOL was the P-VOL of the splitting pair.
235B	The volume you specified as a P-VOL was a TC P-VOL. The reverse copy or the quick restore operation was rejected because the TC pair was not suspended (“PSUE” status) or split (“PSUS” status).
235C	The volume you specified as a P-VOL was a TC S-VOL. Because the TC pair was not suspended (“PSUE” status) or split (“PSUS” status), the reverse copy or the Quick Restore operation was rejected.
235D	The volume you specified as an S-VOL was a TC P-VOL. The reverse copy or the quick restore operation was rejected because the TC pair was not suspended (“PSUE” status) or split (“PSUS” status).
236C	The reverse copy or the quick restore operation was rejected because the volume you specified as the P-VOL has the S-VOL Disable attribute assigned by the Data Retention Utility.
236D	The pair operation was rejected because the volume you specified as the S-VOL has the S-VOL Disable attribute assigned by the Data Retention Utility, the pair operation was rejected.
2370	The pair operation was rejected because the volume you specified as the P-VOL was not mounted, the pair operation was rejected.
2371	The pair operation was rejected because the volume you specified as the P-VOL was blocked or a system disk.
2372	The pair operation was rejected because the volume you specified as the P-VOL was being formatted.
2373	The pair operation was rejected because the volume you specified as the P-VOL was a command device.
2380	The pair operation was rejected for one of the following reasons: • The volume you specified as the S-VOL was not mounted. • The MU number was 3 or more.

SSB2 code	Description
2381	The pair operation was rejected because the volume you specified as the S-VOL was blocked or a system disk.
2382	The pair operation was rejected because the volume you specified as the S-VOL was being formatted.
2383	The pair operation was rejected because the volume you specified as the S-VOL was a command device.
2385	The pair operation was rejected because the volume you specified as the P-VOL was a reserved volume for Volume Migration.
2386	The pair operation was rejected because the volume you specified as the S-VOL was a reserved volume for Volume Migration.
2387	The create pair operation was rejected because the volume you specified as the P-VOL was the volume for Volume Migration.
2394	The registering of the pair in the consistency group was rejected because the number of the pairs in a consistency group exceeded the definable maximum number of pairs.
2395	The pair operation was rejected because the pair sharing the volume you specified as the P-VOL was undergoing the reverse copy operation or the Quick Restore operation.
2396	The pair operation was rejected because the L1 pair sharing the P-VOL you specified as the root volume was undergoing the reverse copy operation or the Quick Restore operation.
2397	The pair operation was rejected because the L2 pair sharing the P-VOL or S-VOL you specified as the node volume was undergoing the reverse copy operation or the Quick Restore operation.
2398	The quick restore or reverse copy operation was rejected because the pair you specified was not suspended (“PSUE” status) or split (“PSUS” status).
2399	The quick restore or reverse copy operation was rejected because some of the pairs sharing the volume you specified as the P-VOL were not suspended (“PSUE” status) or split (“PSUS” status).
239E	The Paircreate operation was rejected because the Protect attribute was set for the volume you specified as the S-VOL.
23A8	The quick restore or reverse copy operation was rejected because the volume you specified as the volume was specified as the P-VOL for XRC.
23A9	The quick restore or reverse copy operation was rejected because the volume you specified as the volume was specified as the P-VOL for CC.
23AA	The pair operation was rejected because the volume you specified as the S-VOL was specified as the P-VOL for XRC.
23AB	The pair operation was rejected because the volume you specified as the S-VOL was specified as the P-VOL for CC.
23AF	Registering the pair in the consistency group from CCI was rejected because the consistency group number you specified was reserved by PPRC/BCM.
23BB	The create pair was rejected because the volume you specified as the S-VOL could not be used as the S-VOL because of Volume Security settings.

SSB2 code	Description
23EF	The pair deletion was rejected because the primary and secondary volumes were being Quick Split.
23F1	The Paircreate operation was rejected because the CTGID you specified was not supported.
9100	You cannot execute the command because the system could not authenticate the user.
B911	The pair operation was rejected because the volume you specified did not exist.
B912	The pair operation was rejected because the S-VOL specified at the pair operation did not exist.
B913	The pair operation was rejected because the mirror ID was invalid.

Troubleshooting consistency group pair-split

If the consistency group pair-split fails, note the following:

- The pairs in the consistency group are suspended ("PSUE" status).
- When the host server is down or has failed, you can define a consistency group that does not have SI pairs. Running the **`paircreate`** command with the consistency group split option under such a condition can cause the **`paircreate`** command to be rejected.

  In this case, complete the following:

  a. Locate a consistency group number that is not used by any pairs in the **Pair Operation** window by sorting the CTG column.

  b. Specify that consistency group number explicitly, and run the **`paircreate`** command with the consistency group split option using CCI on the host server.
- If you use an UR S-VOL as an SI P-VOL and you cannot change the status of some pairs included in the consistency group, some pairs remain unsplit in the consistency group after you run the **`pairsplit`** command in CCI. Consistency is not guaranteed.

  The following are possible reasons why the pair status cannot be changed:

  - The UR pair belongs to a consistency group, and the P-VOL and S-VOL have the same contents. The journal volumes for this pair are full.
  - The SI license is invalid.
  - The SI pair volumes are blocked.
  - The SI pair is in a status that does not allow the pairsplit operation.

    For more information, see Monitoring pair activity, status on page 6-2.
  - The SI pair is a part of cascaded pairs. The other pairs in the cascaded pairs are in a status that does not allow the pairsplit operation.

For more information, see Status for L1, L2 pairs and operations permitted on page 6-5.

- An SI pair volume is also used in a TC (TC) or UR pair. The TC or UR pair is in a status that does not allow the pairsplit operation.

After these factors are removed, perform the pairresync operation, and run the **pairsplit** command.

Calling the Hitachi Data Systems customer support

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

- The circumstances surrounding the error or failure.
- The content of any error message(s) displayed on the host system(s).
- The content of any error message(s) displayed on SN.
- The SN configuration information (use the FD Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by SN.

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://hdssupport.hds.com

A

Interface support for SI operations and options

This appendix lists SI operations and options, and consistency group operations and options, and the interfaces that support them.

Operations supported by Storage Navigator, CCI

The following table lists SI operations and options supported by SN and CCI.

Operation	Options	SN	CCI	
			Command	Option
Reserve volume as S-VOL	No options	YES	Not applicable	Not applicable
Remove reservation as S-VOL	No options	YES	Not applicable	Not applicable
Change system options	No options	YES	Not applicable	Not applicable
Create pairs	No options	YES	paircreate	Not applicable
	MU number	YES*	paircreate	Uses MU# in HORCM.conf file
	Copy pace	YES	paircreate	-c <size>
	Steady Split	YES	paircreate	-split -fq normal
	Quick Split	YES	paircreate	-split -fq quick
	MSGREQ	NO	NO	NO
	ONLINSEC	NO	NO	NO
Split pairs	No options	YES	pairsplit	Not applicable
	Copy pace	YES	pairsplit	-C <size>
	Steady Split	YES	pairsplit	-fq normal
	Quick Split	YES	pairsplit	-fq quick
	Prevent S-VOL read	NO	paircreate	-m noread
Resync 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
* Not supported in the old SN GUI (which is shown in a secondary window).				

Consistency group operations supported by Storage Navigator, CCI

The following table lists SI consistency group (CG) operations and options supported by SN and CCI.

Operation	Option	SN	CCI	
			Command	Option
Reserve CG	No options	YES	Not necessary	Not necessary
Remove CG reserve	No options	YES	Not necessary	Not necessary
Add pairs to a CG	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 can specify CG number	NO	paircreate	-m grp xx (xx = CTGID)
	System allocates CG number	NO	paircreate	-m grp (CTGID is omitted)
CG split (split time not specified)	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
Resync 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 for the consistency group.				

B

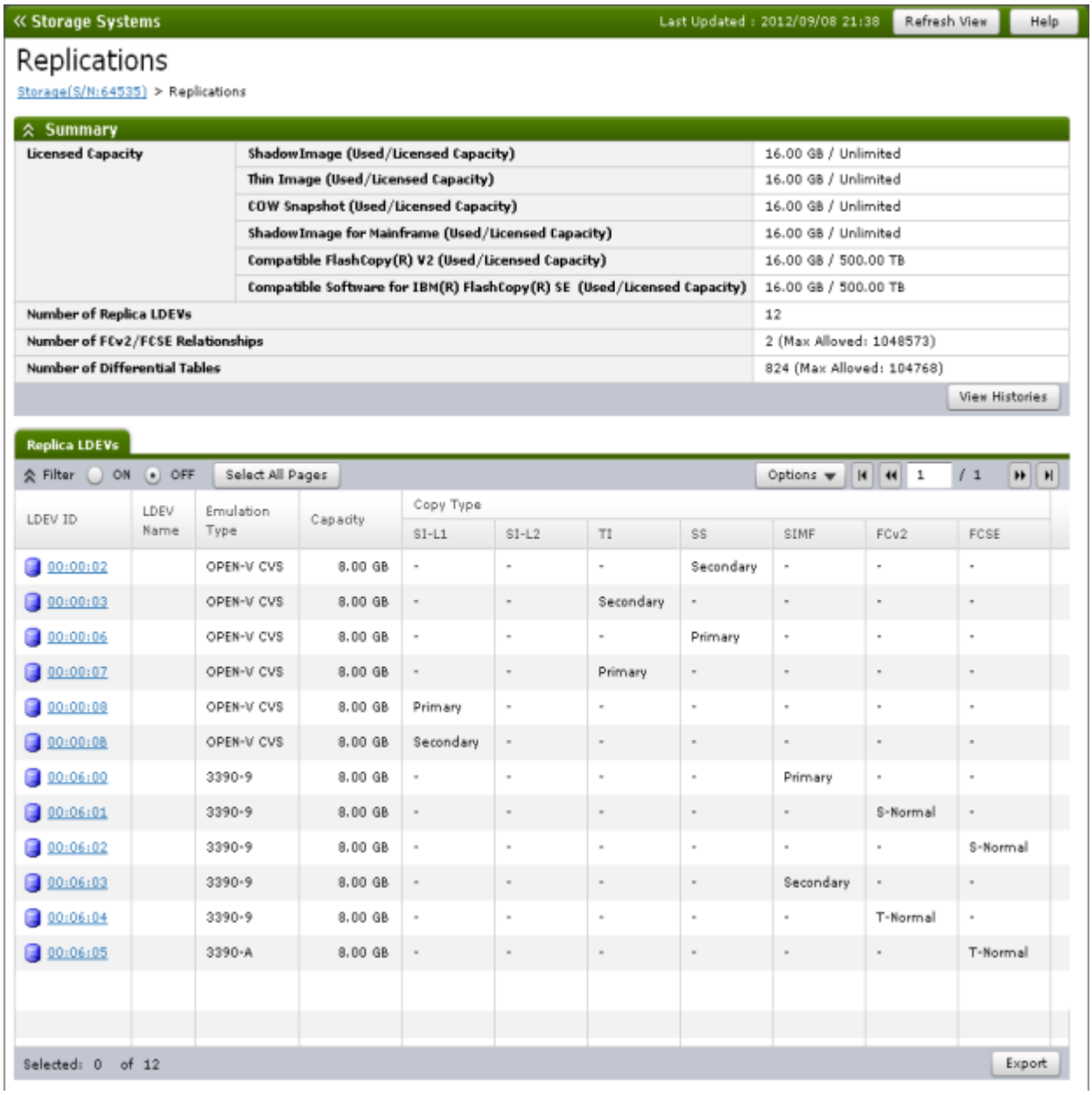
ShadowImage GUI reference

This appendix describes SI windows and dialog boxes in SN.

- Edit Local Replica Option wizard

Replications window

Use this window to view pair information for local replication.



Summary tab

Item	Description
Licensed Capacity	Used and licensed capacity of each product.
Number of Replica LDEVs	Number of LDEVs used for all local replication pairs.
Number of FCv2/FCSE Relationships	Number of relationships that Compatible FlashCopy® V2 and Compatible FlashCopy® SE use.

Item	Description
Number of Differential Tables	(SI, SIz, and SS only.) Number of differential tables in use.
View Histories button	Click to open the **View History** window.

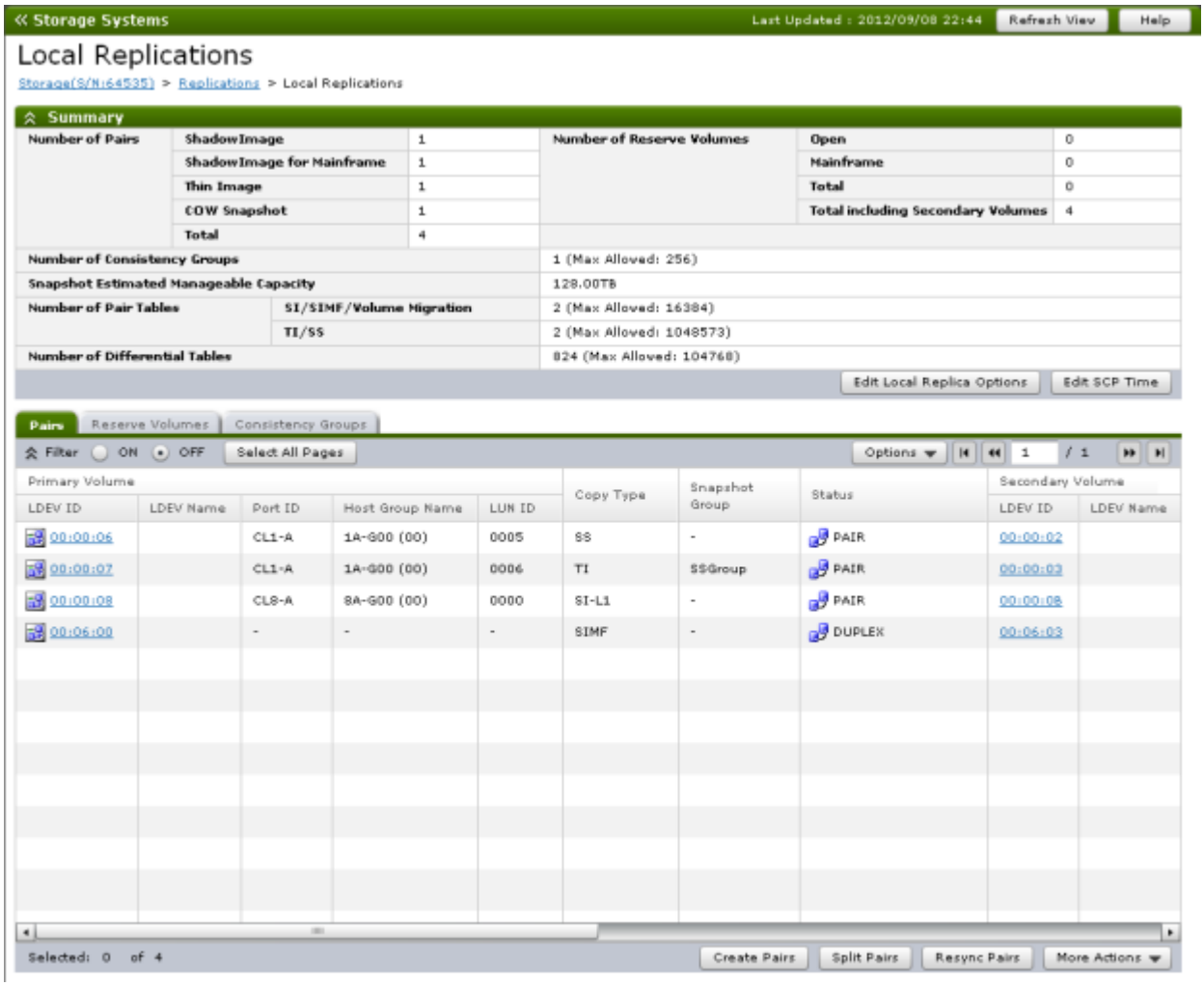
Replica LDEVs tab

Item	Description
LDEV ID	Selected LDEV's identifier
LDEV Name	Selected LDEV's name
Emulation Type	Selected LDEV's emulation type
Capacity	Selected LDEV's capacity
Copy Type	Shows the following copy types: • **SI-L1:** SI L1 P-VOL or S-VOL • **SI-L2:** SI L2 P-VOL or S-VOL • **TI:** HTI P-VOL or S-VOL • **SS:** SS P-VOL or S-VOL • **SIMF:** SIz P-VOL or S-VOL • **FCv2:** Compatible FlashCopy® V2 relationship • **FCSE:** Compatible FlashCopy® SE relationship
Export button	Click to open the dialog box for downloading table information to a file.

Local Replications window

Use this window to view pair, reserve volume, and consistency group information for local replication. Use it also to perform the following operations:

- Creating pairs on page 5-5
- Splitting pairs on page 5-11
- Resynchronizing pairs on page 5-15
- Deleting pairs on page 5-17



Summary tab

Item	Description
Number of Pairs	Number of pairs for each local replication software type
Number of Consistency Groups	Number of consistency groups whose status is other than "Free"
Number of Reserve Volumes	Number of reserved volumes. Values: • **Open:** Number of OPEN system reserved volumes • **Mainframe:** Number of mainframe system reserved volumes • **Total:** Total reserved volumes • **Total including S-VOLs:** Includes number of reserve volumes and number of S-VOL for SI, SIz, HTI, and SS.
Snapshot Estimated Manageable Capacity	Estimated HTI pair capacity. An icon is shown, ⚠, when the value is less than 128 TB. For more information, see the *Hitachi Thin Image User Guide*.

Item	Description
Number of Pair Tables	Number of pair tables in use for the following: • SI/SIz/Volume Migration: SI, SIz, Volume Migration • TI/SS: HTI and SS
Number of Differential Tables	(SI, SIz, and SS only.) Number of differential tables in use.
Edit Local Replica Options button	Click to open the **Edit Local Replica Options** window.
Edit SCP Time button	Click to open the **Edit SCP Time** window.

Pairs tab

The **Pairs** tab shows only pairs to which you are allocated the P-VOL and/or S-VOL.

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. Click to open the **LDEV Properties** window. • **LDEV Name:** The P-VOL's LDEV name. • **Port ID:** The port name of the P-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **Host Group Name:** The host group name of the P-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **LUN ID:** LUN identifier of the P-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz, and SS, a hyphen (-) is shown.
Status	Shows the following icons and pair status names: ("SIMPLEX" and "SMPL" are not statuses that are shown in SN.) • 

Item	Description
	The pair is being deleted. Status names are: SI, HTI: SMPL(PD) SIz: Deleting/TRANS •  This icon is used for the following: **The pair is being copied**. Status names are: SI: COPY(PD)/COPY SIz: PENDING HTI, SS: COPY **The pair is being resynchronized**. Status names are: SI: COPY(RS)/COPY SIz: Resync/PENDING **The pair is being resynchronized from secondary to primary volume**. Status names are: SI: COPY(RS-R)/RCPY SIz: Resync-R/REVRSY HTI, SS: COPY(RS-R)/RCPY **The pair is being split in normal mode**. Status names are: SI: COPY(SP)/COPY SIz: SP-Pend/TRANS •  This icon is used for the following: **The volumes are paired**. Status names are: SI: PAIR SIz: DUPLEX **The pool has exceeded the threshold**. Status name is: HTI, SS: PFUL
Status, continued	•  This icon is used for the following: **The pair is split**. Status names are: SI: PSUS SIz: Split/SUSPOP **The pair is being split in Quick Split mode**. Status names are: SI: PSUS(SP)PSUS SIz: V-Split/SUSPVS **The pool is full**. Status name is: HTI, SS: PFUS •  **The pair is suspended**. Status names are: SI: PSUE SIz: Suspend/SUSPER

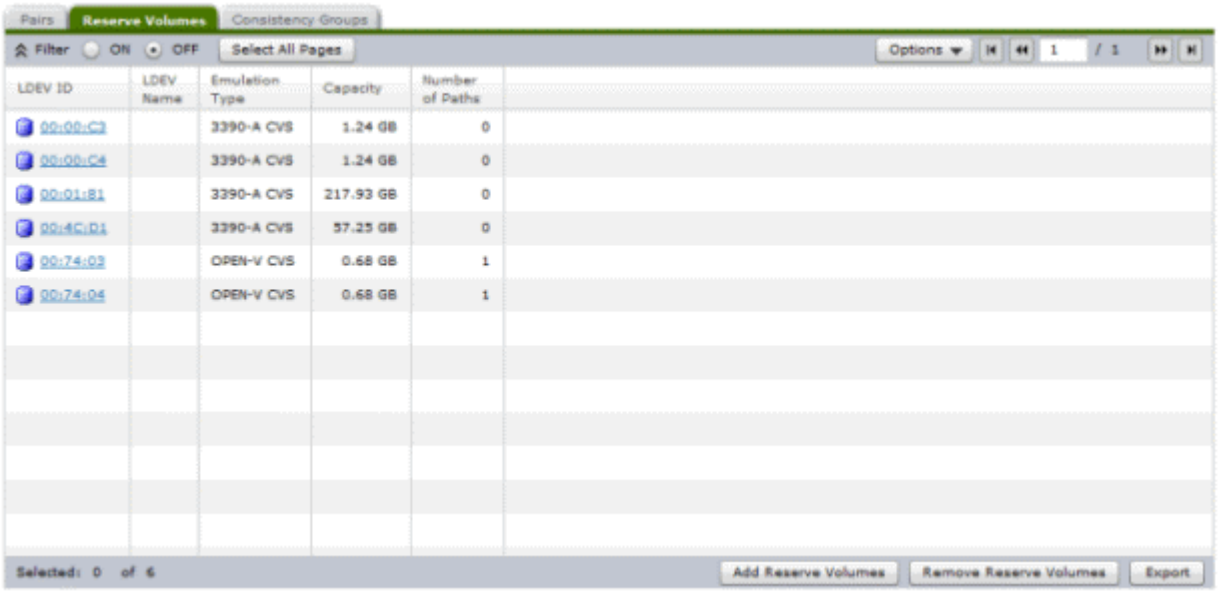
Item	Description
	For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Port ID:** The port name of the P-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **Host Group Name:** The host group name of the P-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **LUN ID:** The LUN ID of the S-VOL LDEV's LUN path. For SIz, a hyphen (-) is shown. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's capacity. • **CLPR:** The S-VOL's CLPR number.
Snapshot Date	(HTI and SS only.) The date and time that a snapshot was acquired. If you have not set a snapshot date for HTI pairs, this item is blank. For SI and SIz, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. If you have not set a pool name for HTI pairs, this item is blank. For SI and SIz, a hyphen (-) is shown.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** If you have not set a copy pace for HTI pairs, this item is blank. For HTI and SS pairs, a hyphen (-) is shown.
CTG ID	Consistency Group ID
Mirror Unit	Mirror unit number
Topology ID	LDEV's topology identifier
Create Pairs button	Click to open the **Create Pairs** wizard.
Split Pairs button	Click to open the **Split Pairs** window.
Resync Pairs button	Click to open the **Resync Pairs** window.
View Pair Synchronous Rate*	Opens the **View Pair Synchronous Rate** window.
View Pair Properties*	Opens the **View Pair Properties** window.
Suspend Pairs*	Opens the **Suspend Pairs** window.

Item	Description
Delete Pairs*	Opens the **Delete Pairs** window.
Export*	Opens the dialog box for downloading table information to a file.
*An option you can choose from the **More Actions** menu.	

Reserve Volumes tab

Use this tab on the **Local Replications** window to view reserved volume information for local replication, and to perform the following operations:

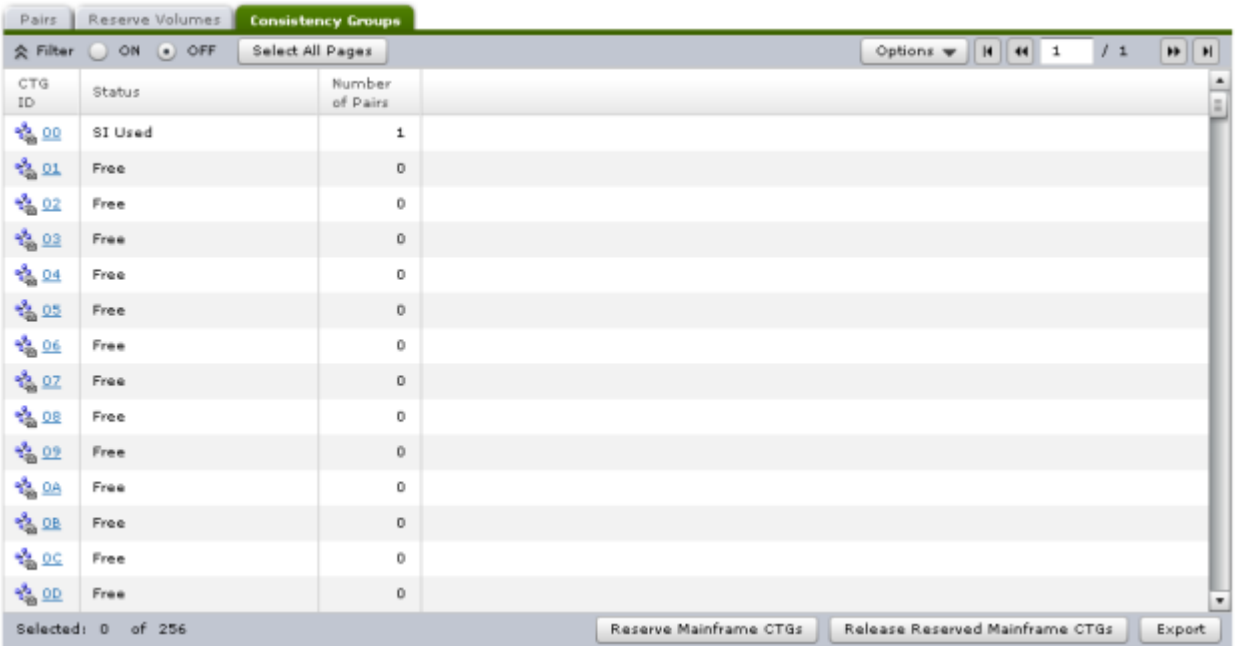
- Reserving secondary volumes on page 4-2
- Removing reserve attribute from a volume on page 6-10



Item	Description
LDEV ID	Reserved volume LDEV's identifier
LDEV Name	Reserved volume LDEV's name
Capacity	Reserved volume's capacity
Number of Paths	The number of paths to reserved volume.
Add Reserve Volumes button	Click to open the **Add Reserve Volumes** window.
Remove Reserve Volumes button	Click to open the **Remove Reserve Volumes** window.
Export button	Click to open the dialog box for downloading table information to a file.

Consistency Group tab

Use this tab in the **Local Replications** window to view consistency group information for local replication

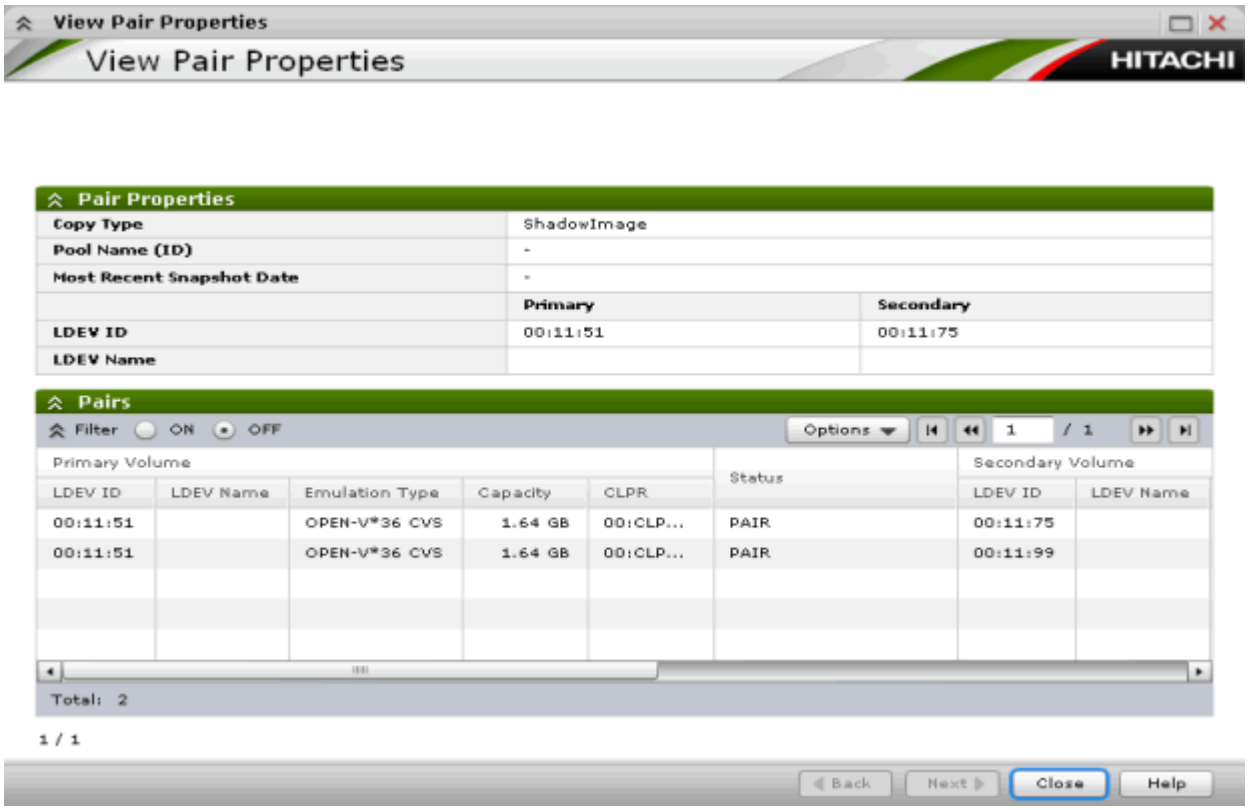


Item	Description
CTG ID	Consistency group identifier. Click to open the **Consistency Group Properties** window.
Status	Possible values include: • **SI Used:** Consistency group used by SI. • **SIMF Used (RAID Manager):** Consistency group used for SIz pairs and managed with CCI. • **SIMF Used (PPRC/BCM):** Consistency group used for SIz pairs and managed using PPRC or BCM. • **TI Used:** Consistency group used by HTI pairs. • **SS Used:** Consistency group used for SS pairs. • **Mainframe Reserved:** Consistency group reserved for PPRC or BCM. • **Free:** Consistency group not being used and is not reserved. • **(Changing...):** Status is in the process of changing.
Number of Pairs	Number of pairs for the consistency group in use.
Reserve Mainframe CTGs button	Click to open the **Reserved Mainframe CTGs** window.
Release Reserved Mainframe CTGs button	Click to open the **Release Reserved Mainframe CTGs** window.
Export button	Click to open the dialog box for downloading table information to a file.

View Pair Properties window

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

For detailed information, see Monitoring pair, volume details on page 6-7.



Pair Properties tab

Item	Description
Copy Type	Type of pair: • **ShadowImage** • **ShadowImage for Mainframe** • **Thin Image** • **COW Copy-on-Write Snapshot**
Pool Name (ID)	(HTI and SS only.) The pool name and ID. If you have not set a pool name for HTI pairs, this item is blank. For SI and SIz, a hyphen (-) is shown.
Most Recent Snapshot Date	(HTI and SS only.) Date and time that the most recent snapshot was acquired. If you have not set a most recent snapshot date for HTI pairs, this item is blank. For SI and SIz, a hyphen (-) is shown.

Item	Description
LDEV ID	Identifiers of P-VOL and S-VOL LDEVs
LDEV Name	Names of P-VOL and S-VOL LDEVs

Pairs table

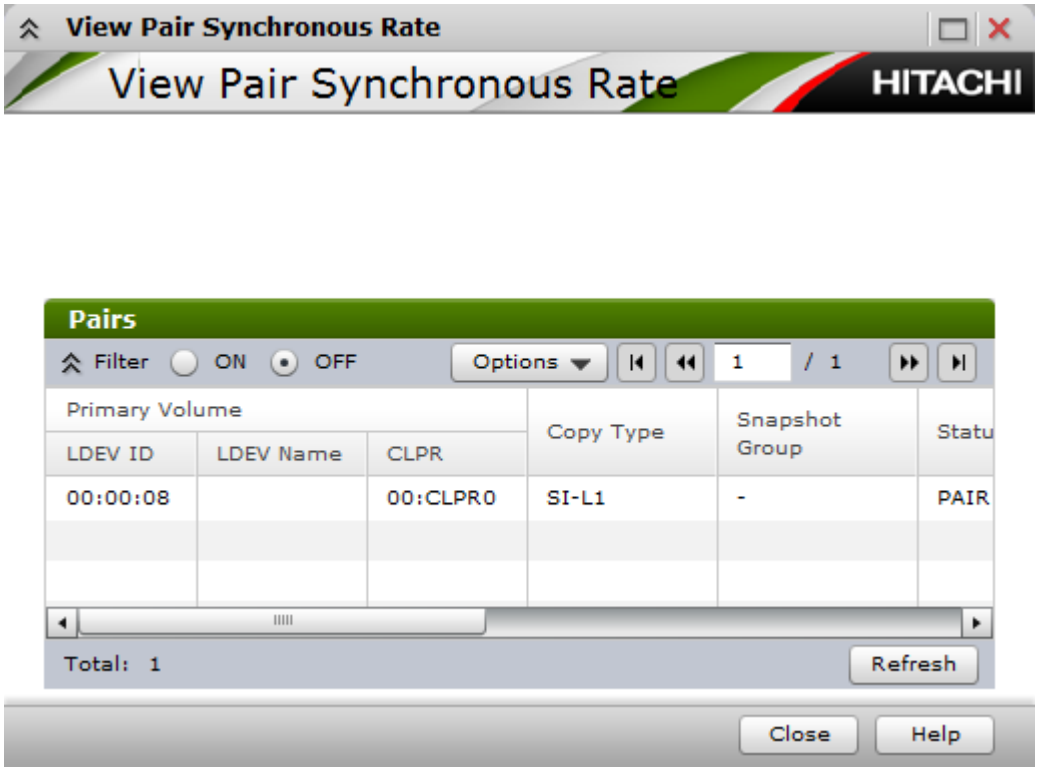
Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR number.
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS, a hyphen (-) is shown.
Status	Pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV name:** The S-VOL's LDEV name. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR number. • **Mode:** Indicates whether the S-VOL has been written to. For SI, this item also indicates whether the S-VOL can be read. o For SI: - "W" is shown if the S-VOL was written to and when the S-VOL was written to and cannot be read when its pair status is "PSUS(SP)/PSUS" or "PSUS". - "N" is shown if the S-VOL cannot be read. You have specified "-m noread" using CCI. - A hyphen (-) indicates that the S-VOL has not been written to and it can be read. o For HTI and SS: - "W" is shown if the S-VOL was written to when its pair status is "PSUS(SP)/PSUS" or "PSUS". - A hyphen (-) indicates that the S-VOL has not been written to. o For SIz: - "W" is shown if the S-VOL was written to when its pair status is "V-Split/SUSPVS" or "Split/SUSPOP".

Item	Description
	- "Protect" is shown if the S-VOL is write-protected. You specified the PROT MODE in BCM as PROTECT when the S-VOL's pair status was "Split/SUSPOP", SP-Pend/TRANS", or "V-Split/SUSPVS". - A hyphen (-) indicates that the S-VOL has not been written to and you made Protect settings.
Snapshot Date	(HTI and SS only.) The date and time when a snapshot was acquired. For SI and SIz, a hyphen (-) is shown.
CTG ID	Consistency group identifier
COPY Pace	(SI and SIz only.) The copy speed. For HTI and SS pairs, a hyphen (-) is shown.
Mirror Unit	The mirror unit number.

View Pair Synchronous Rate window

Use this window to view the percentage of synchronized data between the P-VOL and S-VOL.

For detailed information, see Monitoring synchronous rates on page 6-8.



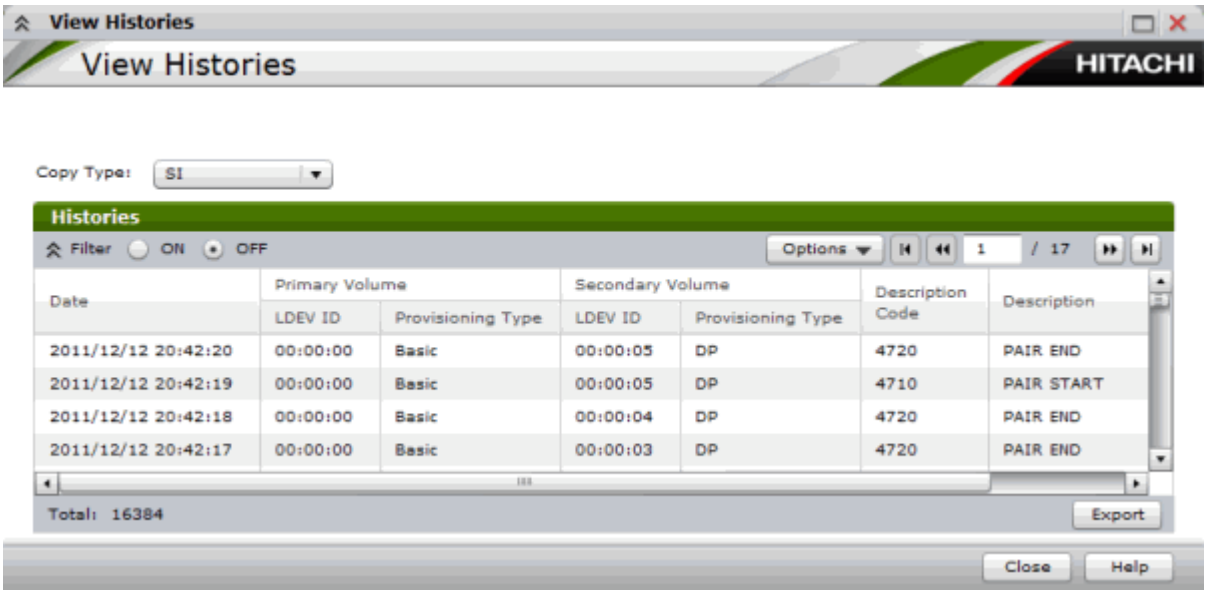
Pairs table

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	Pair status. For more information, see Pair status definitions on page 6-3.
Synchronous Rate (%)	Synchronous rate (%) between P-VOL and S-VOL.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **CLPR:** The -VOL's CLPR number.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, or **Slower** For HTI and SS pairs, a hyphen (-) is shown.
Mirror Unit	Mirror unit number
Refresh	When clicked, updates the information in the **Pairs** table.

View Histories window

Use this window to review the operations that have been performed on pairs. You can view a maximum of 16,384 operation histories.

For full information, see Monitoring a pair's operation history on page 6-8.



Setting fields

Item	Description
Copy Type	Shows the following types of pairs: • **SI:** SI • **TI:** HTI • **SS:** SS • **SIMF:** SIz • FCv2/FCSE: Compatible FlashCopy® V2 and Compatible FlashCopy® SE

Histories table

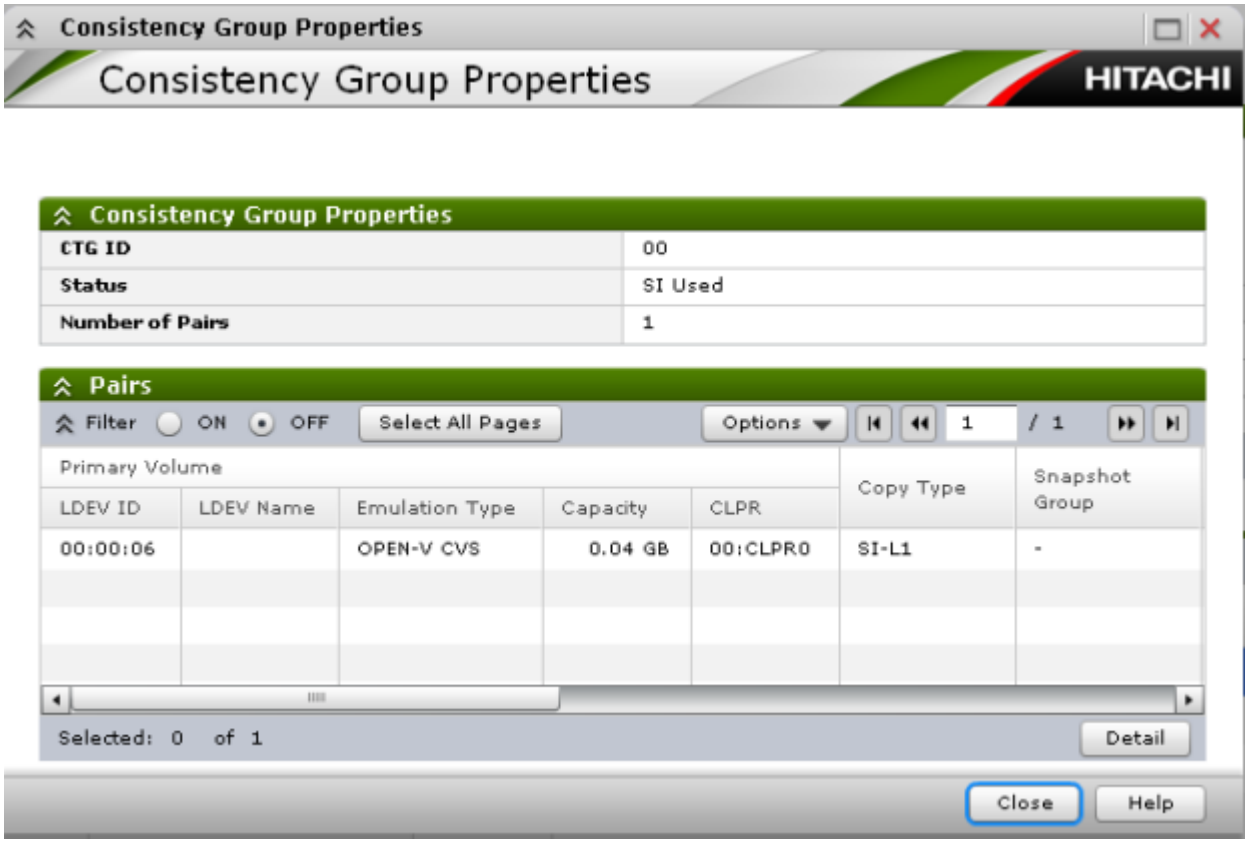
Item	Description
Date	Operation date and time
Primary Volume ("Source Volume" for FCv2/FCSE)	• **LDEV ID:** The P-VOL/source volume's LDEV identifier • **Provisioning Type:** The provisioning type. Values: - **Basic:** Internal volume - **DP:** DP-VOL - **External:** External volume - **External MF:** Migration volume
Secondary Volume ("Target Volume" for FCv2/FCSE)	• **LDEV ID:** The secondary/target volume's LDEV identifier. • **Provisioning Type:** The provisioning type. Values: - **Basic:** Internal volume

Item	Description
	- **DP:** DP-VOL - **External:** External volume
Mirror Unit	The mirror unit number. Shown only when TI or SS is the selected **Copy Type**.
Pool ID	The pool identifier. Shown only when TI or SS is the selected Copy Type.
Relationship ID	The relationship identifier. Shown only when FCv2/FCSE is the selected Copy Type.
Description Code	The code for the type of operation performed.
Description	Description of the operation.
Export	Click to open the dialog box for downloading table information to a file.

Consistency Group Properties window

Use this window to view a list of consistency groups, with status and number of pair information; also use it to view a consistency group's properties.

For full information, see Monitoring consistency groups on page 6-8.



Consistency Group Properties table

Item	Description
CTG ID	Consistency group identifier
Status	Consistency group status • **SI Used:** The consistency group is in use by SI. • **SIMF Used (RAID Manager):** The consistency group is used by SIz and managed with CCI. • **SIMF Used (PPRC/BCM):** The consistency group is used by SIz and managed with PPRC/BCM. • **TI Used:** The consistency group is used by HTI. • **SS Used:** The consistency group is used by SS. • Mainframe Reserved: Consistency group is reserved for use by PPRC and BCM. • **Free:** The consistency group is not being used and is not reserved. • **(Changing...):** Status is the process of changing.
Number of Pairs	Number of pairs assigned to the consistency group

Pairs table

This table shows pairs for P-VOL and/or S-VOL to which you are allocated.

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • SI-L1: SI L1 • SI-L2: SI L2 • TI: HTI • SS: SS • SIMF: SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	The pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier.

Item	Description
	• **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR number.
Snapshot Date	(HTI and SS only.) The date and time that a snapshot was acquired. For SI and SIz pairs, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. For SI and SIz pairs, a hyphen (-) is shown.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** For HTI and SS pairs, a hyphen (-) is shown.
Mirror Unit	The mirror unit number.
Detail button	Click to open the **Pair Properties** window.

Create Pairs wizard

Use this wizard to create pairs, including specifying new pair details.

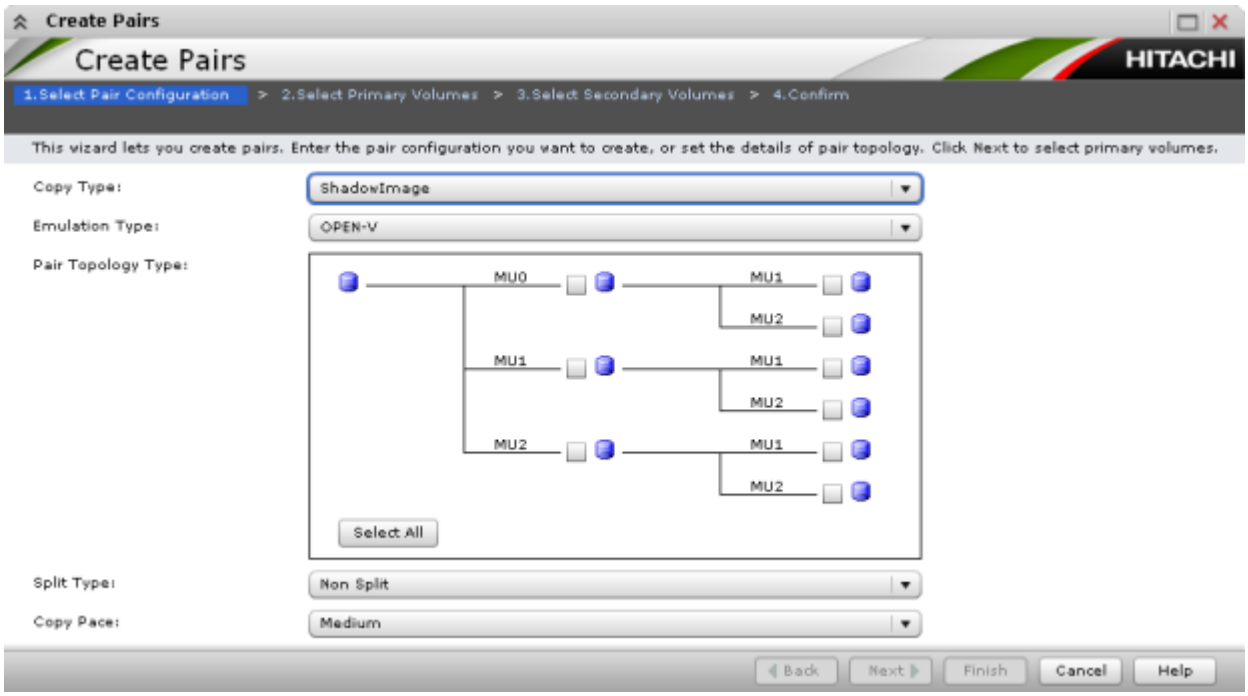
This wizard includes the following windows:

- **Select Pair Configuration** window
- **Select Primary Volumes** window
- **Select Secondary Volumes** window
- **Confirm** window

For full information, see Creating pairs on page 5-5.

Select Pair Configuration window

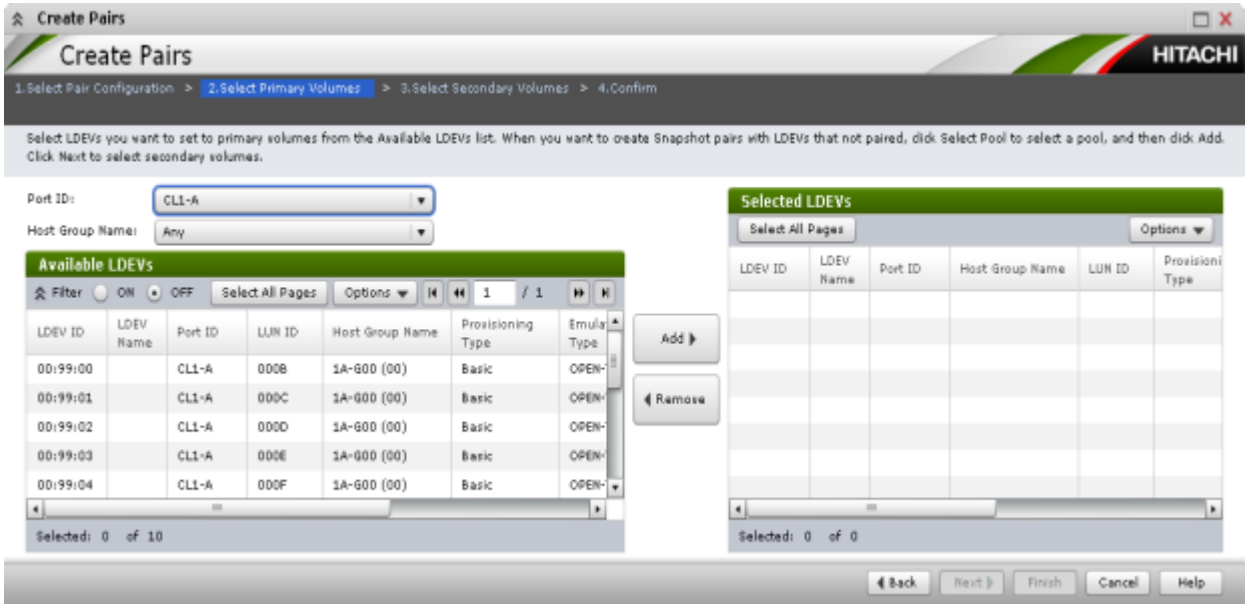
Use this window to configure the pairs you will create.



Item	Description
Copy Type	The copy type. Values: **ShadowImage**, **ShadowImage for Mainframe**, **TI**, or **COW Snapshot**
Emulation Type	The emulation type. For HTI or SS, you can only specify **OPEN-V**.
Pair Topology Type	(SI only.) Use the check boxes to select the pair configuration for the L1 and L2 pairs.
Number of Secondary Volumes	(SIz, HTI and SS only.) The total number of S-VOL assigned to the P-VOL. Includes volumes for the pairs you are creating and volumes for existing pairs.
Initial MU Number	(SIz and SS only.) The initial MU number.
Split Type	(SI and SIz only.) • **Non Split:** Does not split the pair • **Quick Split:** Splits the pair immediately • **Steady Split:** After all differential data is copied, the pair is split.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** For HTI and SS pairs, a hyphen (-) is shown.

Select Primary Volumes window

Use this window to select LDEVs that are P-VOLs.



Item	Description
Use Primary Volumes of Snapshot Pairs	(HTI and SS only.) Indicates whether the P-VOLs are used. • **Yes:** Only HTI and SS P-VOL LDEVs are shown in the **Available LDEVs** table. • **No:** Only unpaired LDEVs are shown in the **Available LDEVs** table.
Port ID	(SI, HTI, SS only.) Filters LDEVs in the **Available LDEVs** table according to the port ID.
Host Group Name	(SI, HTI, SS only.) Filters LDEVs in the **Available LDEVs** table according to host group name. **Any** is the default.

Available LDEVs table

Item	Description
LDEV ID	The LDEV's identifier.
LDEV Name	The LDEV's name.
Port ID	(SI, HTI, SS only.) Port name of the LDEV's LUN path.
Host Group Name	(SI, HTI, SS only.) Host group name of the LDEV's LUN path.
LUN ID	(SI, HTI, SS only.)

Item	Description
	LUN ID of the LDEV's LUN path.
Provisioning Type	The LDEV's provisioning type. Values: • **Basic:** Internal volume • **HDP:** HDP volume • **External**: External volume
Emulation Type	The LDEV's emulation type.
Capacity	Capacity of the LDEV
CLPR	CLPR number of the LDEV
Number of Secondary Volumes	The number of S-VOLs. (SI only) The number for an L1 pair does not include the number of L2 S-VOL.
Primary Volumes	(HTI and SS only.) Information about the P-VOL when the LDEV is used as a S-VOL for an existing pair. Values: • **LDEV ID:** The LDEV identifier. • **LDEV Name:** The LDEV name. • **Port ID:** The port name of the LDEV's LUN path. • **Host Group Name:** The host group name of the LDEV's LUN path. • **LUN ID:** The LUN ID of the LDEV's LUN path. • **Emulation Type:** The volume's emulation type. • **Capacity:** The volume's capacity. • **CLPR:** The volume's CLPR number.
Mirror Unit	(HTI and SS only.) The mirror unit number.
Pool Name (ID)	(HTI and SS only.) The pool name and ID. For SI and SIz, this item is blank.
Select Pool button	(HTI and SS only.) Click to open the **Select Pool** window. **Note:** If you selected **Yes** for **Use Primary Volumes of Snapshot Pairs**, this button is not available.

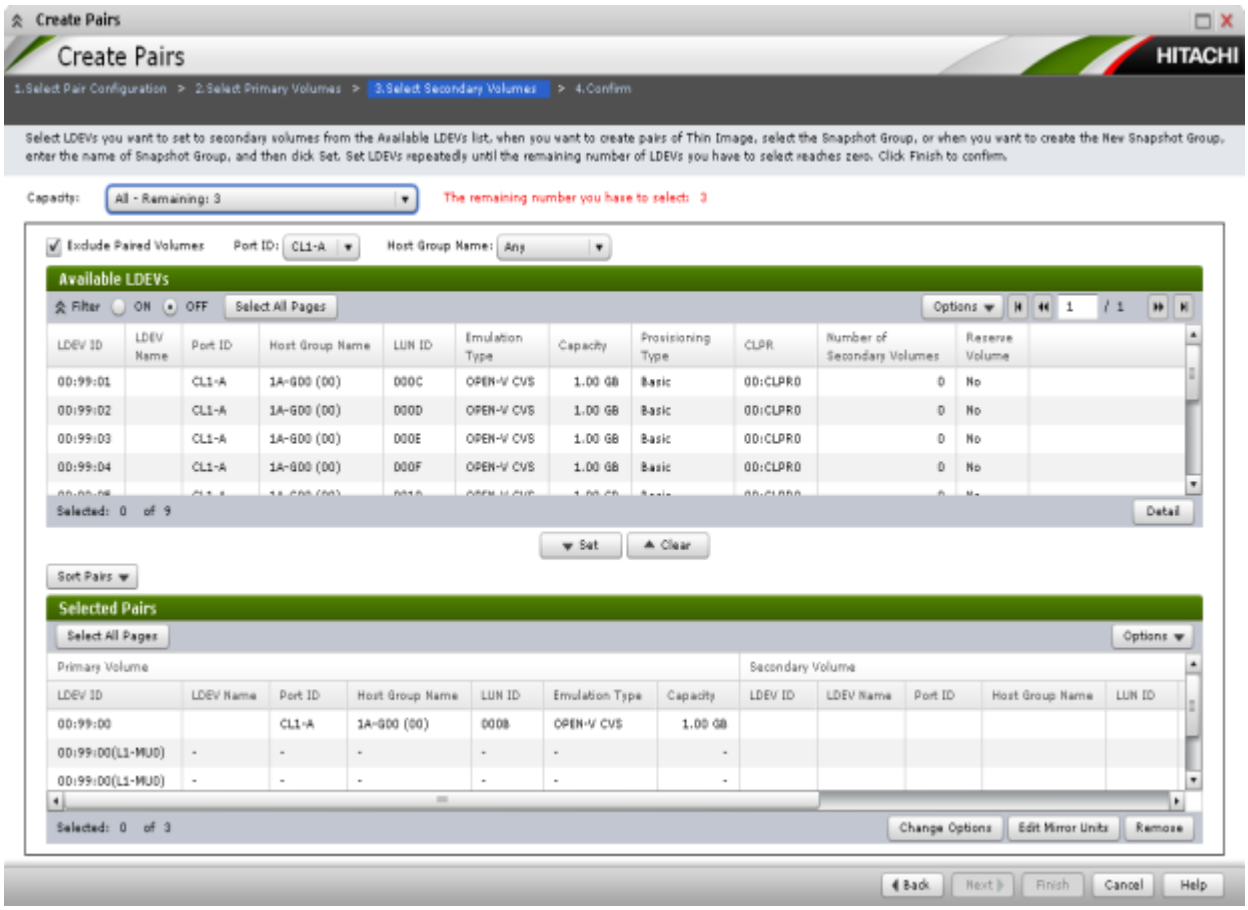
Selected LDEVs table

Item	Description
LDEV ID	The selected P-VOL's LDEV identifier.
LDEV Name	The selected P-VOL's LDEV name.

Item	Description
Port ID	(SI, HTI, and SS only.) The port name of the LDEV's LUN path.
Host Group Name	(SI, HTI, and SS only.) Host group name of the LDEV's LUN path.
LUN ID	(SI, HTI, and SS only.) LUN ID of the LDEV's LUN path.
Provisioning Type	The LDEV's provisioning type. Values: • **Basic:** Internal volume • **HDP:** HDP volume • **External:** External volume
Emulation Type	Emulation type of LDEV
Capacity	Capacity of LDEV.
CLPR	CLPR number
Number of Secondary Volumes	The number of S-VOL. (SI only) The number for an L1 pair does not include the number of L2 S-VOL.
Primary Volume	(HTI and SS only.) Information about the P-VOL. 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:** The host group name of the P-VOL LDEV's LUN path. • **LUN ID:** The LUN ID of the P-VOL LDEV's LUN path. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's capacity. • **CLPR:** The P-VOL's CLPR number.
Mirror Unit	(HTI and SS only.) The mirror unit number.
Pool Name (ID)	(HTI and SS only.) The pool name and identifier.

Select Secondary Volumes window

Use this window to select LDEVs that are the S-VOL.



Item	Description
Capacity list	Allows you to filter the available LDEVs according to the capacity you select.
The remaining number you have to select	Refers to the selected P-VOLs in the **Selected Pairs** table that do not have an assigned S-VOL.
Exclude Paired Volumes	(SI only.) Select to hide the volumes that are already in a pair from the list. Default: Selected
Port ID	(SI, HTI, and SS only.) Filters LDEVs in the **Available LDEVs** table according to the port ID.
Host Group Name	(SI, HTI, and SS only.) Filters LDEVs in the **Available LDEVs** table according to host group name. **Any** is the default.
Detail button	Click to open the **LDEV Properties** window, which contains additional information for the selected LDEV.
Set button	Click to move the selected LDEV to the **Selected Pairs** table.

Item	Description
Clear button	Click to move the selected S-VOL from the **Selected Pairs** table to the **Available LDEVs** table.
Sort Pairs button	(SI only.) Click to sort the **Select Pairs** table according to the following: • **Arrange in Mirror Unit:** Data is shown according to mirror units. • **Arrange in Topology:** Data is shown according to L1 and L2 pairs.
Edit Mirror Unit button	Click to open the **Edit Mirror Units** dialog box, from which you can change the mirror unit numbers, and thereby, pair topology. (SI only) For more information, see the step on pair typology type in Creating pairs on page 5-5.)
Snapshot Group	(HTI only.) Choose to create a new snapshot group or use an existing snapshot group. • **Create new snapshot group:** The new snapshot group name is entered. • **Use defined snapshot group:** An existing snapshot group is selected. If you have not set a snapshot group for HTI pairs, this item is blank.
Change Options button	(SI and SIz only.) Click to open the **Change Options** dialog box, from which you can change the Split Type and Copy Pace.
Remove button	Click to remove the pair from the table. (SI only) You cannot remove L1 pairs if they have an L2 pair.

Available LDEVs table

Item	Description
LDEV ID	The LDEV's identifier.
LDEV Name	The LDEV's name.
Port ID	(SI only.) The port name of the LDEV's LUN path.
Host Group Name	(SI only.) The host group name of the LDEV's LUN path.
LUN ID	(SI only.) The LUN ID of the LDEV's LUN path.
Emulation Type	The LDEV's emulation type.

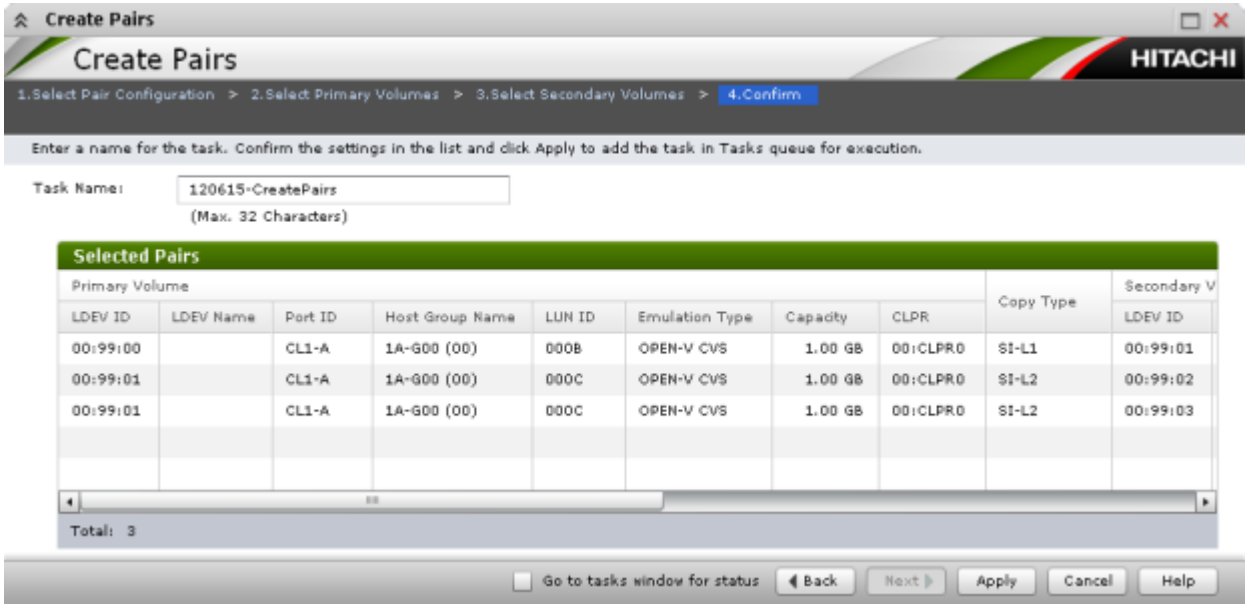
Item	Description
Capacity	The LDEV's capacity.
Provisioning Type	Provisioning type of the LDEV: • Basic: Internal volume • DP: DP-VOL • External: External volume • Snapshot: HTI or SS volume
CLPR	LDEV's CLPR number
Number of Secondary Volumes	(SI only.) The number of S-VOL that the selected P-VOL has been assigned so far. This may include the number of S-VOL for an L2 pair that is already created.
Reserve Volume	(SI and SIz only.) Indicates whether LDEV is reserved as an S-VOL. Values: **Yes** or **No**

Selected Pairs table

Item	Description
Primary Volume	Information about the P-VOL. • **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. For SIz, this item is blank. • **Host Group Name:** The host group name of the P-VOL LDEV's LUN path. For SIz, this item is blank. • **LUN ID:** The LUN ID of the P-VOL LDEV's LUN path. For SIz, this item is blank. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity.
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for TI pairs, this item is blank.
New Snapshot Group	(HTI only.) Values: • **Yes:** New snapshot group is used. • **No:** Existing snapshot group is used.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Port ID:** The port name of the S-VOL LDEV's LUN path.

Item	Description
	For SIz, this item is blank. • **Host Group Name:** The host group name of the S-VOL LDEV's LUN path. For SIz, this item is blank. • **LUN ID:** The LUN ID of the S-VOL LDEV's LUN path. For SIz, this item is blank. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity.
Copy Type	The following types of pairs are shown: • SI-L1: SI L1 • SI-L2: SI L2 • TI: HTI • SS: SS • SIMF: SIz
Mirror Unit	The mirror unit number. For HTI and SS pairs, a hyphen (-) is shown.
Split Type	(SI and SIz only.) One of the following selected split types are shown: • **Non Split:** Does not split the pair. • **Quick Split:** Splits the pair immediately • **Steady Split:** Splits the pair after all differential data is copied
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** For HTI and SS pairs, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and ID number. For SI and SIz pairs, a hyphen (-) is shown.

Confirm window



Selected Pairs table

Item	Description
Primary Volume	• **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. For SIz, this item is blank. • **Host Group Name:** The host group name of the P-VOL LDEV's LUN path. For SIz, this item is blank. • **LUN ID:** The LUN ID of the P-VOL LDEV's LUN path. For SIz, this item is blank. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • SI-L1: SI L1 • SI-L2: SI L2 • TI: TI • SS: SS • SIMF: SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for TI pairs, this item is blank.
New Snapshot Group	(HTI only.)

Item	Description
	• **Yes:** New snapshot group is used. • **No:** Existing snapshot group is used.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Port ID:** (HTI and SI only.) The port name of the S-VOL LDEV's LUN path. • **Host Group Name:** (HTI and SI only.) The Host group name of the S-VOL LDEV's LUN path. • **LUN ID:** (HTI and SI only.) The LUN ID of the S-VOL LDEV's LUN path. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR number.
Split Type	(SI and SIz only.) • **Non Split:** Does not split the pair. • **Quick Split:** Splits the pair immediately • **Steady Split:** Splits the pair after all differential data is copied
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower**
Pool Name (ID)	(HTI and SS only.) The pool name and ID number.
Mirror Unit	(SI and SIz only.) The mirror unit number.

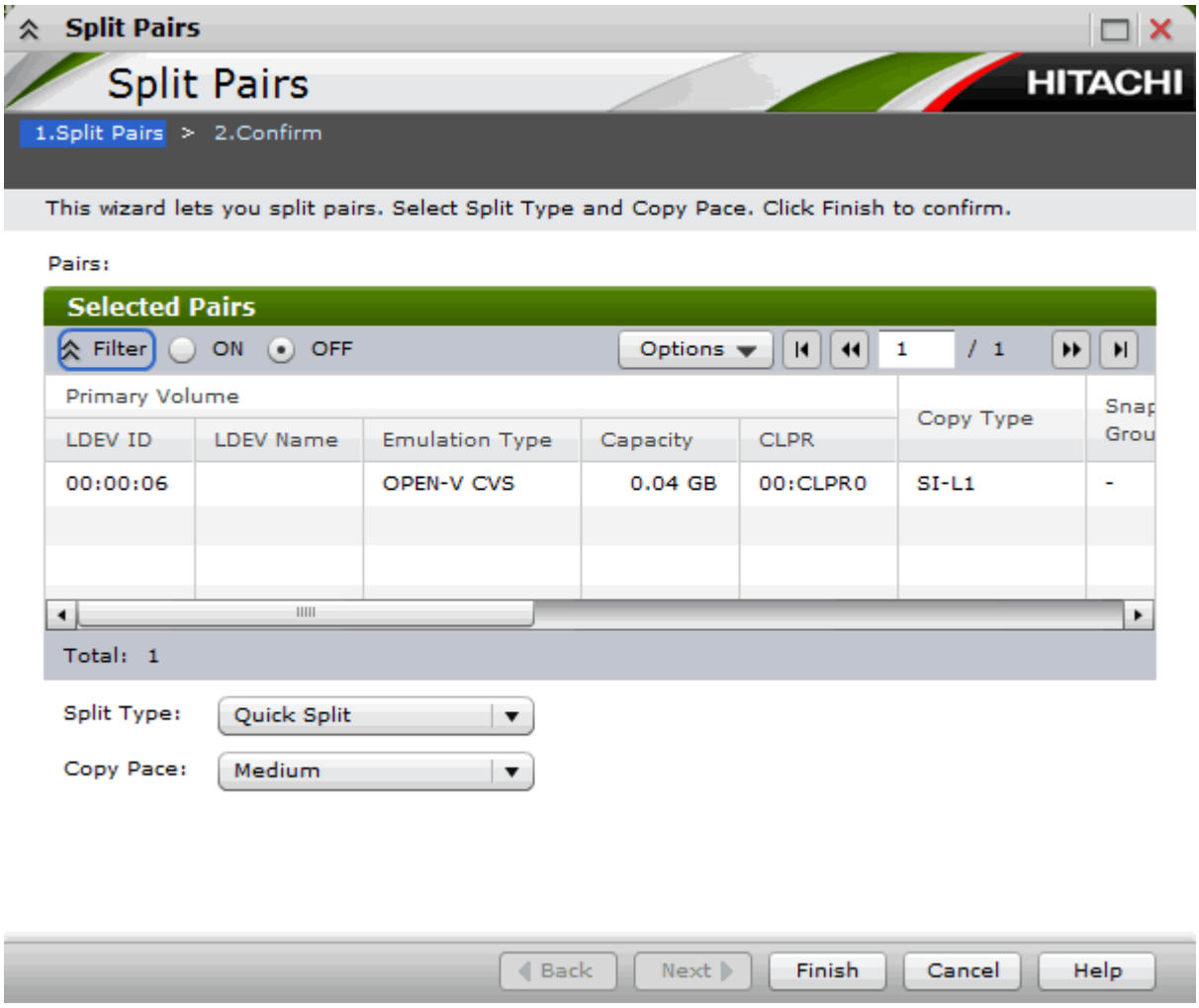
Split Pairs wizard

Use this wizard to split pairs.

Split Pairs window

Use this window to split pairs.

For full information, see Splitting pairs on page 5-11.



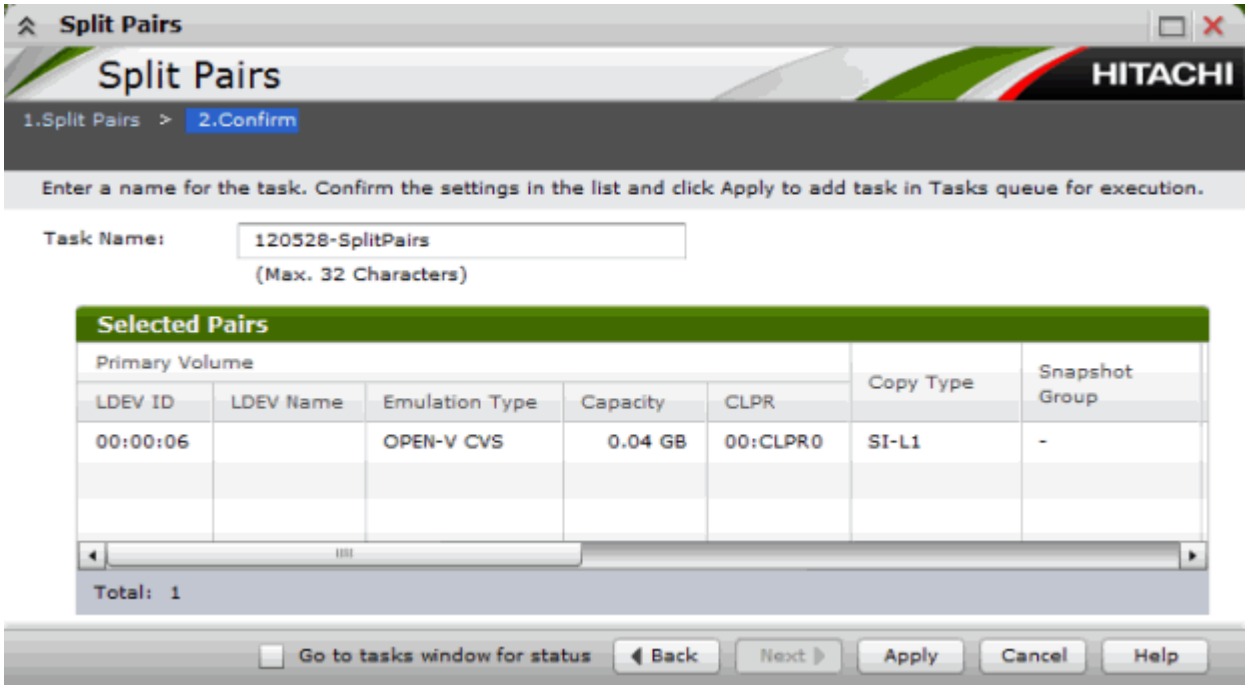
Selected Pairs table

The same **Selected Pairs** table appears on the **Confirm** window and the **Split Pairs** window.

Item	Description
Primary Volume	• **LDEV ID:** P-VOL's LDEV identifier • **LDEV Name:** P-VOL's LDEV name • **Emulation Type:** P-VOL's emulation type • **Capacity:** P-VOL's volume capacity • **CLPR:** P-VOL's CLPR number
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz

Item	Description
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	Pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** S-VOL's LDEV identifier • **LDEV Name:** S-VOL's LDEV name • **Emulation Type:** S-VOL's emulation type • **Capacity:** S-VOL's volume capacity • **CLPR:** S-VOL's CLPR number
Pool Name (ID)	(HTI and SS only.) The pool name and ID number. For SI and SIz pairs, hyphen (-) is shown.
Mirror Unit	Mirror unit number
Split Type list	The split type. Values: • **Quick Split:** Splits the pair immediately • **Steady Split:** After all differential data is copied, the pair is split. For HTI and SS, this is the only option you can select. Default: **Quick Split**
Copy Pace list	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** Default: **Medium** For HTI and SS pairs, a hyphen (-) is shown.

Confirm window



Selected Pairs table

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier • **LDEV Name:** The P-VOL's LDEV name • **Emulation Type:** The P-VOL's emulation type • **Capacity:** The P-VOL's volume capacity • **CLPR:** The P-VOL's CLPR number
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	The pair status. For more information, see Pair status definitions on page 6-3.
Split Type	• **Quick Split:** Splits the pair immediately

Item	Description
	• **Steady Split:** Splits the pair after all differential data is copied.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** For HTI and SS pairs, a hyphen (-) is shown.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier • **LDEV Name:** The S-VOL's LDEV name • **Emulation Type:** The S-VOL's emulation type • **Capacity:** The S-VOL's volume capacity • **CLPR:** The S-VOL's CLPR number
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. For SI and SIz pairs, a hyphen (-) is shown.
Mirror Unit	Mirror unit number

Resync Pairs wizard

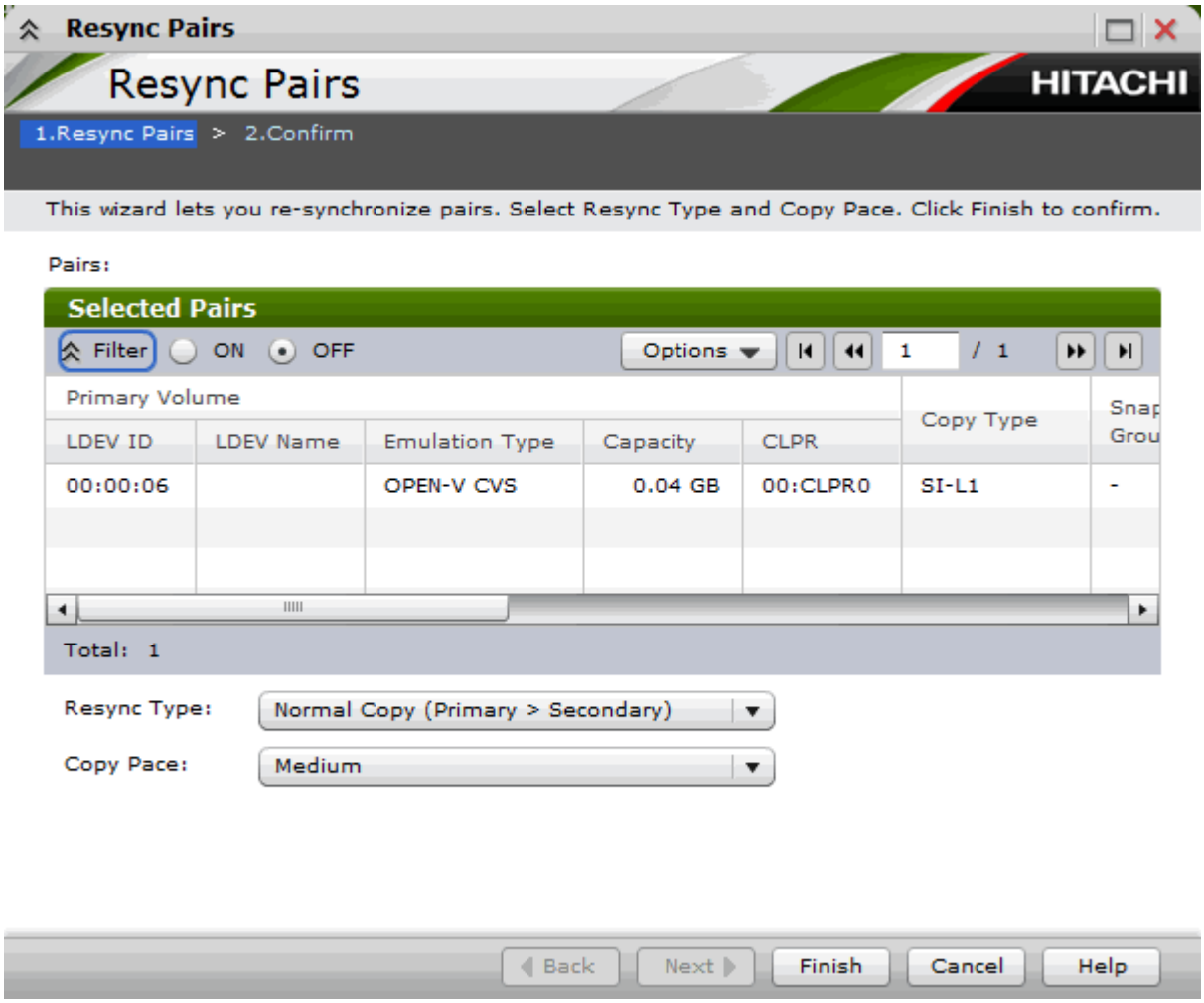
Use this wizard to resynchronize pairs. This wizard includes the following windows:

- **Resync Pairs** window
- **Confirm** window

Resync Pairs window

Use this window to specify resync operation details.

For full information, see Resynchronizing pairs on page 5-15.

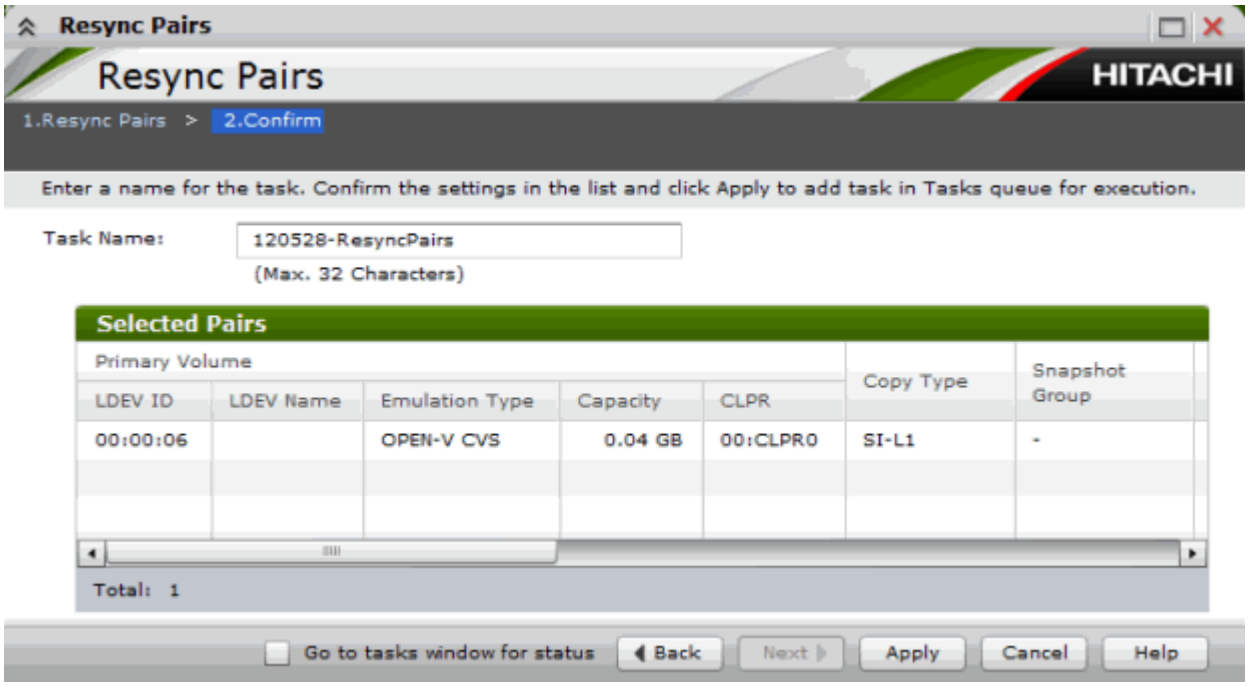


Selected Pairs table

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier • **LDEV Name:** The P-VOL's LDEV name • **Emulation Type:** The P-VOL's emulation type • **Capacity:** The P-VOL's volume capacity • **CLPR:** The P-VOL's CLPR number
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name.

Item	Description
	If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	Pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier • **LDEV Name:** The S-VOL's LDEV name • **Emulation Type:** The S-VOL's emulation type • **Capacity:** The S-VOL's volume capacity • **CLPR:** The S-VOL's CLPR number
Snapshot Date	(HTI and SS only.) The date and time that a snapshot was acquired. For SI and SIz pairs, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. For SI and SIz pairs, a hyphen (-) is shown.
Mirror Unit	The mirror unit number.
Resync Type	The type of resynchronization is specified: • **Normal Copy (Primary > Secondary)** • **Reverse Copy (Secondary > Primary)** • **Quick Resync (Primary > Secondary)** • **Quick Restore (Secondary > Primary)** For more information, see Types of resync operations on page 5-13.
Copy Pace list	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** Default: **Medium** For HTI and SS pairs, a hyphen (-) is shown.

Confirm window



Selected Pairs table

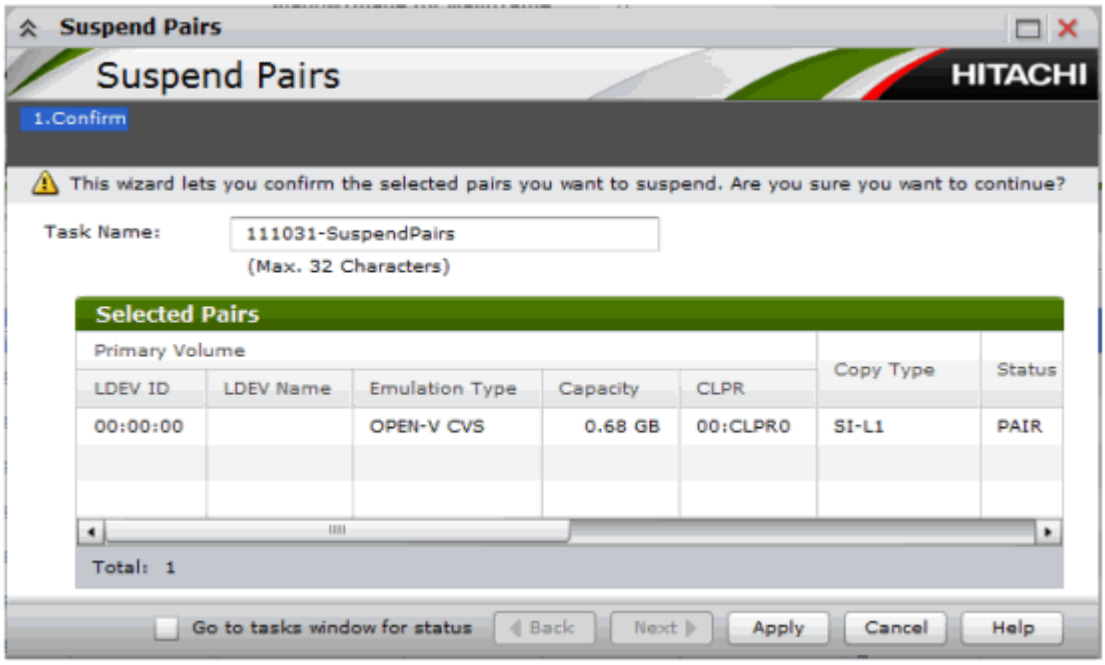
Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier • **LDEV Name:** The P-VOL's LDEV name • **Emulation Type:** The P-VOL's emulation type • **Capacity:** The P-VOL's volume capacity • **CLPR:** The P-VOL's CLPR number
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.
Status	The pair status. For more information, see Pair status definitions on page 6-3.
Resync Type	The resync type. Values:

Item	Description
	• **Normal Copy (Primary > Secondary)** • **Reverse Copy (Secondary > Primary)** • **Quick Resync (Primary > Secondary)** • **Quick Restore (Secondary > Primary)** For more information, see Types of resync operations on page 5-13.
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, **Slower** Default: **Medium** For HTI and SS pairs, a hyphen (-) is shown.
Secondary Volume	The secondary information. Values: • **LDEV ID:** The S-VOL's LDEV identifier • **LDEV Name:** The S-VOL's LDEV name • **Emulation Type:** The S-VOL's emulation type • **Capacity:** The S-VOL's volume capacity • **CLPR:** The S-VOL's CLPR number
Snapshot Date	(HTI and SS only.) The date and time that a snapshot was acquired. For SI and SIz pairs, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. For SI and SIz pairs, a hyphen (-) is shown.
Mirror Unit	The mirror unit number.

Suspend Pairs window

Use this window to suspend pair creation.

For full information, see Suspending pair creation on page 5-9.



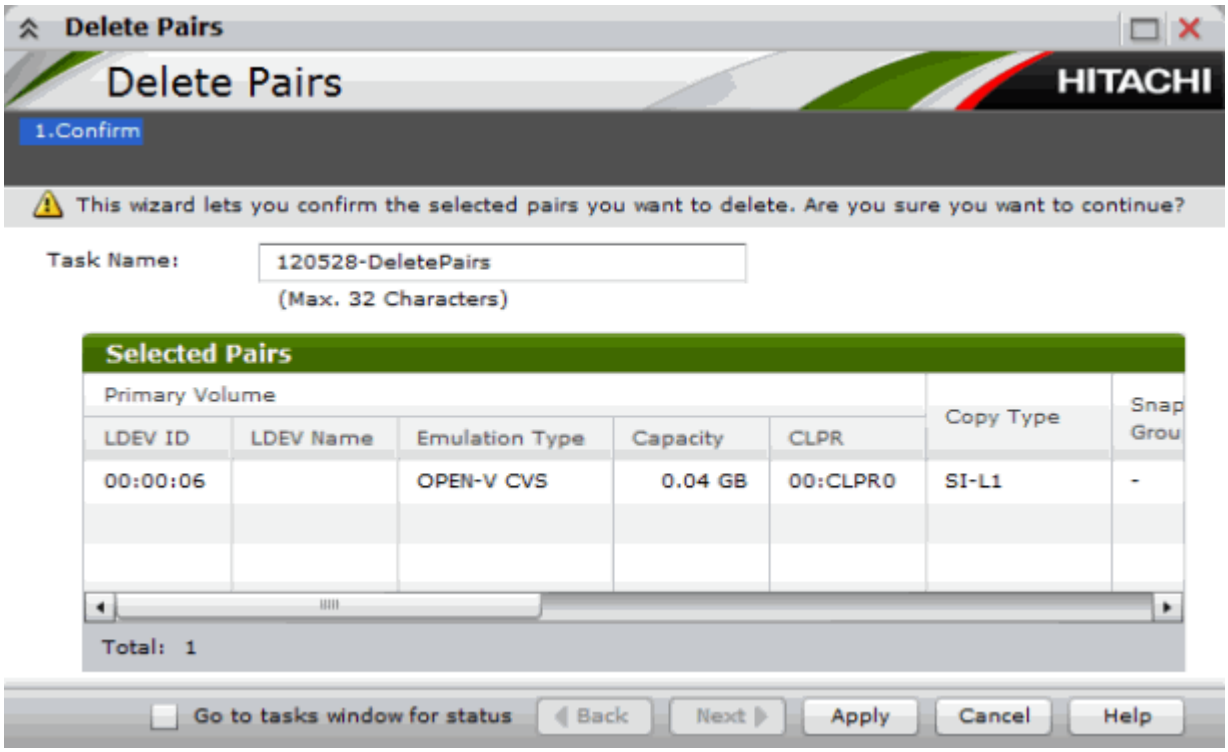
Selected Pairs table

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** TI • **SS:** SS • **SIMF:** SIz
Status	Pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR number.
Mirror Unit	The mirror unit number.

Delete Pairs window

Use this window to delete pairs.

For full information, see Deleting pairs on page 5-17.



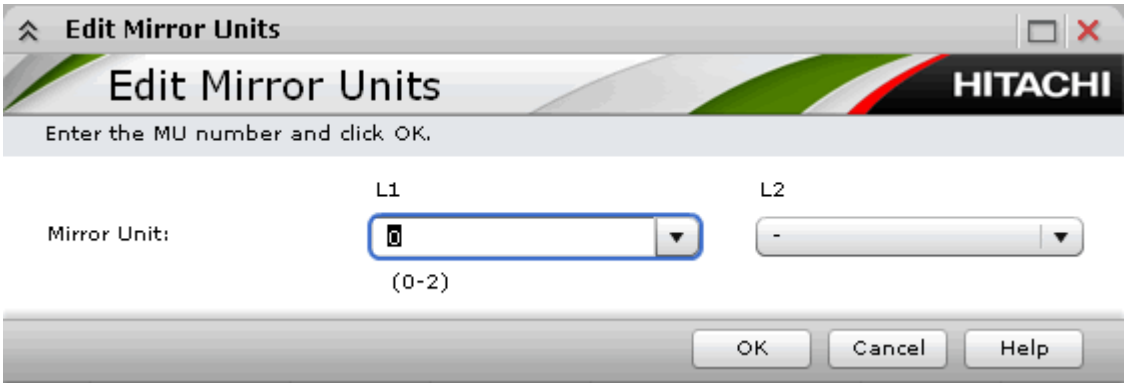
Selected Pairs table

Item	Description
Primary Volume	• **LDEV ID:** The P-VOL's LDEV identifier. • **LDEV Name:** The P-VOL's LDEV name. • **Emulation Type:** The P-VOL's emulation type. • **Capacity:** The P-VOL's volume capacity. • **CLPR:** The P-VOL's CLPR number.
Copy Type	Shows the following types of pairs: • **SI-L1:** SI L1 • **SI-L2:** SI L2 • **TI:** HTI • **SS:** SS • **SIMF:** SIz
Snapshot Group	(HTI only.) The snapshot group name. If you have not set a snapshot group for HTI pairs, this item is blank. For SI, SIz and SS pairs, a hyphen (-) is shown.

Item	Description
Status	The pair status. For more information, see Pair status definitions on page 6-3.
Secondary Volume	• **LDEV ID:** The S-VOL's LDEV identifier. • **LDEV Name:** The S-VOL's LDEV name. • **Emulation Type:** The S-VOL's emulation type. • **Capacity:** The S-VOL's volume capacity. • **CLPR:** The S-VOL's CLPR number.
Snapshot Date	(HTI and SS only.) The date and time that a snapshot was acquired. For SI and SIz, a hyphen (-) is shown.
Pool Name (ID)	(HTI and SS only.) The pool name and identification number. For SI and SIz, a hyphen (-) is shown.
Mirror Unit	The mirror unit number.

Edit Mirror Units dialog box

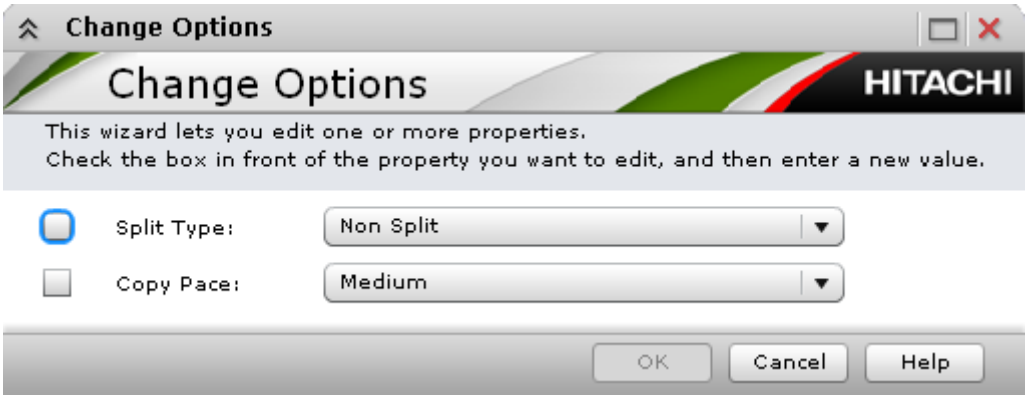
Use this dialog box to change mirror unit numbers.



Item	Description
Mirror Unit	Mirror unit number assigned to L1 and L2 volumes (SI only). For more information, see the step on MU number in Creating pairs on page 5-5.

Change Options dialog box

Use this dialog box to change the Split Type and Copy Pace. The changes you make in this dialog box applies to all new pairs you create.



Item	Description
Split Type	• **Non Split:** Does not split the pair • **Quick Split:** Splits the pair immediately. Specify this if you want to have the S-VOL available for read and write I/O immediately after the pair split operation is issued. Any remaining differential data is copied to the S-VOL in the background. • **Steady Split:** After all differential data is copied, the pair is split. Default: **Non Split**
Copy Pace	(SI and SIz only.) The speed at which the split operation is performed. Values: **Faster**, **Medium**, or **Slower** Default: **Medium** For HTI and SS pairs, a hyphen (-) is shown.

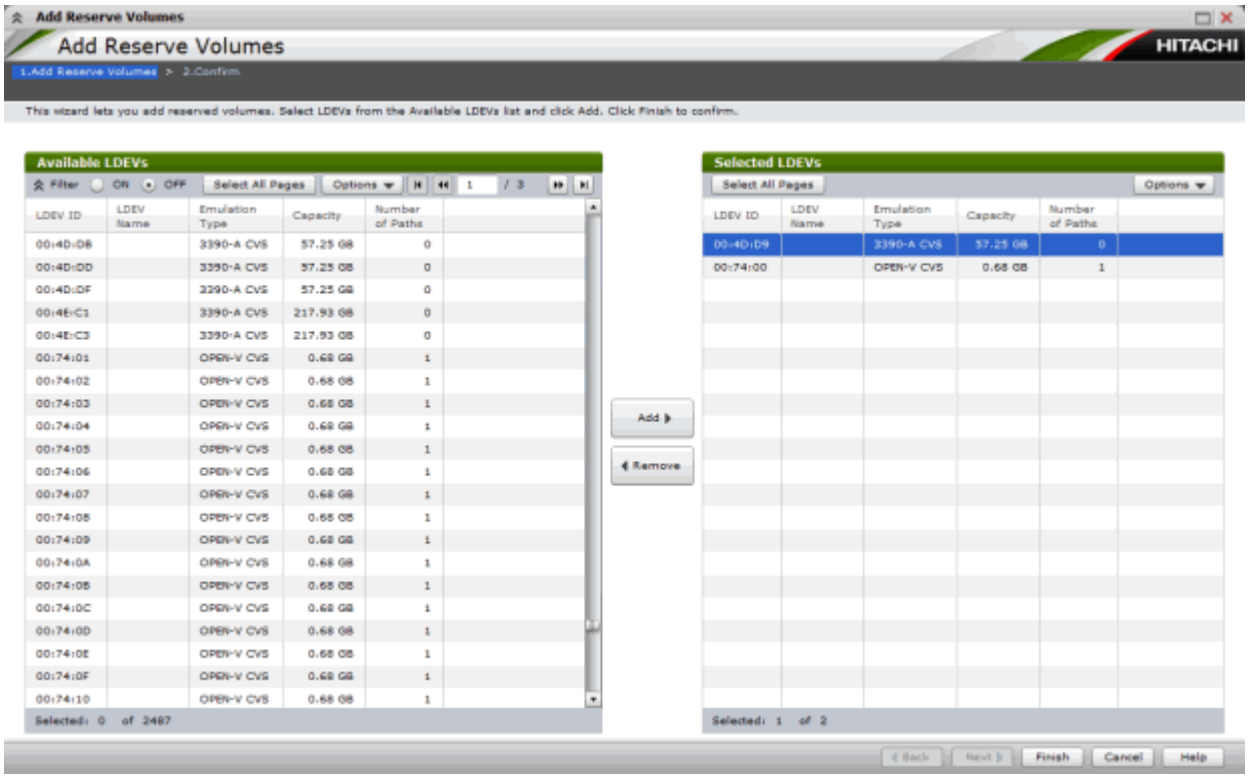
Add Reserve Volumes Wizard

Use this wizard to reserve a volume as a S-VOL.

Add Reserve Volumes window

Use this window to select LDEVs for use as reserved S-VOL.

For full information, see Reserving secondary volumes on page 4-2.



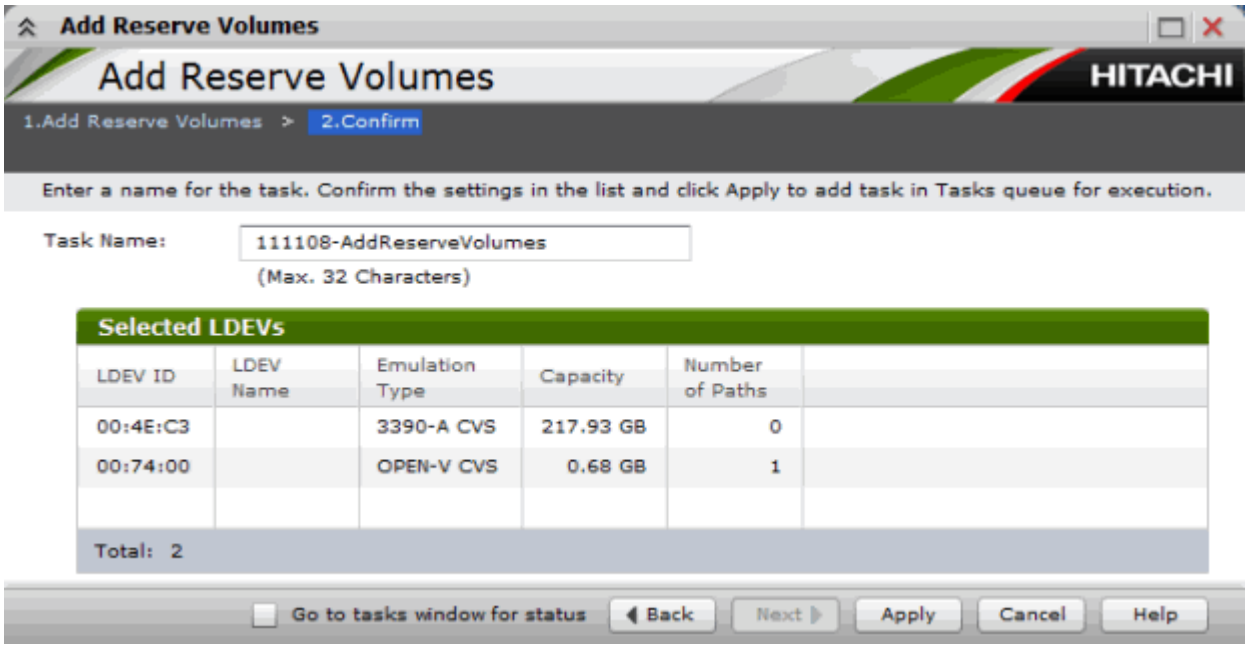
Available LDEVs table

Item	Description
LDEV ID	LDEV identification number.
LDEV Name	LDEV name
Emulation Type	Emulation Type of each LDEV
Capacity	Capacity of each LDEV
Number of Paths	Number of paths to each LDEV

Selected LDEVs table

Item	Description
LDEV ID	Selected reserved volume’s LDEV identifier.
LDEV Name	Selected reserved volume’s LDEV name
Emulation Type	Selected reserved volume’s emulation type
Capacity	Selected reserved volume’s capacity
Number of Paths	Number of paths to each LDEV

Confirm window



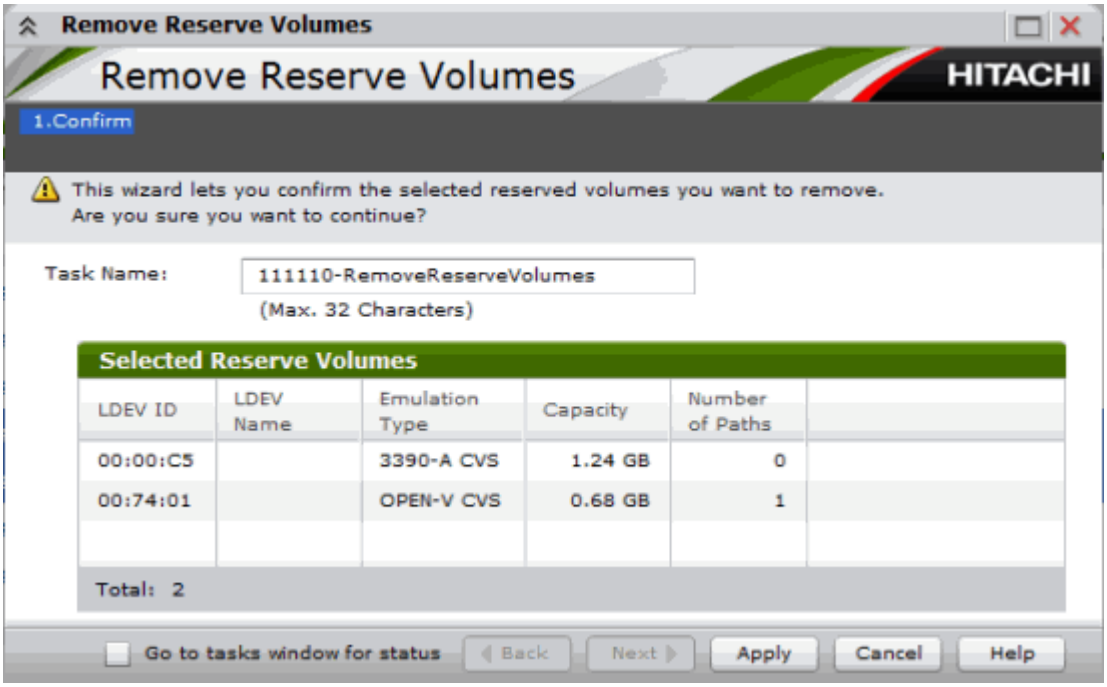
Selected LDEVs table

Item	Description
LDEV ID	Selected reserved volume's LDEV identifier.
LDEV Name	Selected reserved volume's name
Emulation Type	Selected reserved volume's emulation type
Capacity	Selected reserved volume's capacity
Number of Paths	Number of paths for each LDEV

Remove Reserve Volumes window

Use this window to remove the reserve attribute from a volume.

For full information, see Removing reserve attribute from a volume on page 6-10.



Selected Reserve Volumes table

Item	Description
LDEV ID	Selected reserved volume's LDEV identifier
LDEV Name	Selected reserved volume's LDEV name
Emulation Type	Selected reserved volume's emulation type
Capacity	Selected reserved volume's capacity
Number of Paths	Number of paths to each LDEV

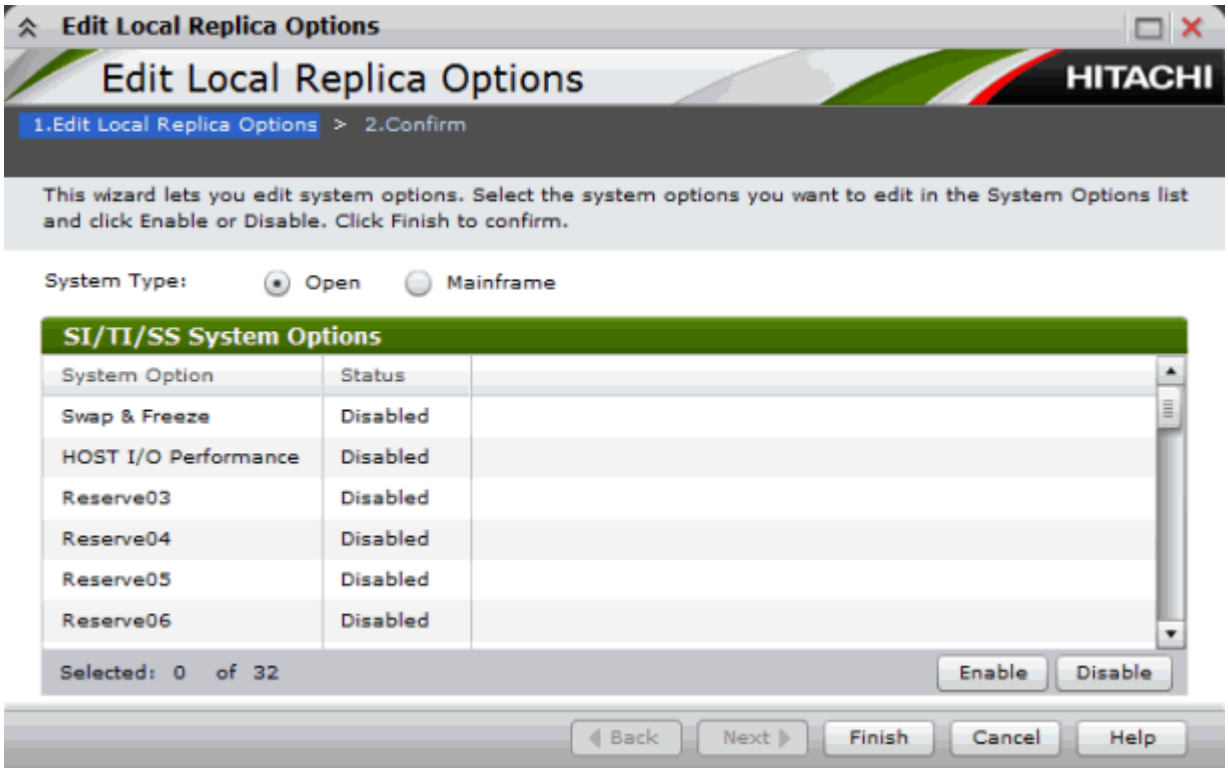
Edit Local Replica Option wizard

Use this wizard to enable and disable options that affect performance.

Edit Local Replica Option window

Use this window to specify options that affect performance.

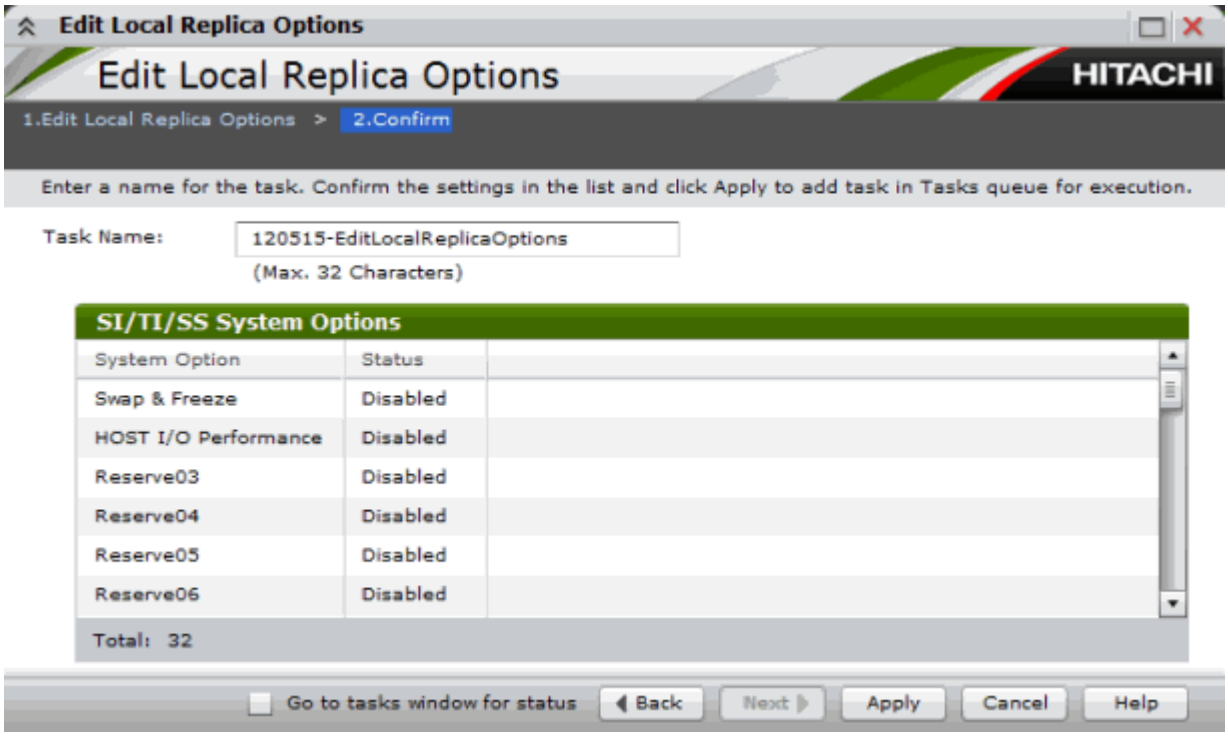
For full information, see System options that affect performance on page 4-3.



SI/TI/SS System Options table

Item	Description
System Option	Options that you can change. Values: • **Swap & Freeze** • **Host I/O Performance** • **Copy Pace Ext. Slower1** • **Copy Pace Ext. Slower2** • **Copy Pace Ext. None** For more information, see Setting performance options on page 4-4.
Status	Shows whether the option is currently enabled or disabled.
Enable button	Click to enable the selected option.
Disable button	Click to disable the selected option.

Confirm window



SI/TI/SS System Options table

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

C

Configuration operations (secondary window)

This appendix provides instructions for configuring SI using the previous SN GUI, which opens in a secondary window.

Configuration workflow

Setup for SI consists of the following:

1. Ensuring that primary and secondary volumes are set up correctly.
2. (Optional) Reserving volumes for use as S-VOLs.
3. Setting the HOST I/O Performance option, which boosts I/O performance, though copy time slows as a result. (Optional.)

Setting up primary and secondary volumes

Set up the primary and secondary volumes before making copies. Ensure that the volumes you plan to use meet the requirements for pair volumes in Planning pair volumes on page 2-4.

Reserving S-VOLs

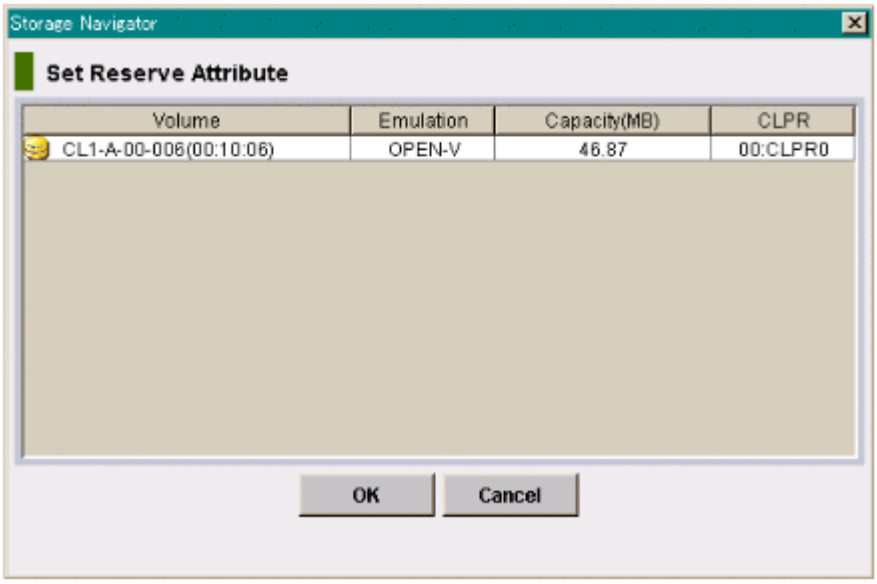
This is an optional feature you can use to reserve volumes that are not assigned to a pair ("SMPL" status) for use as S-VOLs. The storage system rejects write I/Os to reserved volumes except those that are split ("PSUS" status).

Prerequisite information

Volumes to be reserved must be:

- Not assigned to a pair ("SMPL" status)
- Unreserved and unpaired

1. Select the volume or volumes that you want to reserve offline from the host.
2. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
3. Change to Modify mode by clicking the  icon.
4. In the tree in the **Pair Operations** window, select the appropriate port or host group CU image for the volumes you want to reserve.
   Related volumes are shown in the volume list.
5. To show unreserved volumes ("SMPL" status), complete the following:
   a. Click **Display Filter**.
   b. Clear the **Reserved** and **Pair** check boxes.
   c. Select **Non-Pair**, and click **OK**.
6. In the **Volume** list, right-click the desired unreserved pair ("SMPL" status), then click **Change Reserve** from the menu.

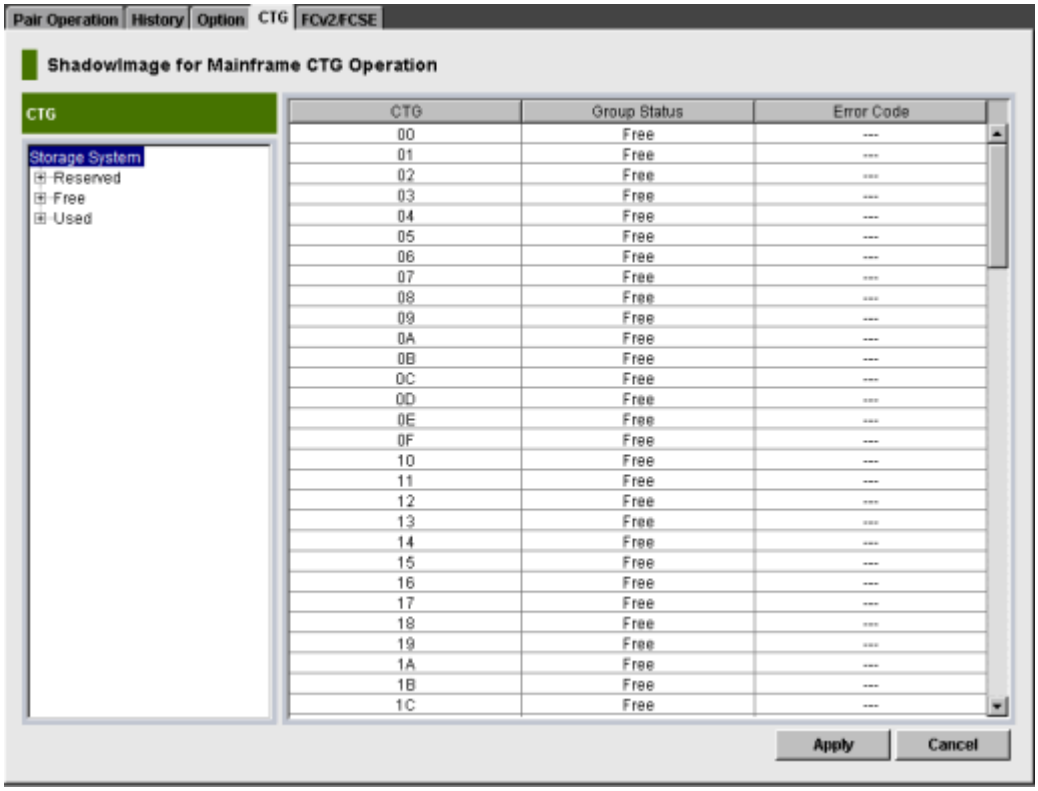


7. In the **Set Reserve Attribute** dialog box, confirm that the volumes you want to reserve are shown and selected, then click **OK**.
   The selected volumes are shown in the **Preview** list.
8. In the **Pair Operations** window, click **Apply**.

Reserving a consistency group

A consistency group number is required when assigning pairs to a consistency group. Once you have assigned pairs to a consistency group, you can perform pair operations on the pairs in the group, including consistency group pair-split.

1. In SN, click **Actions > Local Replications > SI/SS > CTG**.



2. Change to Modify mode by clicking the icon.
3. Select and right-click one or more **CTG**s with status **Free**, then click **Add CT Group**.
4. Click **Apply**. The status changes to Reserved.

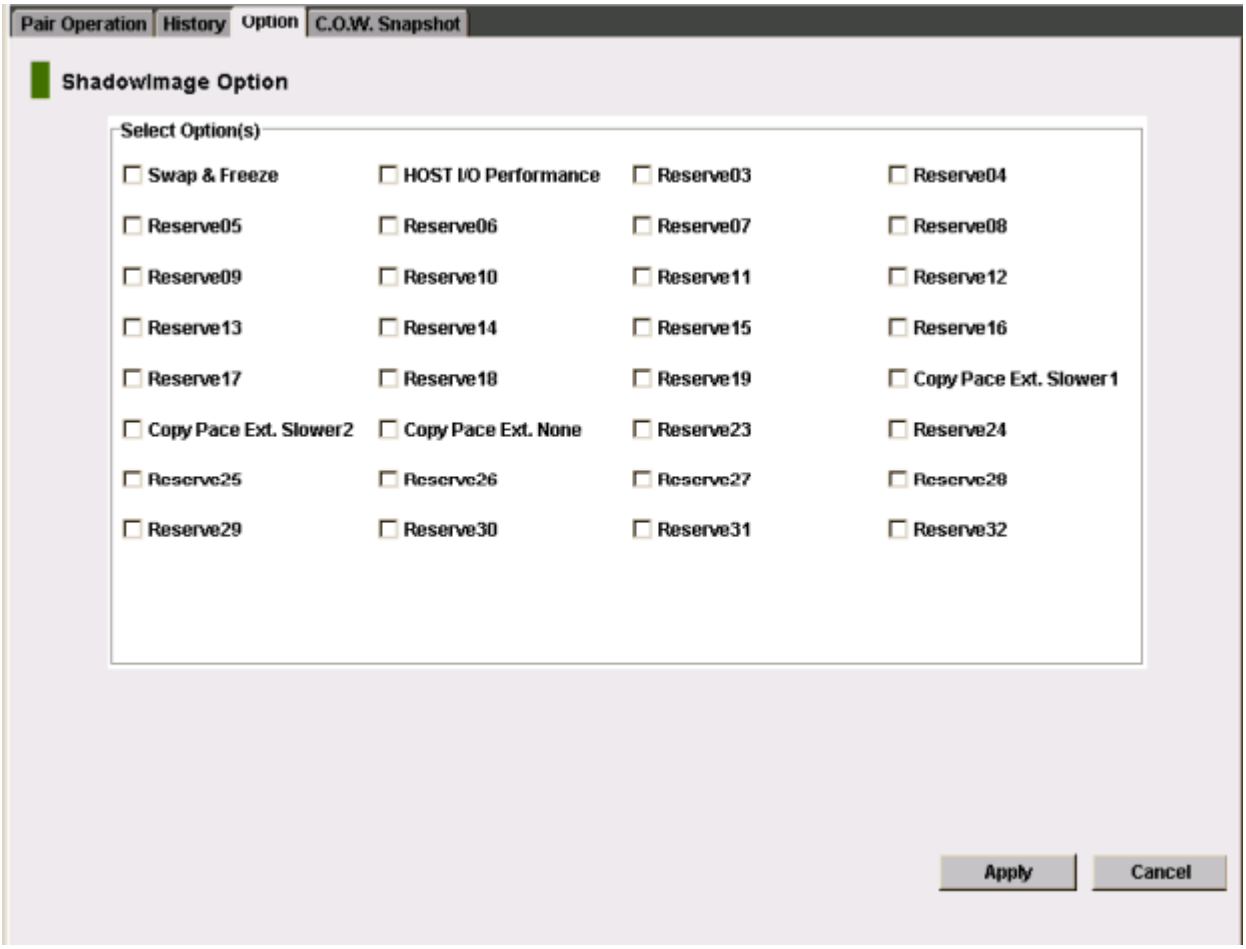
You can **remove the reserve attribute** by selecting the Reserved group or groups, right-clicking, and selecting **Delete CT Group**.

Setting performance options

You can enable and disable the following options that affect performance. For descriptions of these options, see System options that affect performance on page 4-3.

If you have both SIz and SI pairs, Hitachi recommends that you enable this option on both; otherwise host I/O response may not improve.

1. In SN, click **Actions > Local Replications > SI/SS > Option**.
2. Change to Modify mode by clicking the icon.
3. In the **ShadowImage Option** window, select the option you want and click **Apply**.


Pair Operation
History
Option
C.O.W. Snapshot
ShadowImage Option
Select Option(s)
Swap & Freeze
HOST I/O Performance
Reserve03
Reserve04
Reserve05
Reserve06
Reserve07
Reserve08
Reserve09
Reserve10
Reserve11
Reserve12
Reserve13
Reserve14
Reserve15
Reserve16
Reserve17
Reserve18
Reserve19
Copy Pace Ext. Slower1
Copy Pace Ext. Slower2
Copy Pace Ext. None
Reserve23
Reserve24
Reserve25
Reserve26
Reserve27
Reserve28
Reserve29
Reserve30
Reserve31
Reserve32
Apply
Cancel

D

Pair operations (secondary window)

This appendix provides instructions for performing pair operations using the previous SN GUI, which opens in a secondary window.

Pair operations workflow

A typical pair-operations workflow follows:

- Check pair status. Each operation requires a pair to have a specific status. You also check pair status to ensure that an operation completed successfully.
- Create the pair, in which the S-VOL becomes a duplicate of the P-VOL. You can create the pair and immediately split it so that you can have instant access to the S-VOL.
- Split the pair, which separates the primary and secondary volumes and allows use of S-VOL data by secondary applications.
- Resynchronize the pair, in which the S-VOL is again updated from the P-VOL.
- Delete the pair, in which the pair relationship between the pair volumes is ended, though the data remains.

Check pair status

Every pair operation requires the pair to have a specific status. When you want to perform a pair operation, check pair status to ensure that you can proceed successfully.

- For pair status definitions and instructions for finding pair status, see Monitoring the system on page 6-2.
- For the operations allowed for specific pair statuses, see Status, pair operations permitted on page 6-4.
- When you have L2 pairs, besides checking pair status, you will also check whether an operation is possible given the status of related L1 and L2 pairs. For information, see Status for L1, L2 pairs and operations permitted on page 6-5.

Creating L1 and/or L2 pairs

When you create the initial copy, data in the P-VOL is copied to the S-VOL. During the operation, the P-VOL can receive updates from the host. When the initial copy is completed, the updated data in the P-VOL—differential data—is copied to the S-VOL periodically (update copy).

You can create the pair and immediately split it so that you can have instant access to the S-VOL. For more information about creating and splitting pairs, see Splitting pairs, creating and splitting pairs on page D-5.

You can create pairs for L1 or L2. Instructions for both procedures are included in this topic.

Prerequisite information

- Make sure that your volumes are set up for pairing. For more information, see Planning pair volumes on page 2-4.

- If the P-VOL is used with another pair, the pair status of the existing pairs must be "PAIR".
- If the P-VOL is not used with another pair, the P-VOL and S-VOL must not be assigned to a pair ("SMPL" status).
- Because pair creation affects performance on the host, observe the following:
  - Create a pair when I/O load is light.
  - Limit the number of pairs that you create simultaneously.
- When a pair is created, the S-VOL's LDEV is allocated to the same processor blade to which the P-VOL's LDEV is allocated.
- You must first create the SI pair if you are using one of its volumes as a TI P-VOL.

  If an MU number is not available, complete the following:

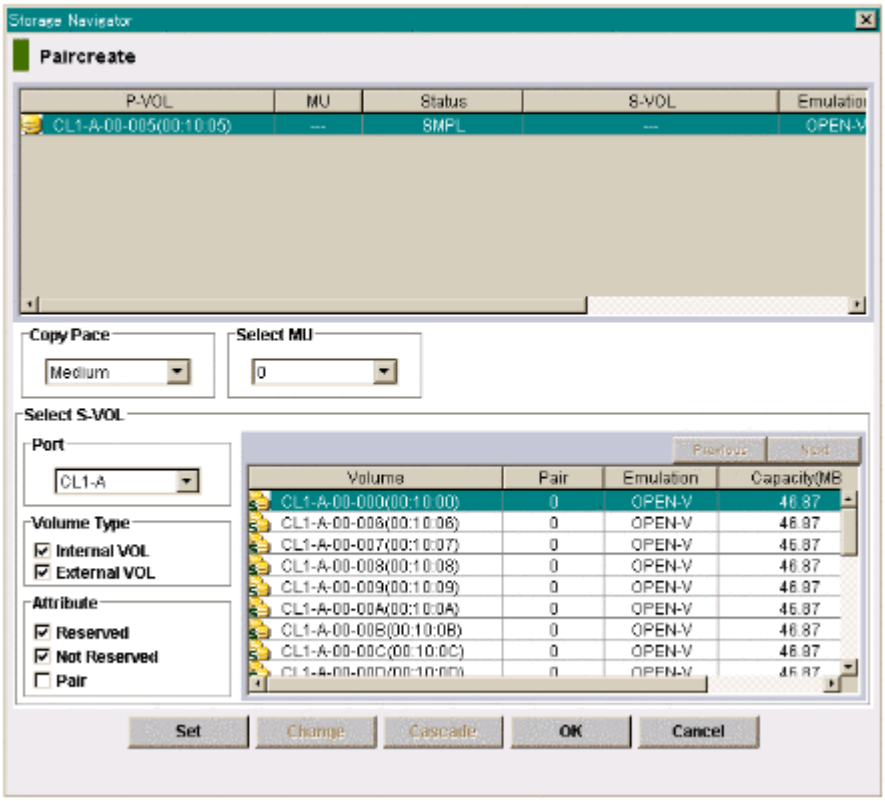
  a. Delete a TI pair whose MU number is 0-to-2.
  b. Create an SI pair.
  c. Create the TI pair.

WARNING: The SI paircreate operation overwrites all existing data on the S-VOL. The user is responsible for backing up data on the S-VOLs before creating SI pairs.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Change to Modify mode by clicking the  icon.
3. In the tree, in the **Pair Operations** window, select the port or host group where the volumes to be P-VOLs are located.

   Related volumes are shown in the volume list.
4. In the volume list, select the volumes that are the P-VOLs. Do not select reserved volumes.

   If you are creating an L2 pair, select an existing L1 pair.
5. Right-click your selections and select **Paircreate**.



6. In the **Paircreate** dialog box, verify that the desired P-VOLs are shown in the pair list. To remove a volume, right-click and select **Delete**.
7. Select the P-VOL that you want to pair.

   If you are creating an L2 pair, select an existing L1 pair. The L1 S-VOL becomes the L2 P-VOL.
8. In **Copy Pace**, select the pace at which data is to be copied, **Slower**, **Medium**, or **Faster**. System performance is affected by the pace you select, less for Slower, more for Faster.

Note: The copy pace you assign is always reflected to any pairs that you added earlier and are still present in the **Preview** list. To maintain the copy pace given to the earlier pairs, click **Apply** before adding new pairs with a different copy pace.

9. Select an **MU** number for the pair.
   - An MU number can be assigned to only one pair.
   - Use 0, 1, or 2 for an L1 pair.
   - Use 1 or 2 for an L2 pair.
10. Show the volumes available for S-VOLs by selecting the following filters from the **Select S-VOL** box:
    - Select a **Port** to show associated volumes.
    - Select a **Volume Type** to show internal or external volumes. You can select both if desired.

- Select an **Attribute** to show volumes previously reserved as S-VOLs, or volumes that are not reserved. You can select both if desired.
- You can also filter by existing pairs that may be used for creating L2 pairs (select the **Pair** check box).

11. Select the volume to be the S-VOL from the volume list in the **Select S-VOL** box.
12. Do one of the following:
    - If creating an L1 pair, click **Set**. This places the volume as the S-VOL in the pair list.

      - You can add a second or third S-VOL to the same L1 P-VOL by repeating steps 8-11.

      - To create another pair with a new P-VOL, repeat steps 7-11.
    - If creating an L2 pair, click **Cascade**. This places a new L2 pair in the pair list.

      To add a second L2 pair, repeat steps 8-11.
13. If you need to change an S-VOL, highlight the pair then select the new volume in the S-VOL list and click **Change**. The changed pair is shown in the pair list.
14. Click **OK** when finished creating pairs.
15. In the **Pair Operation** window, review the information in the **Preview** list. To change a selection, right-click it, select **Modify**, and make your changes.
16. Click **Apply** to commit the pairs to the storage system.

Splitting pairs, creating and splitting pairs

Update copying continues until the pair is split. After the pair is split, updates continue to the P-VOL but not to the S-VOL; data in the S-VOL is ensured at the time of the split. All update data are stored in the differential bitmap for use when resynchronizing the pair.

You can use one of the following options to split a pair:

- **Steady split,** which is a typical pair split operation in which any remaining differential data from the P-VOL is copied to the S-VOL and then the pair is split.
- **Quick split**, in which the pair is immediately split 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.
- Create and simultaneously split an L1 or L2 pair. This allows you to access S-VOLs as soon as possible.

Prerequisite information

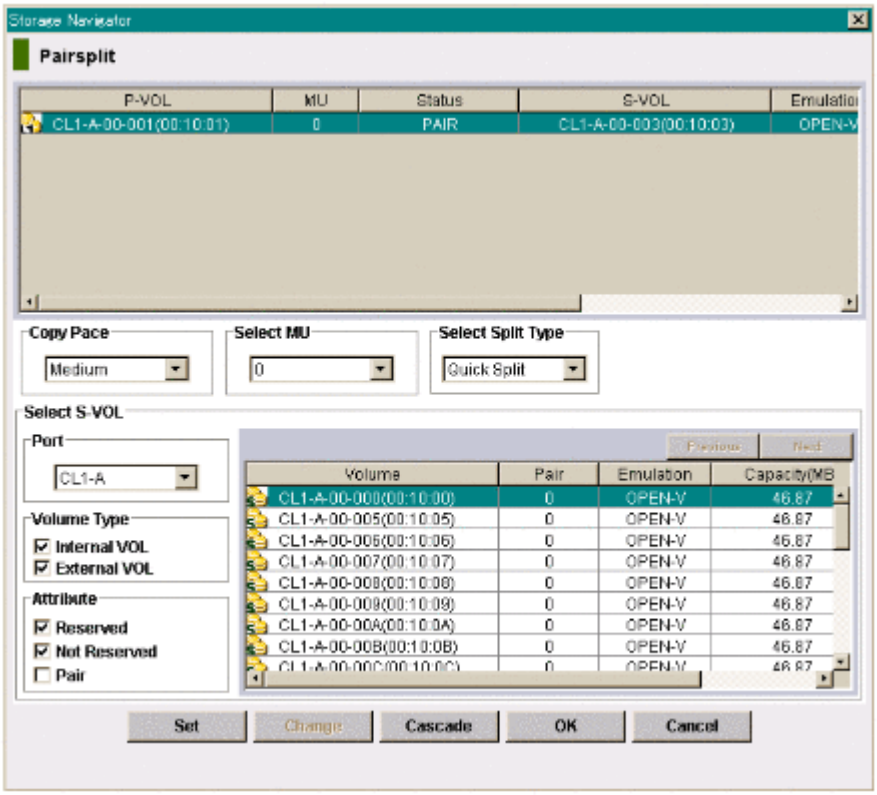
- Pair status must be one of the following:
  - If you are splitting an existing pair, “PAIR”
  - If you are creating and immediately splitting an L1 pair, “SMPL” status

- If you are creating and immediately splitting an L2 pair, the L1 pair must be split ("PSUS" status)

- For a split operation on an existing pair to complete faster, stop host access to the P-VOL.
- If you are performing multiple split operations before clicking **Apply**, both **Copy Pace** and **Split Type** that you set during the last operation are the settings that are used for all split operations (in the Preview list) when you click **Apply**.
- The split operation may take longer than normal if system option mode 459 is ON and the S-VOL is an external volume. The reason is because after differential data is copied to cache, it must also be destaged to the external storage system, which takes more time.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Change to Modify mode by clicking the  icon.
3. In the tree, in the **Pair Operations** window, select the port or host group where the pairs or volumes are located.

   Related volumes are shown in the volume list. If a volume is already paired, pair information is also shown.
4. Select one of the following:
   - The pair or pairs to be split.
   - When you create and split an L2 pair, the operation is begun using the L1 pair. Select the SMPL volumes or pair with which you will create and split a new pair.
5. Right-click the selection and from the menu, click **Pairsplit**.



6. For **Pairsplit**, complete the following:
   a. Ensure the pairs that you want to split are shown.
   b. Select the volume that is not assigned to a pair ("SMPL" status) that you want to be the P-VOL in an L1 pair-create-and-split operation.
   c. Select the L1 pair whose S-VOL are the P-VOL in an L2 pair create and split operation.
7. From **Copy Pace**, select the pace at which the pairs are to be split, **Slower**, **Medium**, or **Faster**. **Copy Pace** affects the host I/O performance: a slower pace minimizes impact, a faster pace has the greatest impact. The pace you select is used for all pairs in the operation.
8. For pairs being created and split, select an **MU** number. For L1 pairs, use 0, 1, or 2. For L2 pairs, use 1 or 2.

Note:

- You cannot select an MU number for an L2 pair that is being used in the associated L1 pair.
- You cannot select an MU number that is being used for an SS pair.

9. From **Select Split Type**, select one of the following:
   - **Steady Split**: Any remaining differential data between P-VOL and S-VOL is copied to the S-VOL before the split. Read and write access to the S-VOL is available only when the operation completes.

- **Quick Split**: Read and write access to the S-VOL is available immediately. Any remaining differential data between P-VOL and S-VOL is copied to the S-VOL in the background.

10. If you are splitting an existing pair or pairs, click **OK** and go to the last two steps in this procedure.

    If you are creating and splitting a pair, continue to the next step.

11. Show the volumes available for S-VOLs by selecting the following filters from the **Select S-VOL** box:

    - Select a **Port** to show associated volumes.
    - Select a **Volume Type** to show internal or external volumes. You can select both if desired.
    - Select an **Attribute** to show volumes previously reserved as S-VOLs, or volumes that are not reserved. You can select both if desired.
    - You can also filter by existing pairs that may be used for creating L2 pairs (select the **Pair** check box).

12. Select the volume to be the S-VOL from the volume list in the **Select S-VOL** box.
13. Do one of the following:

    - To create and split an L1 pair, click **Set**. This adds the pair to the **Volume** list as an L1 pair.
    - To create and split an L2 pair, click **Cascade**. This adds the pair to the **Volume** list as an L2 pair.

14. To replace an S-VOL in the volume/pair list, select the pair, select the desired S-VOL in the **Select S-VOL** box and then click **Change**.
15. To complete the operation, click **OK**.
16. In the **Pair Operation** window, review the information in the **Preview** list. To change a selection, right-click it, select **Modify**, and make your changes.
17. Click **Apply** to commit the operation to the storage system.

Splitting pairs in a consistency group

Use consistency group pair-split to simultaneously split all the pairs in a consistency group.

Prerequisite information

- Make sure to change the status of pairs in the same consistency group according to the copy group.

1. Define a consistency group for the SI pairs that you will split using consistency group pair-split.
2. Specify the consistency group split option, then create the pairs.
3. Split the pairs in the consistency group. The pairs are split simultaneously.

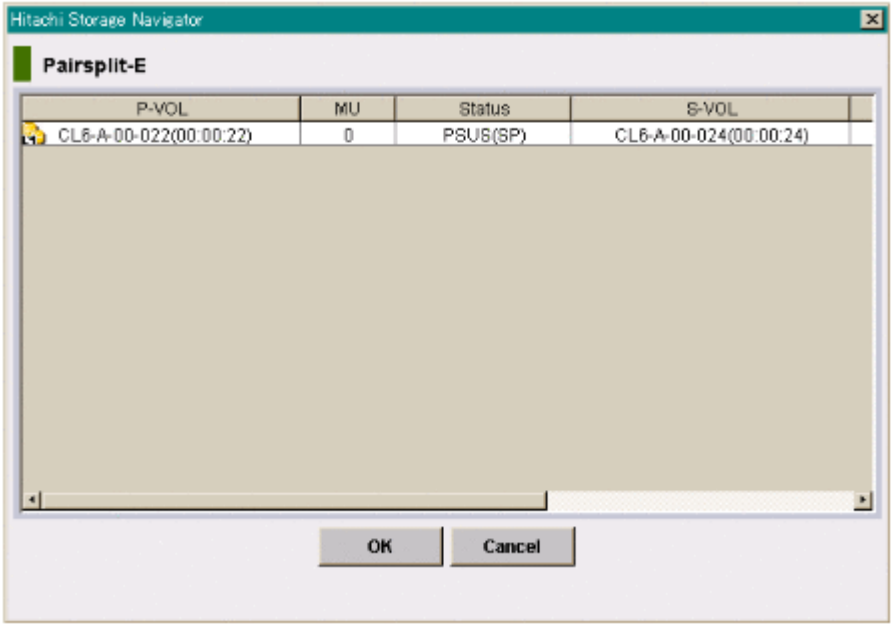
Suspending pair creation

Suspending the creation of pairs (initial copy to the S-VOL) changes the pair status to "PSUE". The S-VOL continues accepting write I/O operations from the P-VOL and marks the entire P-VOL track as difference data. Resynchronizing a suspended pair changes the pair status to "COPY(RS)/ COPY" and copies the entire P-VOL to the S-VOL. While the pairresync operation for a split pair can be very fast, the pairresync operation for a suspended pair takes as long as the initial copy operation.

The storage system automatically suspends a pair when it detects an error condition related to an update copy operation, or when it cannot keep the pair mirrored.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Change to Modify mode by clicking the  icon.
3. In the tree, in the **Pair Operations** window, select the port or host group where the pairs or volumes are located.

   Related volumes are shown in the volume list. If a volume is already paired, pair information is also shown.



4. Select the pairs that you want to suspend (or the volumes whose pairs you want to suspend), right-click the selected pairs to show the menu, and select the **Pairsplit-E** command to open the **Pairsplit-E** dialog box.
5. On the **Pairsplit-E** dialog box, select the pairs you want to suspend, and click **OK** to reflect the settings to the **Preview** List on the **Pair Operation** window.

   To remove pairs from the list, complete the following:

   a. Select the unneeded pairs.
   b. Right-click while selecting the pairs.

c. From the menu, select the **Delete** command.

6. Repeat steps 4 and 5 to suspend additional pairs in the **Pair Operation** window.
7. In the **Pair Operation** window, click **Apply** to suspend the specified pairs.

   The **Pair Operation** window shows the results of the **Pairsplit-E** operations, that is, the pair status changed to "PSUE".

Resynchronizing pairs

You resynchronize a pair that was split by a user or suspended by the storage system. Resynchronizing updates the S-VOL so that it is again paired with the P-VOL.

Caution: Resynchronizing the pair does not guarantee that P-VOL data is the same as S-VOL data. Data in the two volumes is the same only when the pair is split.

- You can forward resync, from P-VOL to S-VOL, and reverse resync, from S-VOL to P-VOL.
  - You can perform a Normal Copy or a Quick Resync, in both directions.
  - The P-VOL remains accessible to hosts for both read and write operations during a Normal Copy operation. The S-VOL is inaccessible to hosts during a Normal Copy operation.
  - The P-VOL remains read-disabled during the Reverse Copy operation.
- In a forward Quick Resync from P-VOL to S-VOL, status changes to "PAIR" without actually resynchronizing the data in the S-VOL. Differential data is copied to the S-VOL when update copy operations are performed.
  - The P-VOL remains accessible to all hosts for both read and write operations during a quick resync operation.
  - In a forward Quick Resync you cannot be sure the data in the P-VOL and S-VOL is the same when an host I/O is not present during the operation. Split the pair to ensure that data is the same.
- In a Quick Restore (reverse Quick Resync), the P-VOL and S-VOL are swapped. No actual data is copied, and the pair is placed in "PAIR" status.
  - The P-VOL and S-VOL are inaccessible during this operation. When the operation completes, the P-VOL is accessible.
  - When differential data between P-VOL and S-VOL is small, the Reverse Copy operation may be completed faster than the Quick Restore operation.
- Performing LDEV maintenance work during the Quick Restore process increases the time for the operation to complete.

Prerequisite information

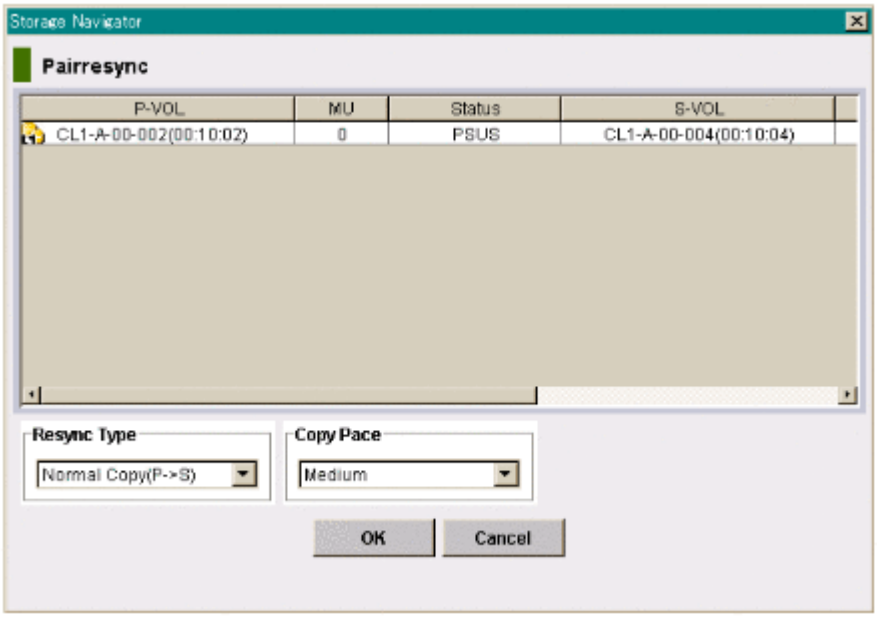
- To Reverse Copy or Quick Restore, the pair must be split ("PSUS" status).

- While you are performing a Quick Restore, make sure of the following:
  - The SVP is in View mode, not Modify mode
  - SN configuration and other tasks are stopped
- The Quick Restore cannot be used under the following conditions:
  - If either pair volume is a DP-VOL
  - If the S-VOL is also part of an SS pair
- The **`pairresync`** normally takes less time when the pair is split ("PSUS status) than when the pair is suspended ("PSUE" status). This is because the amount of differential data accumulated for a split pair is usually far less than the total amount of data in the P-VOL, which must be copied in full when the pair was suspended by the storage system.
- If you use BEDs supporting encryption, you can create an SI pair by using an encrypted volume and a non-encrypted volume. For example, you can create the pair specifying an encrypted volume as the P-VOL and a non-encrypted volume as the S-VOL. In this case, data in the encrypted P-VOL changes to non-encrypted data in the S-VOL.
- If a pair consists of encrypted volumes and a non-encrypted volume, and the Quick Restore is run, the P-VOL and S-VOL encryption statuses are reversed.
- With a Quick Restore, SN may show outdated information. Click **Refresh View** to ensure the most up-to-date information.
- To keep the P-VOL and S-VOL unsynchronized when performing a Quick Restore, enable the Swap&Freeze option prior to performing the operation. Update copy operations are then suppressed when the Quick Restore is completed, and the pair is in "PAIR" status.
- If you perform a reverse or quick restore operation on a pair whose P-VOL is also paired with other S-VOLs, the P-VOL and other S-VOLs are no longer synchronized.
- For Reverse Copy or Quick Restore operation, the following restrictions apply:
  - Pairs sharing the same P-VOL must be split ("PSUS" status) or suspended ("PSUE" status).
  - If a Quick Format is being performed on either of the pair volumes, the Quick Restore operation cannot be performed.
  - If the pair shares a volume with TC or UR, the TC or UR pair must be suspended to perform either backward resync operation.
  - Quick Restore cannot be performed when SI and shared TC or UR volumes include an external volumes.
  - You cannot create a TC or UR pair with a volume shared by SI during either backward resync operation.
  - When the Reverse Copy or Quick Restore operation is in progress, you cannot create, split, or resync any pair sharing the same P-VOL. You can delete or suspend the pairs, however.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.

2. Change to Modify mode by clicking the  icon.
3. In the tree, in the **Pair Operations** window, select the port or host group where the pairs or volumes are located.

   Related volumes are shown in the volume list. If a volume is already paired, pair information is also shown.
4. In the volume list, select the pairs to be resynchronized, right-click, and select **Pairresync**.



5. In the **Pairresync** dialog box, select the **Resync Type** as follows:
   - **Normal Copy(P->S)** to resynchronize the pairs normally. All differential data is updated to the S-VOL.
   - **Quick Resync(P->S)** to immediately change pair status to "PAIR". Resynchronization of data does not occur immediately. Differential data is copied during update copying.
   - **Reverse Copy(S->P)** to copy the S-VOL data to the P-VOL. All differential data is updated to the P-VOL. Not available for L2 pairs.
   - **Quick Restore(S->P)** to swap the P-VOL and S-VOL. Any differential data between the volumes is copied during update copying. Not available for L2 pairs.
6. From **Copy Pace**, select the pace at which the pairs are to be resynchronized, **Slower**, **Medium**, or **Faster**. **Copy Pace** affects the host I/O performance: a slower pace minimizes impact, a faster pace has the greatest impact. The pace you select is applied for all pairs in the operation.
7. Click **OK**.
8. In the **Pair Operation** window, review the information in the **Preview** list. To change a selection, right-click it, select **Modify**, and make any changes.
9. Click **Apply** to commit the operation to the storage system.

10. Make sure that pair status changes to "PAIR" before attempting any other operation.

Note: Note the following:

- If the reverse or Quick Restore ends abnormally, the pair is suspended ("PSUE" status). In this case, the P-VOL is read/write-enabled for all hosts, but the data is not guaranteed. The S-VOL remains write-disabled (read-only) and data is not guaranteed. The status of other pairs sharing the same P-VOL does not change.

Deleting pairs

You can delete a pair when you do not need it. Deleting a pair unassigns the P-VOL and S-VOL from the pair ("SMPL" status) and their data remains intact. After deletion, both volumes are available for use in another pair.

Prerequisite information

- The pair cannot be in the process of Quick Split ("PSUS(SP)/PSUS" status).
- When a pair is created, the processor blade allocated to the P-VOL's LDEV is also allocated to the S-VOL's LDEV. When a pair is deleted, the processor blade that was originally allocated to the S-VOL'S LDEV is allocated to it again. If the original processor blade was removed, another processor blade is allocated.
- If you delete a pair, the status of the volumes first changes to "SMPL(PD)" then to "SMPL". "SMPL" status is not shown in SN. You can check pair status in the **Pair Operation** window.

  To distinguish between "SMPL" and "SMPL(PD)" volumes using CCI, run the **`pairdisplay`** and **`Inqraid`** commands. The **`pairdisplay`** command shows status but cannot distinguish between "SMPL" and "SMPL(PD)"; and the **`Inqraid`** shows whether a volume is being used by SI.

  - If the result of the **`pairdisplay`** command is "SMPL", and the result of the **`Inqraid`** command is PVOL or SVOL, then SI is still using the pair and status is "SMPL(PD)".
  - If the result of the **`pairdisplay`** command is "SMPL", and the result of the **`Inqraid`** command is not PVOL or SVOL, SI is not using the volumes. Therefore, status is confirmed as "SMPL".
- To perform tasks such as pair operation or event waiting, after deleting a pair, wait 10 seconds—until the volume status changes from "SMPL(PD)" to "SMPL" as is unassigned from the pair. If you do not wait 10 seconds, the operation might end abnormally.

1. Synchronize the P-VOL and S-VOL before deleting the pair. Complete the following:

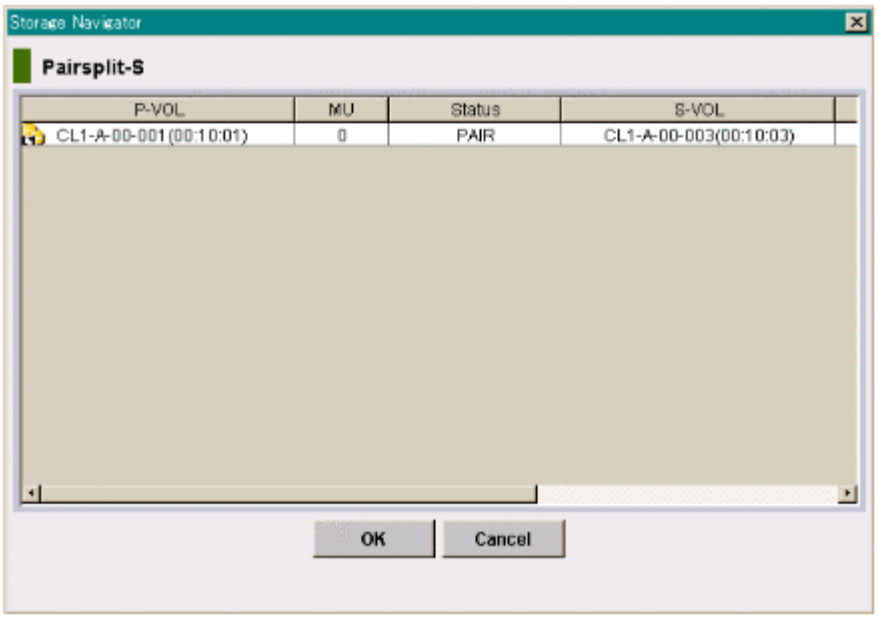
   a. Wait until all write I/Os to the P VOL are complete.

   b. Set the P-VOL offline.

c. Split the pair. This copies differential data to the S VOL.

2. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
3. Change to Modify mode by clicking the  icon.
4. In the tree, in the **Pair Operations** window, select the port or host group where the pairs or volumes are located.

   Related volumes are shown in the volume list. If a volume is already paired, pair information is also shown.
5. Select the pairs you want to delete, right-click, and from the menu, select **Pairsplit-S**.



6. If you selected a pair that you do not want to delete, select the pair on the **Pairsplit-S** dialog box, right-click, then click **Delete**. The pair is removed from the deletion list.
7. Click **OK**.
8. In the Pair Operation, review the information in the **Preview** list.
9. Click **Apply** to commit the operation to the storage system.

E

Monitoring and maintaining the system (secondary window)

This appendix provides information and instructions for monitoring and maintaining the SI system using the previous SN GUI, which opens in a secondary window.

Monitoring the system (secondary window)

Monitoring helps you keep track of pairs and volumes and their current and past conditions. Monitoring should be an ongoing activity. This topic provides information for monitoring the following:

- Pair status.
- Pair and pair volume details.
- Status and other pair information for pairs in a consistency group.
- S-VOL path information.
- Number of pairs in the storage system, with remaining license capacity.
- A pair's history of operations.

Monitoring pair activity, status (secondary window)

Monitoring the SI system is necessary to maintain your pairs.

- Each operation requires a specific status or statuses. When you want to perform a pair command, first check the pair's status.
- Pair-status changes when an operation is performed. Check status to see that pairs are operating correctly and that status is changing to the appropriate state during and after the operation.

Monitoring using the SN GUI is done at the user's discretion. Monitoring should be repeated frequently. Email notifications of problems in pair operations can be set up using the GUI.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Locate the pair whose status you want to review. Review pair status in the **Status** column.

You can view more details for the pair by right-clicking and selecting **Detail**. For more information about the fields, see Reviewing pair, volume details on page E-3.

Pair status definitions (secondary window)

When checking your pairs' status in the SN secondary window, click **Refresh View** to make sure pair data is current.

See the following topics related to pair status:

- Pair status definitions on page 6-3.
- Status, pair operations permitted (secondary window) on page E-3.
- Status for L1, L2 pairs and operations permitted on page 6-5.
- Status of unaffected S-VOLs, operations permitted on page 6-7.

Status, pair operations permitted (secondary window)

A pair's status shows whether a desired operation can be performed. Each operation requires a specific status, or is permitted for multiple possible statuses.

Supported operations and statuses are shown in the following tables.

Pair Status	Pair operation					
	Create pairs	Split pairs	Resync pairs (forward)	Resync pairs (reverse)	Suspend pairs	Delete pairs
SMPL	YES	YES	NO	NO	NO	NO
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	NO	NO	NO	NO	YES	YES
PSUS(SP)/ PSUS	NO	NO	YES	NO	YES	NO
PSUS	NO	NO	YES	YES	YES	YES
COPY(RS)/ COPY	NO	NO	NO	NO	YES	YES
COPY(RS-R)/ RCPY	NO	NO	NO	NO	YES	YES
PSUE	NO	NO	YES	NO	NO	YES

Related information

- Status of unaffected S-VOLs, operations permitted on page 6-7
- Status for L1, L2 pairs and operations permitted on page 6-5

Reviewing pair, volume details

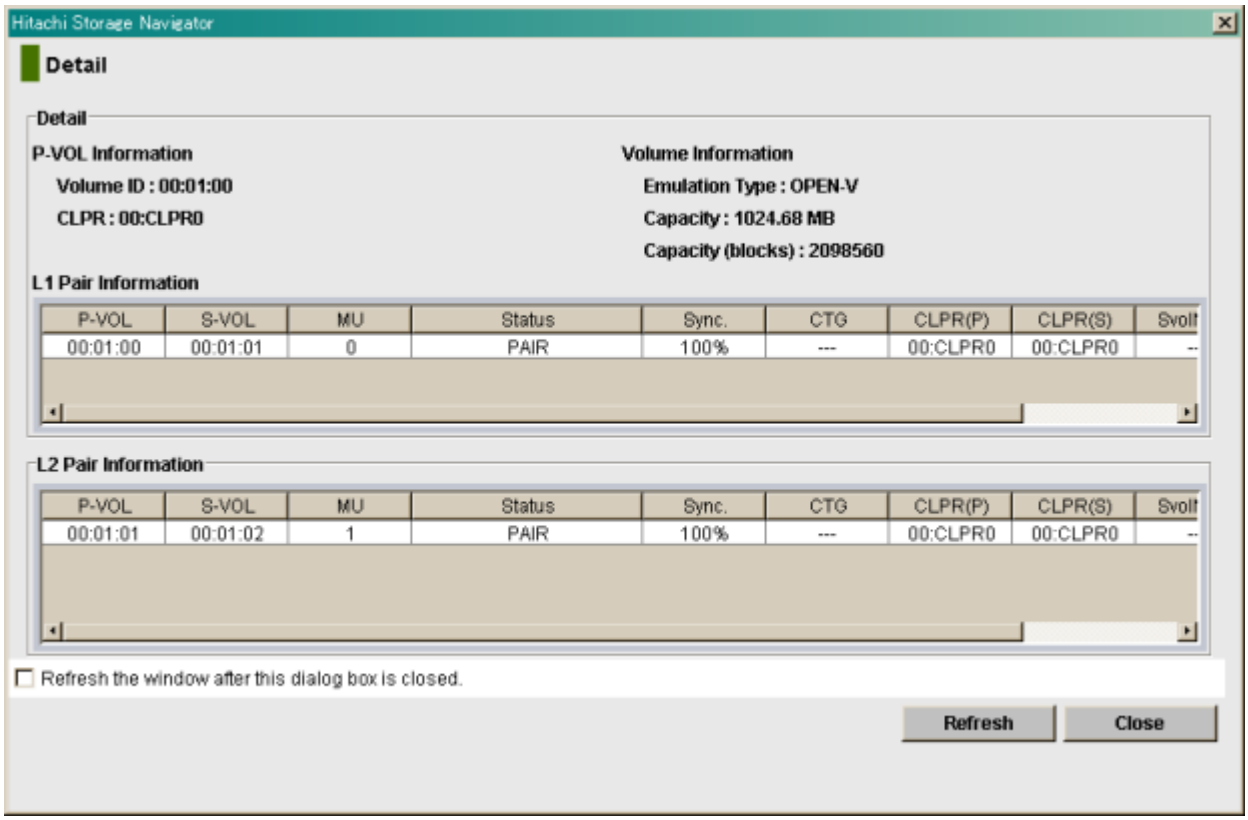
You can review the data related to L1 and L2 pairs and their volumes. This includes volume capacity, pair status, P-VOL and S-VOL identifiers, and several other details.

Note: LDEVs for P-VOLs and S-VOLs listed in SN may end in the following special symbols:

- A pound or gate symbol (#), which indicates an external volume (for example, 00:00:01#).
- The letter "X", which indicates that a virtual volume used by Dynamic Provisioning (for example, 00:00:01X).

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. In the tree, select the port or host group where the pairs or volumes are located. Related volumes are shown in the volume list.
3. From the volume list, complete the following:
   a. Select and right-click the volume or pair whose information you want to see.
   b. From the menu, select **Detail**.
      The **Detail** dialog box opens.

   Field descriptions are provided in the following table.



Field	Description
P-VOL Information	Volume ID: Shows LUN information using LDKC number:CU number:LDEV number format. CLPR: Shows CLPR number:CLPR name.
Volume Information	Shows the volume's emulation type, capacity, and number of blocks.
Pair Information	• P-VOL: Shows LUN information using LDKC number:CU number:LDEV number format. • S-VOL: Shows LUN information using LDKC number:CU number:LDEV number format. • MU: The pair's MU number (mirror unit number). • Status: The status of the pair. • Sync: Percentage that P-VOL and S-VOL are synchronized.

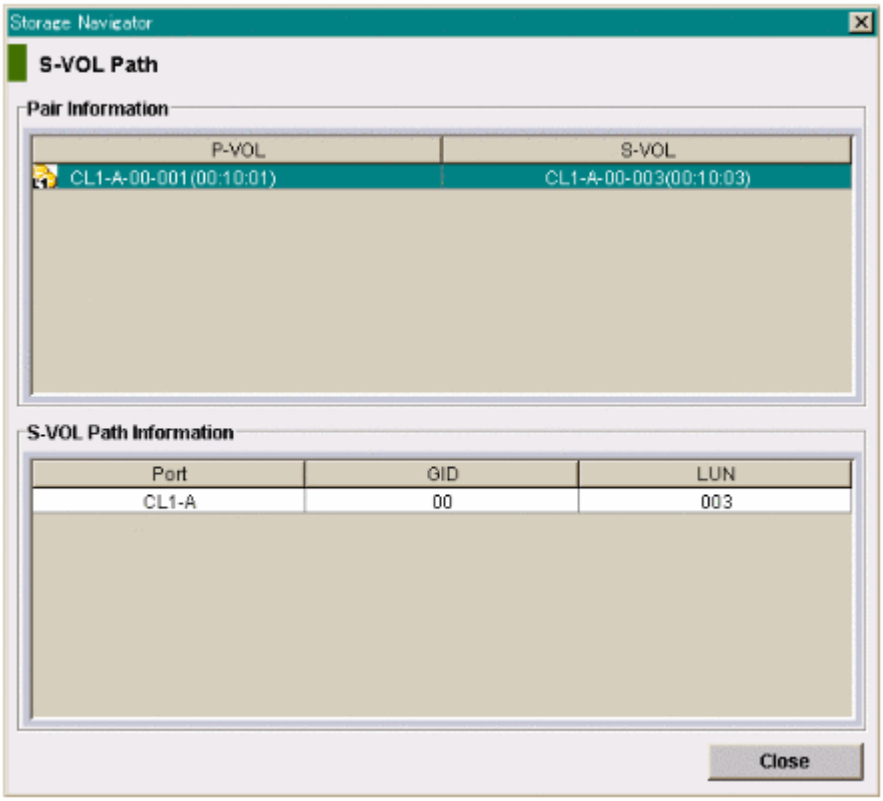
Field	Description
	• CTG: The consistency group number shows if the pair is registered in the group. If the pair is not registered to the consistency group, dashes (---) are shown. • CLPR(P): The identifier for the P-VOL's cache logical partition (CLPR) shows in CLPR number:CLPR name format. • CLPR(S): The identifier for the S-VOL's cache logical partition (CLPR) shows in CLPR number:CLPR name format. • Svol Mode: Indicates whether the S-VOL has been written to and whether it can be read. For more information about Svol Mode, see Volume list on page F-4. • Copy Pace: Indicates the speed that data is copied according to the pair status. For more information about Copy Pace, see Volume list on page F-4.
Refresh the window after this dialog box is closed.	If you select the check box, the information shown in the **Pair Operation** window is updated after the **Detail** dialog box closes. If you do not select the check box, the information in the **Pair Operation** window is the same before and after you close the **Detail** dialog box.

Reviewing S-VOL path information

You can view path information for the S-VOL. You do this in the **S-VOL Path** dialog box.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. In the tree, select the appropriate port or host group for the desired pairs. Related volumes are shown.
3. Complete the following:
   a. Select a pair.
   b. Right-click and select **S-VOL** Path from the menu.
      The **S-VOL Path** dialog box opens.

   Field descriptions are provided in the following table.



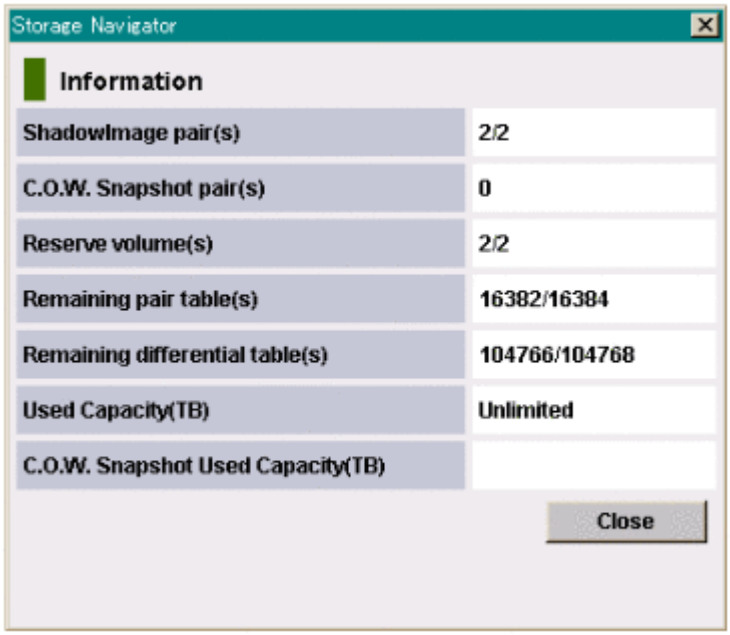
Field	Description
Pair Information	P-VOL and S-VOL columns shows the following path information (examples below from P-VOL column): • Port ID (cluster name and channel number. For example: *CL3-D*) • Group number (GID) of the host group. For example: *00* • LU number. For example: *000* • LDKC number:CU number:LDEV number. For example: *00:14:00*
S-VOL Path Information	Port number, GID number, and LU number.

Reviewing pair, license information

You can check the current state of your pairs and licensed capacity. Do this using the **Information** dialog box.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Complete the following:
   a. Right-click the volume list, in any location.
   b. From the menu, select **Information**.
      The **Information** dialog box opens.

Field descriptions are provided in the following table.



Field	Description
SI pair(s)	Shows the number of SI pairs/and the total number of pair tables for SI and SIz. For example: *12/12*. **Notes:** • The maximum number of pairs allowed in one storage system is 16,384, including migration plans and relationships. For example, if a storage system contains TI or SS pairs, migration plans of Volume Migration, and relationships of Compatible FlashCopy® V2 and Compatible FlashCopy® SE, the maximum number of pairs allowed for SI would be 16,384 minus these. • Volume size also limits the number of pairs. For more information, see Planning number of pairs on page 2-4.
C.O.W. Snapshot pairs	The number of SS pairs.
Reserve volume(s)	The number total number of reserved volumes for SI and SIz.
Remaining pair table(s)	The number of remaining pair tables in the storage system/and the total number of pair tables in the system. For more information, see Planning number of pairs on page 2-4. The following software use pair tables: • SIz • Volume Migration (when migration plan is used)
Remaining differential table(s)	The number of remaining differential tables in the storage system/and the total number of differential tables in the system. For more information, see Planning number of pairs on page 2-4. The following software use pair tables: • SIz • Compatible FlashCopy® V2 • Compatible FlashCopy® SE

Field	Description
	• SS • Volume Migration
Used Capacity (TB)	Shows license information used by SI, and the total license capacity reserved for SI. "Unlimited" is shown when there is no limit on license capacity for SI.
C.O.W. Snapshot Used Capacity (TB)	Shows license information used by SS, and the total license capacity reserved for SS. "Unlimited" is shown when there is no limit on license capacity for SS.

Reviewing a pair's operation history

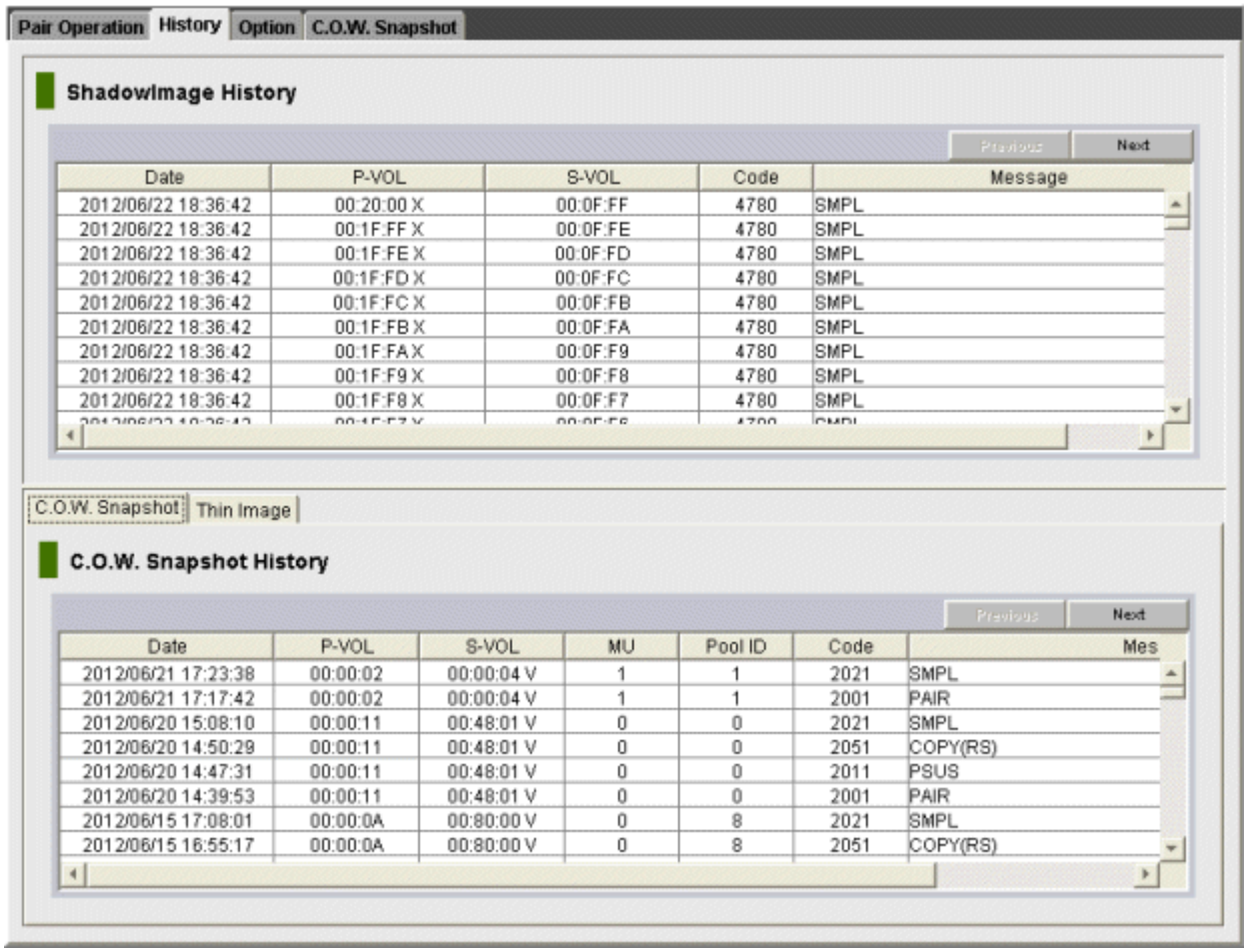
You can review the operations that have been performed on a pair using the History window.

1. In SN, click **Actions > Local Replications > SI/SS > History**.

   If some of the pairs include LUSE volumes, or if the total number of the following pairs and migration plans is 500 or more in the storage system, you may need to wait for a while until the **History** window shows operation history. In addition, if you use 1,000 or more pairs concurrently, some operation history might not be recorded.

   The **History** window show the following pair types:

   - SI
   - TI
   - SS
   - Volume Migration migration plans



2. Locate the SI **History** list in the upper area.
3. To change the order in which items are listed, click a column title in the list.

   The list is sorted based on the items in the clicked column.

   - If there are more than 16,384 records of operations, the list is divided into multiple pages and only the list which is currently shown is sorted.
   - If you click the same column title again, you can switch the sorting order (Ascending or Descending).
4. If the information on the list is not updated, click **File** and then **Refresh**. The list is updated to the latest information.

   For operations involving the copying process, the **History** window does not show information about the operations until the copying process starts. If you perform an operation on a pair before the copying process starts, the **History** window does not show information about the operation.
5. If there are many records of operations, click the scroll button. The list scrolls and the operation history that was not previously shown is shown.

If you click and drag down the frame border that divides the **History** window into upper and lower panes, you can expand the display area of the list.

6. If there are more than 16,384 records of operations, click **Next**.
   The list shows subsequent records of operations.
   - If you click **Previous**, the list switches to the previous page.
   - If there are 16,384 or fewer records of operations, you cannot click **Previous** and **Next**.
   - The storage system saves up to 512,000 records of latest operations.

Maintaining the system (secondary window)

Some maintenance tasks are a response to behavior discovered during system monitoring. You can also change certain settings to keep the system in tune with your changing requirements.

This topic provides maintenance information and instructions for Removing reserve attribute from a volume on page E-10.

For other maintenance tasks, including maintaining pairs during system and device maintenance, see Maintaining the system on page 6-10.

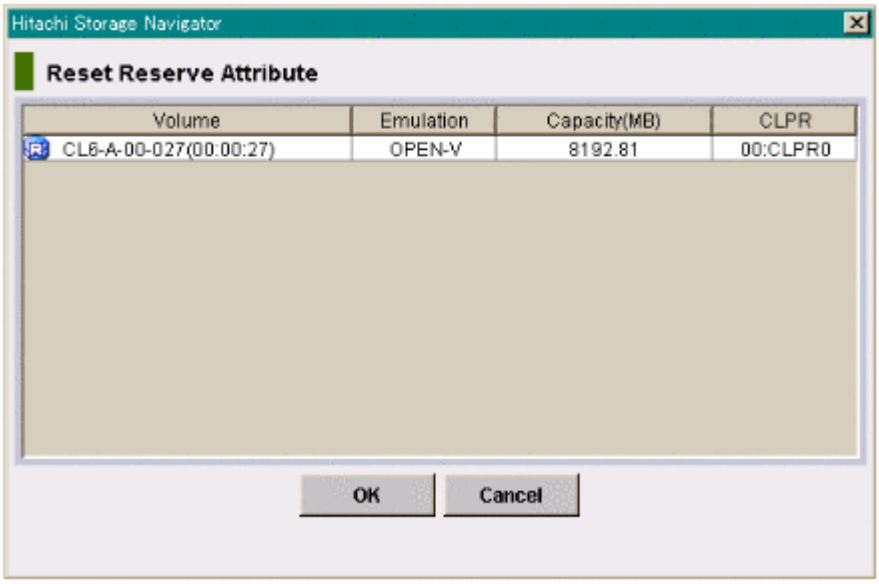
Removing reserve attribute from a volume

You can remove the S-VOL reserve attribute from a volume.

Prerequisite information

Before removing the reserve attribute from a volume, make sure that the status is SMPL.

1. In SN, click **Actions > Local Replications > SI/SS > Pair Operation**.
2. Click  to change to the Modify mode.
3. In the tree, select the appropriate port or host group for the volumes from which you want to remove the reserve attribute.
   Related volumes display in the volume list. To show only reserved volumes ("SMPL" status), click **Display Filter**, then complete the following:
   a. Make sure that the **Pair** attribute is cleared.
   b. Select **Reserve**.
   c. Click **OK**.
4. In the volume list, right-click the desired SMPL volumes, then click **Change Reserve** from the menu.
   The **Reset Reserve Attribute** dialog box opens.



5. Select the pairs from which you want to remove the attribute, then click **OK**.
   The selected volumes display in the **Preview** list.
6. To change a selection, right-click, select **Modify**, and make your changes.
7. When ready, on the **Pair Operations** window click **Apply**.

F

ShadowImage GUI reference (secondary window)

This appendix describes the SI windows and dialog boxes in the previous version of the SN GUI, which opens in a secondary window.

Pair Operation window

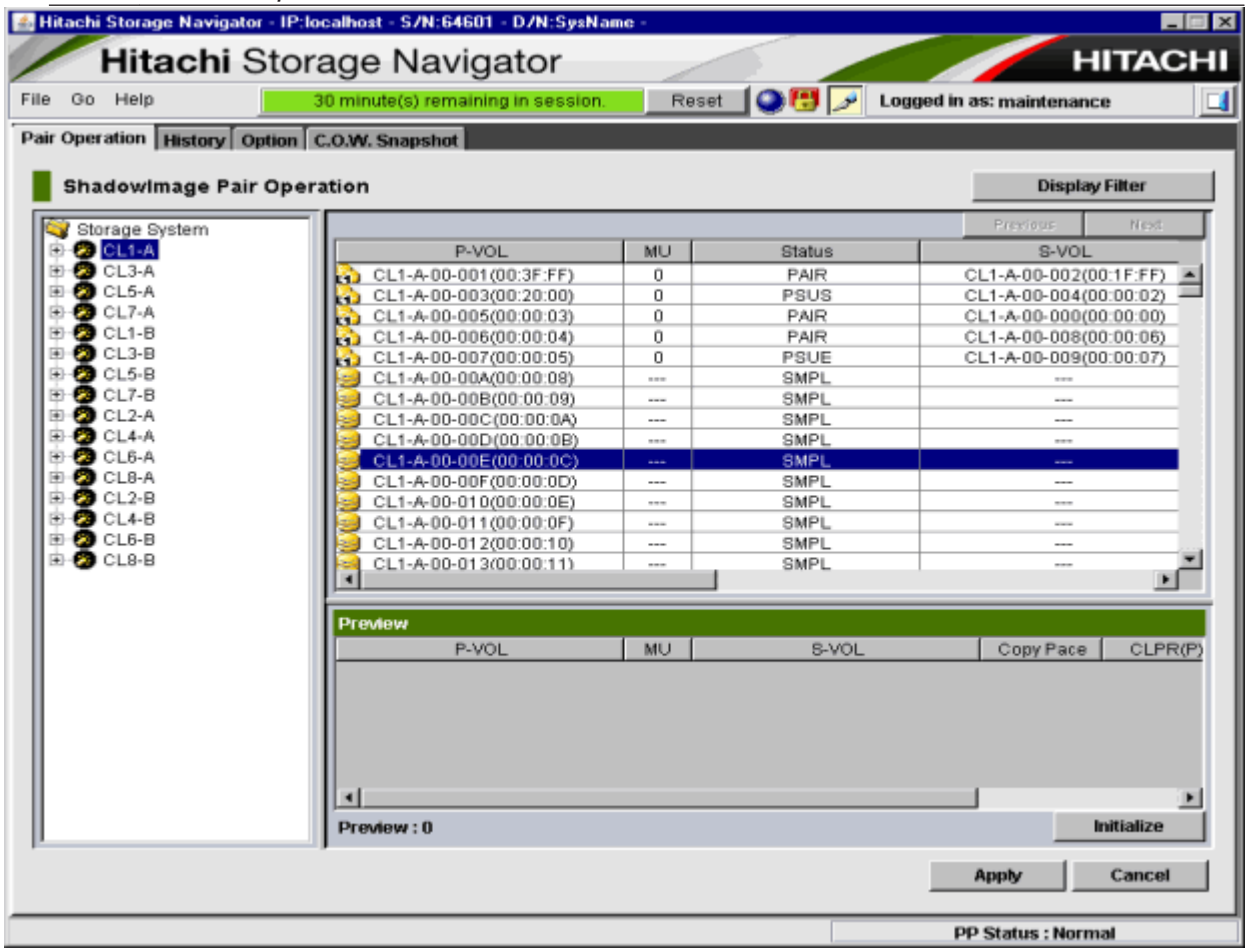
Use this window to view SI pairs.

You can perform the following procedures from the window:

- Creating L1 and/or L2 pairs on page D-2
- Splitting pairs, creating and splitting pairs on page D-5
- Suspending pair creation on page D-9
- Resynchronizing pairs on page D-10
- Deleting pairs on page D-13
- Monitoring pair activity, status (secondary window) on page E-2

Select one of the following areas of the Pair Operations window for information:

Note: The **Pair Operation** window opens and shows information for SI and SS pairs. This topic explains the items related to the SI pairs. For more information about the items related to the SS pairs, see the *Hitachi Copy-on-Write Snapshot User Guide*.



Main components

Field	Description
Tree	The connected port and host group. Select the desired port or host group to display related LUs. If you select storage system on the top of the tree, a volume is not shown.
Volume list	Pair information. For more information, see Volume list on page F-4. **Note:** P-VOLs and S-VOLs listed in SN may end in special symbols. An LDEV number that ends with a pound or gate symbol (#) indicates an external volume (for example, 00:00:01#). An LDEV number that ends with a letter "X" indicates that a virtual volume used by Dynamic Provisioning (for example, 00:00:01X).
Icons	Indicate the following information:  L1 pair  L2 pair  S-VOL  Reserved volume. In Preview list, this is a preview item.  Error. Is shown in Preview list.  Port. Is shown in Tree.  Host group. Is shown in Tree.  SMPL volume. This icon indicates a volume in "SMPL" status when it is shown in the **Volume** list.  Root. Is shown in Tree.
Display Filter button	When clicked, the **Display Filter** dialog box appears. In it, you can filter the fields and volume types in the **Volume** list.
Previous list	Shows the operation(s) you have specified but not yet applied to the storage system. You can change or delete the operations when you right-click the item in the **Preview** list.
Apply	Saves changes shown in the in the Preview list to the storage system. If an error occurs during an operation, the failed operation will remain in the **Preview** list with an error icon () shown on the left of the operation name. For more information about the SI error codes, see the *Hitachi Storage Navigator Messages*.
Cancel	Cancels the changes shown in the **Preview** list.

Volume list

The Volume list shows the installed volumes on the selected port, with storage system and pair information for each volume.

You can filter the information in the list to show the data you want, including the types of volumes that display such as SI.

For more information, see Display Filter dialog box on page F-6.

The maximum number of volumes on one screen is 1,024. If you have more than this to view, click **Next** above the list.

Field	Description
Message	A message displays if a volume or pair does not exist. If you see the message in the **Volume** list, click a different icon in the tree on the left area of the **Pair Operation** window.
P-VOL	P-VOL information in AAA-BB-CCC(XX:YY:ZZ) format. • AAA is the port ID (cluster and channel number) • BB is the group number of host group • CCC is the LU number • XX:YY:ZZ is the LDKC number:CU number:LDEV number
MU	The MU number of the SI pair formed with the P-VOL. MU#s are mirror unit numbers. The storage system assumes the same numbers of P-VOLs as S-VOLs. For example, when a P-VOL is paired with three S-VOLs, though just one P-VOL exists, the storage system assumes that there are three P-VOLs. These "virtual" P-VOLs are mirror units, MUs.
Status	Pair status. For more information, see Pair status definitions on page 6-3.
S-VOL	S-VOL information in AAA-BB-CCC(XX:YY:ZZ) format. • AAA is the port ID (cluster and channel number) • BB is the group number of host group • CCC is the LU number • XX:YY:ZZ is the LDKC number:CU number:LDEV number Only one path is listed, even for LUs with more than one. The path is connected to the first port configured for the path.
CTG	The S-VOL's consistency group number. If you have not set a consistency group for the S-VOL, dashes (---) are shown.
SvolMode	Indicates whether the S-VOL has been written to and whether it can be read. • Dashes (---) indicate that it has not been written to and can be read. • W indicates that it has been written to. The S-VOL pair status is "PSUS(SP)/PSUS" or "PSUS", and the host writes to it. • N indicates that it cannot be read because of the CCI -m noread specification.
Copy Pace	Indicates the speed that data is copied according to pair status.

Field	Description
	• Slower, Medium, or Faster is shown if the pair status is "COPY(PD)/COPY", "COPY(SP)/COPY", "PSUS(SP)/PSUS", "COPY(RS)/COPY", or "COPY(RS-R)/RCPY". • Dashes (----) display if the pair status is none of the above. **Note:** When you create SI pairs by using CCI, the copy pace is set as follows: • When the track size is 1 or 2, Slower is set. • When the track size is 3, Medium is set. • When the track size is 4 to 15, Faster is set.
Sync	Indicates the percentage of pair synchronization: • Dashes (----) display for volumes or pairs in "SMPL" and "SMPL(PD)" status. • The percentage of copied data is shown for pairs in "COPY(PD)/COPY", "COPY(SP)/COPY", "PSUS(SP)/PSUS", and "PSUE" status. • The percentage of identical data in the P-VOL and S-VOL for volumes in "PAIR", "PSUS", "COPY(RS)/COPY", or "COPY(RS-R)/RCPY" status.
Emulation	The volume's emulation type.
Capacity (MB)	The volume's storage capacity is shown in megabytes
CLPR (P)	The P-VOL's cache logical partition
CLPR (S)	The S-VOL's cache logical partition

Preview list

The **Preview** list is shown below the **Volume** list. It shows the pair operations and changes you have made. You can review your changes, make modifications, and apply them to the storage system.

Field	Description
P-VOL	P-VOL information in AAA-BB-CCC(XX:YY:ZZ) format. • AAA is the port ID (cluster and channel number) • BB is the group number of host group • CCC is the LU number • XX:YY:ZZ is the LDKC number:CU number:LDEV number
MU	The MU number of the SI pair formed with the P-VOL.
S-VOL	S-VOL information in AAA-BB-CCC(XX:YY:ZZ) format. • AAA is the port ID (cluster and channel number) • BB is the group number of host group • CCC is the LU number • XX:YY:ZZ is the LDKC number:CU number:LDEV number
Copy Pace	Speed that data is copied according to the pair status.

Field	Description
CLPR (P)	P-VOL's cache logical partition
CLPR (S)	S-VOL's cache logical partition
Error Code	If you click Apply and then the operations in the Preview list fail, an error code indicates the cause of the error.

Data in the status bar below the Preview list indicate the number of changes, the type of change (the operation), and any command options.

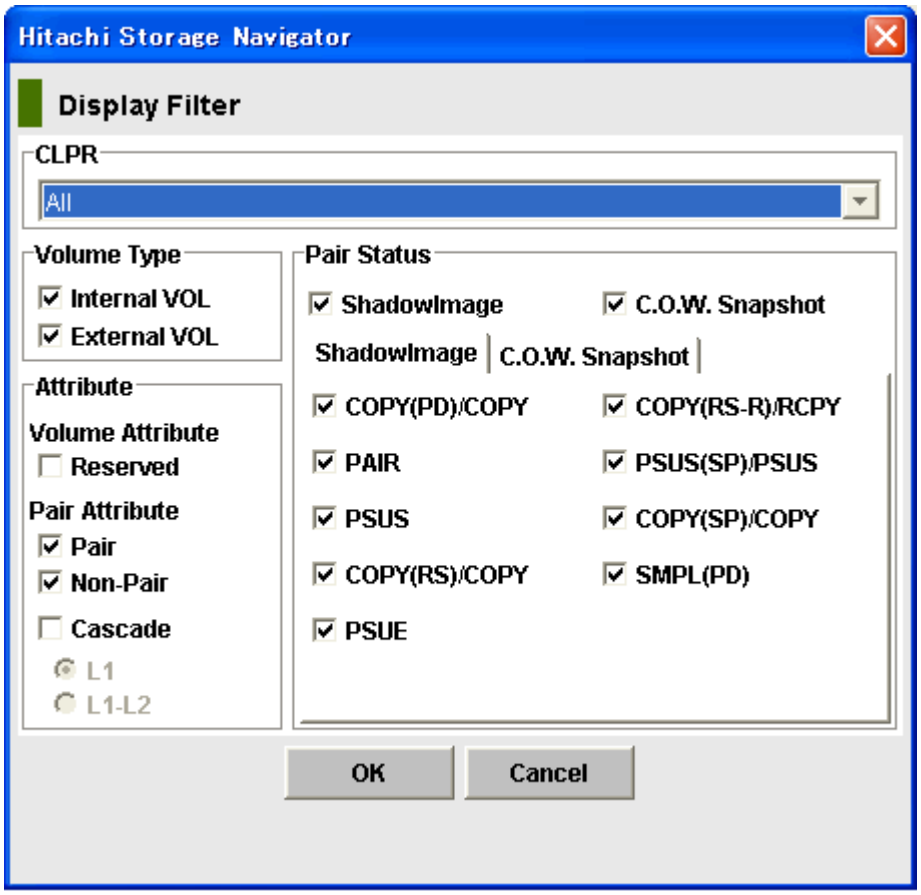
Pair Operation command menu

Right-click a volume or pair to open the pair operation command menu. The following table describes the commands that display in the menu.

Command	Description
Detail	Opens the **Detail** dialog box, which shows detailed information for the selected volume or pair.
Paircreate	Opens the **Paircreate** dialog box, in which you create new pairs.
Pairsplit	Opens the **Pairsplit** dialog box, in which you split pairs.
Pairresync	Opens the **Pairresync** dialog box, in which you resynchronize pairs.
Pairsplit-E	Opens the **Pairsplit-E** dialog box, in which you suspend pairs.
Pairsplit-S	Opens the **Pairsplit-S** dialog box, in which you delete pairs.
Change Reserve	Opens the **Set/Reset Reserve Attribute** dialog box, in which you set/reset the S-VOL reserve attribute.
S-VOL Path	Opens the **S-VOL Path** dialog box, which shows S-VOL's port or host group.
Information	Opens the **Information** dialog box, which shows number of pairs or reserved volumes.

Display Filter dialog box

Use this dialog box to filter the volumes on the **Pair Operations** window. To open this dialog box, click **Display Filter** in the **Pair Operation** window.



The filter settings you select are effective in the current session only. They reset when you select another software product.

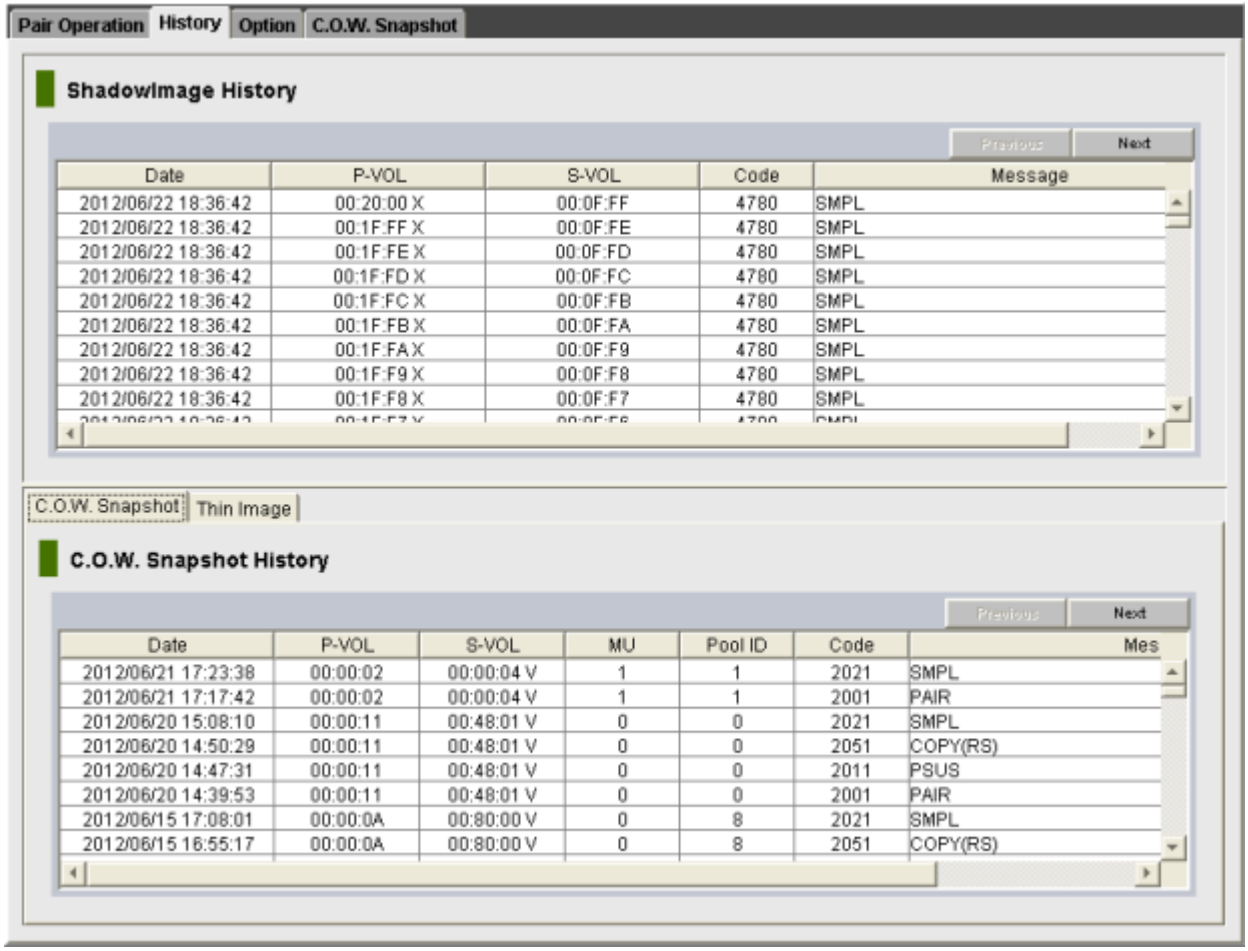
Field	Description
CLPR	Cache logical partition (CLPR)
Volume Type	Internal or external volumes are specified. Both boxes are selected by default. Clear the box you do not want.
Attribute	• **Volume Attribute.** If you select the Reserved check box, only reserved volumes display. Reserved volumes include volumes specified as S-VOLs. • **Pair Attribute.** You can select pair volumes, non-pair volumes, or cascade levels (L1 or L2).
Pair Status	Status of the pairs you want to see.

Note: If you select **Cascade**, you cannot select **Reserved**. If you select **L1-L2**, you cannot select any other check boxes.
If you do not select **ShadowImage** or **Copy-on-Write Snapshot**, all the check boxes in each tab are unavailable.

History window

Use this window to view the history of operations performed on SI, TI, and SS pairs and data associated with the operations.

- The upper pane shows SI history.
- The lower pane shows TI and SS history.



Field	Description
Date	Date and time of the operation.
P-VOL	The LDKC:CU:LDEV of the P-VOL used in the operation.
S-VOL	The LDKC:CU:LDEV of the S-VOL used in the operation.
Code	SI reference codes. The codes refer to the messages shown in the following table.
Message	The description of the operation or part of an operation.

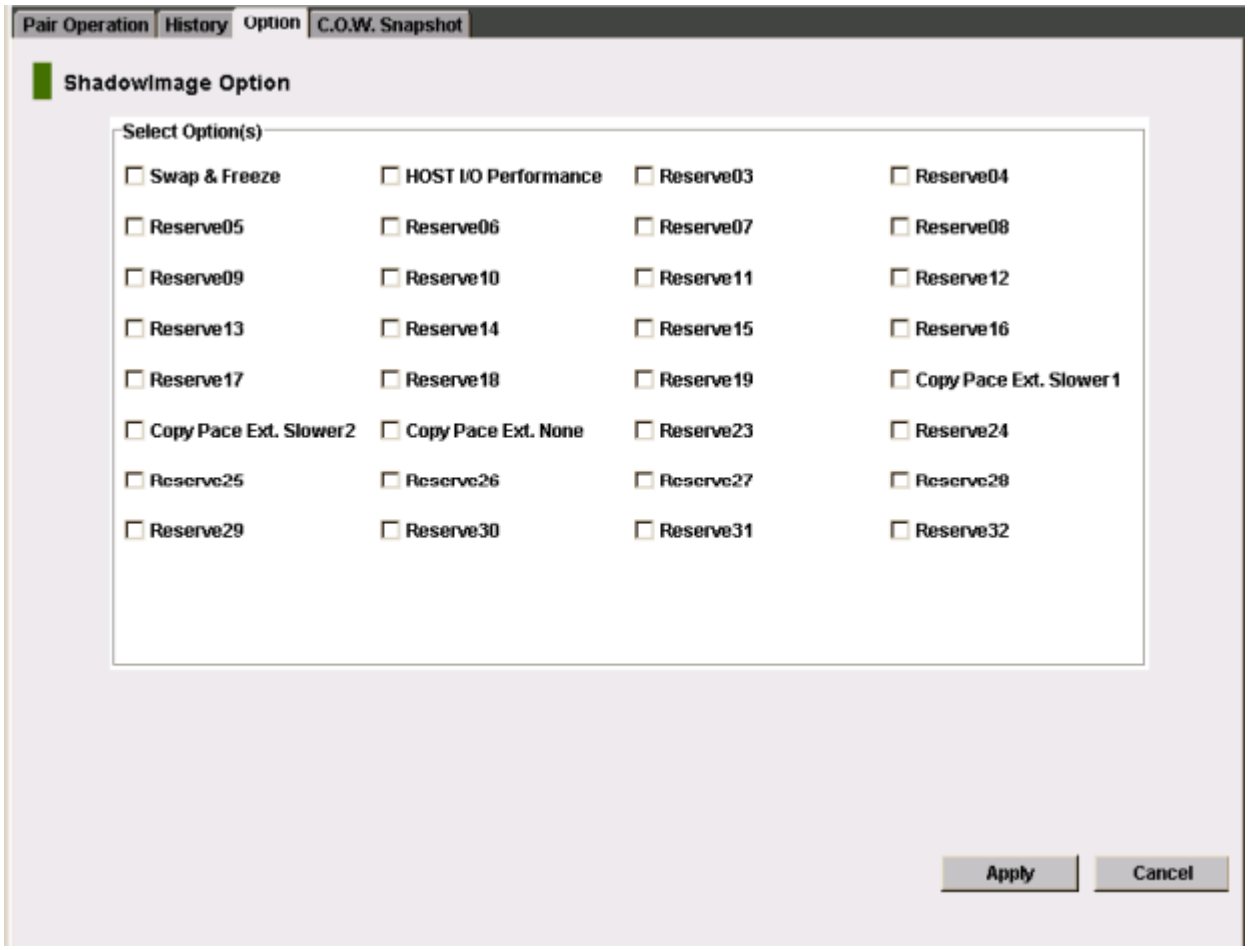
The following table shows reference codes.

Code	Message	Description
4710	PAIR START	The initial copy started.

Code	Message	Description
4720	PAIR END	The initial copy ended, and the pair status changed to "PAIR".
4730	PSUS START	The pair split started.
4740	PSUS END	The pair split ended, and the pair status changed to "PSUS".
4750	COPY(RS)/COPY START COPY(RS-R)/RCPY START	Resynchronization of pairs started.
4760	COPY(RS)/COPY END COPY(RS-R)/RCPY END	Resynchronization of pairs ended, and the pair status changed to "PAIR".
4780	SMPL	The pair was deleted, and the pair status changed to "SMPL".
4790	PSUE	The pair was suspended, and the pair status changed to "PSUE".
47D0	COPY ABNORMAL END	A copy ended abnormally (reason other than above).
47E9	INITIALIZE START	Initialization started.
47EA	INITIALIZE END	Initialization ended normally.
47EB	INITIALIZE ENDED ABNORMAL	Initialization ended abnormally.

Option window

Use this window to set the Swap&Freeze, the HOST I/O Performance, Copy Threshold, and Copy Pace options. For more information, see System options that affect performance on page 4-3.


Pair Operation
History
Option
C.O.W. Snapshot
ShadowImage Option
Select Option(s)
Swap & Freeze
HOST I/O Performance
Reserve03
Reserve04
Reserve05
Reserve06
Reserve07
Reserve08
Reserve09
Reserve10
Reserve11
Reserve12
Reserve13
Reserve14
Reserve15
Reserve16
Reserve17
Reserve18
Reserve19
Copy Pace Ext. Slower1
Copy Pace Ext. Slower2
Copy Pace Ext. None
Reserve23
Reserve24
Reserve25
Reserve26
Reserve27
Reserve28
Reserve29
Reserve30
Reserve31
Reserve32
Apply
Cancel

Glossary

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

#

2DC
two-data-center. Refers to the local and remote sites, or data centers, in which TrueCopy (TC) and Universal Replicator (UR) combine to form a remote replication configuration.
In a 2DC configuration, data is copied from a TC 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.

3DC
three-data-center. Refers to the local, intermediate, and remote sites, or data centers, in which TC and UR combine to form a remote replication configuration. A 3DC configuration can also combine three UR sites.
In a 3DC configuration, data is copied from a local site to an intermediate site and then to a remote site (3DC cascade configuration), or from a local site to two remote sites (3DC multi-target configuration).

A

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

array
Another name for a RAID storage system.

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

array group
See *RAID group*.

async
asynchronous

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

B

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

BC
business continuity

BCM
Business Continuity Manager

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

BLK, blk
block

bmp
bitmap

C

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

ca
cache

cache logical partition (CLPR)
Consists of virtual cache memory that is set up to be allocated to different hosts in contention for cache memory.

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

cascade configuration
In a 3DC cascade configuration for remote replication, data is copied from a local site to an intermediate site and then to a remote site using TrueCopy and Universal Replicator. See also *3DC*.
In an SI cascade configuration, two layers of secondary volumes can be defined for a single primary volume. Pairs created in the first and second layer are called cascaded pairs.

cascade function
A ShadowImage function for open systems 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*, *level-1 pair*, and *level-2 pair*.

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

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.

CCI
Command Control Interface

CFL
Configuration File Loader. A Storage Navigator function for validating and running scripted spreadsheets.

CFW
cache fast write

CG
See *consistency group (CTG)*.

CTG
See *consistency group (CTG)*.

CH
channel

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

CHAP
challenge handshake authentication protocol

CL
cluster

CLI
command line interface

CLPR
cache logical partition

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

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

configuration definition file
Defines the configuration, parameters, and options of Command Control Interface operations. A text file that defines the connected hosts and the volumes and groups known to the Command Control Interface instance.

consistency group (CG, CTG)
A group of pairs on which copy operations are performed simultaneously; the pairs' status changes at the same time. See also *extended consistency group (EXCTG)*.

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

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

copy-on-write
Point-in-time snapshot copy of any data volume within a storage system. Copy-on-write snapshots only store changed data blocks, therefore the amount of storage capacity required for each copy is substantially smaller than the source volume.

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.

COW
copy-on-write

COW Snapshot
Hitachi Copy-on-Write Snapshot

CTG
See *consistency group (CTG)*.

CTL
controller

CU
control unit

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

CYL, cyl
cylinder

cylinder bitmap
Indicates the differential data (updated by write I/Os) in a volume of a split or suspended copy pair. The primary and secondary volumes each have their own cylinder bitmap. When the pair is resynchronized, the cylinder bitmaps are merged, and the differential data is copied to the secondary volume.

D

DASD
direct-access storage device

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 to-be-changed data blocks in the data pool.

DB
database

DBMS
database management system

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

device
A physical or logical unit with a specific function.

device emulation
Indicates the type of logical volume. 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.

DEVN
device number

DFW
DASD fast write

DHCP
dynamic host configuration protocol

differential data
Changed data in the primary volume not yet reflected in the copy.

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

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

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

DKC
disk controller. Can refer to the RAID storage system or the controller components.

DKCMAIN
disk controller main. Refers to the microcode for the RAID storage system.

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

DKU
disk unit. Refers to the cabinet (floor model) or rack-mounted hardware component that contains data drives and no controller components.

DMP
Dynamic Multi Pathing

DRU
Hitachi Data Retention Utility

DP-VOL
Dynamic Provisioning-virtual volume. A virtual volume with no memory space used by Dynamic Provisioning.

dynamic provisioning
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. Also called thin provisioning.

E

EC
error code

emulation
The operation of the Hitachi RAID storage system to emulate the characteristics of a different storage system. For device emulation the mainframe host "sees" the logical devices on the RAID storage system as 3390-x devices. For controller emulation the

mainframe host "sees" the control units (CUs) on the RAID storage system as 2105 or 2107 controllers.
RAID storage system operates the same as the storage system being emulated.

emulation group
A set of device emulation types that can be intermixed within a RAID group and treated as a group.

env.
environment

ERC
error reporting communications

ESCON
Enterprise System Connection

EXCTG
See *extended consistency group (ECTG)*.

EXG
external volume group

ext.
external

extended consistency group (EXCTG)
A set of Universal Replicator for Mainframe journals in which data consistency is guaranteed. When performing copy operations between multiple primary and secondary systems, the journals must be registered in an EXCTG.

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

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

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

F

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

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

FBA
fixed-block architecture

FC
fibre channel; FlashCopy

FCA
fibre-channel adapter

FC-AL
fibre-channel arbitrated loop

FCIP
fibre-channel internet protocol

FCP
fibre-channel protocol

FCSP
fibre-channel security protocol

FIBARC
Fibre Connection Architecture

FICON
Fibre Connectivity

FIFO
first in, first out

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

FSW
fibre switch

FTP
file-transfer protocol

FV
fixed-size volume

FWD
fast-wide differential

G

GID
group ID

GUI
graphical user interface

H

HA
high availability

HACMP
High Availability Cluster Multi-Processing

HAM
Hitachi High Availability Manager

HDLM
Hitachi Dynamic Link Manager

HDP
Hitachi Dynamic Provisioning

HDS
Hitachi Data Systems

HDT
Hitachi Dynamic Tiering

HDvM
Hitachi Device Manager

HGLAM
Hitachi Global Link Availability Manager

H-LUN
host logical unit

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

HORC
Hitachi Open Remote Copy. Another name for Hitachi TrueCopy.

HORCM
Hitachi Open Remote Copy Manager. Another name for Command Control Interface.

host failover
The process of switching operations from one host to another host when the primary host fails.

host group
A group of hosts of the same operating system platform.

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

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

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

HRpM
Hitachi Replication Manager

HSCS
Hitachi Storage Command Suite. This suite of products is now called the Hitachi Command Suite.

HUR
Hitachi Universal Replicator

HXRC
Hitachi Extended Remote Copy. Another name for Hitachi Compatible Replication for IBM XRC.

I

iFCP
internet fibre-channel protocol

IML
initial microcode load; initial microprogram load

IMPL
initial microprogram load

initial copy
An initial copy operation is performed when a copy pair is created. Data on the primary volume is copied to the secondary volume.

initiator port
A fibre-channel port configured to send remote I/Os to an RCU target port on another storage system. See also *RCU target port* and *target port*.

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; Copy-on-Write Snapshot in-system replication provides "snapshots" of logical volumes that are stored and managed as virtual volumes (V-VOLs).
See also *remote replication*.

intermediate site (I-site)
A site that functions as both a TrueCopy secondary site and a Universal Replicator primary site in a 3-data-center (3DC) cascading configuration.

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

IO, I/O
input/output

IOPS
I/Os per second

IP
internet protocol

IPL
initial program load

J

JNL
journal

JNLG
journal group

journal group (JNLG)
In a Universal Replicator system, journal groups manage data consistency between multiple 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 on until it is copied to the S-VOL.

JRE
Java Runtime Environment

L

L1 pair
See *layer-1 (L1) pair*.

L2 pair
See *layer-2 (L2) pair*.

LAN
local-area network

layer-1 (L1) pair
In a ShadowImage cascade configuration, a layer-1 pair consists of a primary volume and secondary volume in the first cascade layer. An L1 primary volume can be paired with up to three L1 secondary volumes. See also *cascade configuration*.

layer-2 (L2) pair
In a ShadowImage cascade configuration, a layer-2 (L2) pair consists of a primary volume and secondary volume in the second cascade layer. An L2 primary volume can be paired with up to two L2 secondary volumes. See also *cascade configuration*.

LBA
logical block address

LCP
local control port; link control processor

LCU
logical control unit

LDEV
logical device

LDKC
See *logical disk controller (LDKC)*.

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

LED
light-emitting diode

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

local copy
See *in-system replication*.

local site
See *primary site*.

logical device (LDEV)
An individual logical data volume (on multiple drives in a RAID configuration) in the storage system. An LDEV may or may not contain any data and may or may not be defined to any hosts. Each LDEV has a unique identifier or "address" within the storage system composed of the logical disk controller (LDKC) number, control unit (CU) number, and LDEV number. The LDEV IDs within a storage system do not change.An LDEV formatted for use by 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 Universal Storage Platform V storage system supports two LDKCs, LDKC 00 and LDKC 01.

logical unit (LU)
A logical volume that is configured for use by open-systems hosts (for example, OPEN-V).

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

logical volume
See *volume*.

logical volume image (LVI)
A logical volume that is configured for use by mainframe hosts (for example, 3390-9).

LU
logical unit

LUN
logical unit number

LUNM
Hitachi LUN Manager

LUSE
Hitachi LUN Expansion; Hitachi LU Size Expansion

LV
logical volume

M

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

main site
See *primary site*.

main volume (M-VOL)
A primary volume on the main storage system in a TrueCopy for Mainframe copy pair. The M-VOL contains the original data that is duplicated on the remote volume (R-VOL). See also *remote volume (R-VOL)*.

master journal (M-JNL)
Holds differential data on the primary Universal Replicator system until it is copied to the restore journal (R-JNL) on the secondary system. See also *restore journal (R-JNL)*.

max.
maximum

MB
megabyte

Mb/sec, Mbps
megabits per second

MB/sec, MBps
megabytes per second

MCU
See *main control unit (MCU)*.

MF, M/F
mainframe

MIH
missing interrupt handler

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

M-JNL
main journal

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

MP
microprocessor

MP blade
Blade containing an I/O processor. Performance in the storage system is tuned by allocating a specific MP blade to each I/O-related resource (LDEV, external volume, or journal). Specific blades are allocated, or the storage system can automatically select a blade.

MSCS
Microsoft Cluster Server

mto, MTO
mainframe-to-open

MU
mirror unit

multi-pathing
A performance and fault-tolerant technique that uses more than one physical connection between the storage system and host system. Also called multipath I/O.

M-VOL
main volume

N

node volume
A level-2 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

NVS
nonvolatile storage

O

OPEN-V
A logical unit (LU) of user-defined size that is formatted for use by open-systems hosts.

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

OS
operating system

OS/390
Operating System/390

P

pair
Two logical volumes in a replication relationship in which one volume contains original data to be copied and the other volume contains the copy of the original data. The copy

operations can be synchronous or asynchronous, and the pair volumes can be located in the same storage system (in-system replication) or in different storage systems (remote replication).

pair status
Indicates the condition of a copy pair. A pair must have a specific status for specific operations. When an operation completes, the status of the pair changes to the new status.

parity group
See *RAID group*.

path failover
The ability of a host to switch from using the primary path to a logical volume to the secondary path to the volume when the primary path fails. Path failover ensures continuous host access to the volume in the event the primary path fails.
See also *alternate path* and *failback*.

PG
parity group. See *RAID group*.

physical device
See *device*.

PiT
point-in-time

point-in-time (PiT) copy
A copy or snapshot of a volume or set of volumes at a specific point in time. You can use a point-in-time copy for backup or mirroring application to run concurrently with the system.

pool
A set of volumes that are reserved for storing SS data or Dynamic Provisioning write data.

pool volume (pool-VOL)
A logical volume that is reserved for storing snapshot data for Copy-on-Write Snapshot operations or write data for Dynamic Provisioning.

port attribute
Indicates the type of fibre-channel port: target, RCU target, or initiator.

port block
A group of four fibre-channel ports that have the same port mode.

port mode
The operational mode of a fibre-channel port. The three port modes for fibre-channel ports on the Hitachi RAID storage systems are standard, high-speed, and initiator/ external MIX.

PPRC
Peer-to-Peer Remote Copy

Preview list
The list of requested operations on Storage Navigator.

primary site
The physical location of the storage system that contains the original data to be replicated and that is connected to one or more storage systems at the remote or secondary site via remote copy connections. A primary site can also be called a "main site" or "local site".
The term "primary site" is also used for host failover operations. In that case, the primary site is the host computer where the production applications are running, and the secondary site is where the backup applications run when the applications at the primary site fail, or where the primary site itself fails.

primary volume
The volume in a copy pair that contains the original data to be replicated. The data in the primary volume is duplicated synchronously or asynchronously on the secondary pairs.
The following Hitachi products use the term P-VOL: Storage Navigator, SS, ShadowImage, ShadowImage for Mainframe, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, and High Availability Manager.
See also *secondary volume (S-VOL)*.

P-site
primary site

P-VOL
See *primary volume*.

Q

quick format
The quick format feature in Virtual LVI/Virtual LUN in which the formatting of the internal volumes is done in the background. This allows system configuration (such as defining a path or creating a TrueCopy pair) before the formatting is completed. To execute quick formatting, the volumes must be in blocked status.

quick restore
A reverse resynchronization in which no data is actually copied: the primary and secondary volumes are swapped.

quick split
A split operation in which the pair is split immediately before the differential data is copied to the secondary volume (S-VOL). Any remaining differential data is copied to the S-VOL in the background. The benefit is that the S-VOL is immediately available for read and write I/O.

R

R/W, r/w
read/write

RAID
redundant array of inexpensive disks

RAID group
A redundant array of inexpensive drives (RAID) that have the same capacity and are treated as one group for data storage and recovery. A RAID group contains both user data and parity information, which allows the user data to be accessed in the event that one or more of the drives within the RAID group are not available. The RAID 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 RAID0, RAID1, RAID2, RAID3, RAID4, RAID5 and RAID6.

RCP
remote control port

RCU
See *remote control unit (RCU)*.

RD
read

RCU target port
A fibre-channel port that is configured to receive remote I/Os from an initiator port on another storage system.

remote console PC
A previous term for the personal computer (PC) system that is LAN-connected to a RAID storage system. The current term is Storage Navigator PC.

remote control port (RCP)
A serial-channel (ESCON) port on a TrueCopy main control unit (MCU) that is configured to send remote I/Os to a TrueCopy remote control unit (RCU).

remote control unit (RCU)
A storage system at a secondary or remote site that is configured to receive remote I/Os from one or more storage systems at the primary or main site.

remote copy
See *remote replication*.

remote copy connections
The physical paths that connect a storage system at the primary site to a storage system at the secondary site. Also called data path.

remote replication
Data replication configuration in which the storage system that contains the original data is at a local site and the storage system that contains the copy of the original data is at a remote site. TrueCopy and Universal Replicator provide remote replication. See also *in-system replication*.

remote site
See *secondary site*.

remote volume (R-VOL)
In TrueCopy for Mainframe, a volume at the remote site that contains a copy of the original data on the main volume (M-VOL) at the main site.

restore journal (R-JNL)
Holds differential data on the secondary Universal Replicator system until it is copied to the secondary volume.

resync
"Resync" is short for resynchronize.

RF
record format

RIO
remote I/O

R-JNL
restore journal

RL
record length

RMI
Remote Method Invocation

rnd
random

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

RPO
recovery point objective

R-SIM
remote service information message

R-site
remote site (used for Universal Replicator)

RTC
real-time clock

RTO
recovery time objective

R-VOL
See *remote volume (R-VOL)*.

R/W
read/write

S

S#
serial number

S/N
serial number

s/w
software

SAID
system adapter ID

SAN
storage-area network

SATA
serial Advanced Technology Attachment

SC
storage control

SCDS
source control dataset

SCI
state change interrupt

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

SCSI
small computer system interface

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

secondary volume
The volume in a copy pair that is the copy. The following Hitachi products use the term "secondary volume": Thin Image, Copy-on-Write Snapshot, ShadowImage, ShadowImage for Mainframe, TrueCopy, Universal Replicator, Universal Replicator for Mainframe, High Availability Manager, and Compatible XRC.
See also *primary volume*.

seq.
sequential

service information message (SIM)
SIMs are generated by a RAID storage system when it detects an error or service requirement. SIMs are reported to hosts and displayed on Storage Navigator.

service processor (SVP)
The computer inside a RAID storage system that hosts the Storage Navigator software and is used by service personnel for configuration and maintenance of the storage system.

severity level
Applies to service information messages (SIMs) and Storage Navigator error codes.

SI
Hitachi ShadowImage

SIz
Hitachi ShadowImage for Mainframe

sidefile
An area of cache memory that is used to store updated data for later integration into the copied data.

SIM
service information message

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

SM
shared memory

SMTP
simple mail transfer protocol

SN
serial number shown in Storage Navigator

snapshot
A point-in-time virtual copy of a SS 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
simple network management protocol

SOM
system option mode

source volume (S-VOL)
The volume in a mainframe local copy pair containing the original data. This term is used only for the following Hitachi products: ShadowImage for Mainframe, IBM FlashCopy, Compatible FlashCopy® V2, and Dataset Replication.

space
Generally refers to the data storage capacity of a disk drive or flash drive.

SRM
Storage Replication Manager

SS
snapshot

SSB
sense byte

SSID
(storage) subsystem identifier. SSIDs are used as an additional way to identify a control unit on mainframe operating systems. Each group of 64 or 256 volumes requires one SSID, therefore there can be one or four SSIDs per CU image. For VSP, one SSID is associated with 256 volumes.

SSL
secure socket layer

steady split
In ShadowImage, a typical pair split operation in which any remaining differential data from the P-VOL is copied to the S-VOL and then the pair is split.

S-VOL
See *secondary volume* or *source volume (S-VOL)*.

SVP
See *service processor (SVP)*.

sync
synchronous

system option mode (SOM)
Additional operational parameters for the RAID storage systems that enable the storage system to be tailored to unique customer operating requirements. SOMs are set on the service processor.

T

target port
A fibre-channel port that is configured to receive and process host I/Os.

target volume (T-VOL)
The volume in a mainframe copy pair that is the copy. The term is used only in the earlier version of the Storage Navigator GUI (still in use), for the following Hitachi products: ShadowImage for Mainframe, Dataset Replication, Compatible FlashCopy® V2.
See also *source volume (S-VOL)*.

TB
terabyte

TC
Hitachi TrueCopy

TCz
Hitachi TrueCopy for Mainframe

TDEVN
target device number

TGT
target; target port

THD
threshold

TID
target ID

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

T-VOL
See *target volume (T-VOL)*.

U

update copy
An operation that copies differential data on the primary volume of a copy pair to the secondary volume. Update copy operations are performed in response to write I/Os on the primary volume after the initial copy operation is completed.

UR
Hitachi Universal Replicator

URz
Hitachi Universal Replicator for Mainframe

USP
Hitachi TagmaStore® Universal Storage Platform

USP V
Hitachi Universal Storage Platform V

USP VM
Hitachi Universal Storage Platform VM

UT
Universal Time

UTC
Universal Time-coordinated

V

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

VB
variable length and blocking (mainframe record format)

view mode
The mode of operation of Storage Navigator that allows viewing only of the storage system configuration. The two Storage Navigator modes are view mode and modify mode.

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

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

virtual volume (V-VOL)
The secondary volume in a Thin Image or Copy-on-Write Snapshot pair. When in "PAIR" status, the V-VOL is an up-to-date virtual copy of the primary volume (P-VOL). When in

"SPLIT" status, the V-VOL points to data in the P-VOL and to replaced data in the pool, maintaining the point-in-time copy of the P-VOL at the time of the split operation. When a V-VOL is used with Dynamic Provisioning, it is called a DP-VOL.

VLL
Hitachi Virtual LVI/LUN

VLVI
Hitachi Virtual LVI

VM
volume migration; volume manager

VOL, vol
volume

VOLID
volume ID

volser
volume serial number

volume
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. A mainframe volume is called a logical volume image (LVI), and an open-systems volume is called a logical unit. (LU).

volume pair
See *copy pair*.

V-VOL
virtual volume

V-VOL management area
Contains the pool management block and pool association information for SS operations. The V-VOL management area is created automatically when additional shared memory is installed and is required for SS operations.

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