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Hitachi TrueCopy®

User Guide

Hitachi Virtual Storage Platform G1000 and G1500

Hitachi Virtual Storage Platform F1500

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Systems

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Contents

Preface

This document describes and provides instructions for using Hitachi TrueCopy® (TC) to perform remote replication operations on the storage system. Read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

Intended audience

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

Readers of this document should be familiar with the following:

- Data processing and RAID systems and their basic functions.
- The Hitachi Device Manager - Storage Navigator software and the *Hardware Guide* for your storage system.
- Remote replication and disaster recovery configurations for enterprise storage data centers.

Product version

This document revision applies to the following microcode or firmware:

- VSP G1000, G1500, and VSP F1500: microcode 80-05-4*x* or later
- VSP G200, G400, G600, G800, and VSP F400, F600, F800: firmware 83-04-4*x*
- SVOS 7.2 or later

Release notes

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

Changes in this revision

- Corrected the Thin Image pair condition for a UR+TI relation. (Volume types that can be shared with TrueCopy on page 88)

Referenced documents

The following documents are referenced in this guide:

- *Global-Active Device User Guide*, MK-92RD8072
- *Hitachi Device Manager - Storage Navigator Messages*, MK-92RD8017
- *Hitachi ShadowImage® User Guide*, MK-92RD8021
- *Hitachi Universal Replicator User Guide*, MK-92RD8023
- *Provisioning Guide for Open Systems*, MK-92RD8014

- *System Administrator Guide*, MK-94RD8016

Document conventions

This document uses the following storage system terminology conventions:

Convention	Description
VSP G series	Refers to the following storage systems: • Hitachi Virtual Storage Platform G1000 and G1500 • Hitachi Virtual Storage Platform G200 • Hitachi Virtual Storage Platform G400 • Hitachi Virtual Storage Platform G600 • Hitachi Virtual Storage Platform G800
VSP F series	Refers to the following storage systems: • Hitachi Virtual Storage Platform F1500 • Hitachi Virtual Storage Platform F400 • Hitachi Virtual Storage Platform F600 • Hitachi Virtual Storage Platform F800
VSP Gx00 models	Refers to all of the following models, unless otherwise noted. • Hitachi Virtual Storage Platform G200 • Hitachi Virtual Storage Platform G400 • Hitachi Virtual Storage Platform G600 • Hitachi Virtual Storage Platform G800
VSP Fx00 models	Refers to all of the following models, unless otherwise noted. • Hitachi Virtual Storage Platform F400 • Hitachi Virtual Storage Platform F600 • Hitachi Virtual Storage Platform F800

This document uses the following typographic conventions:

Convention	Description
Bold	• Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click **OK**. • Indicates emphasized words in list items.
Italic	• Indicates a document title or emphasized words in text. • Indicates a variable, which is a placeholder for actual text provided by the user or for output by the system. Example: `pairdisplay -g group` (For exceptions to this convention for variables, see the entry for angle brackets.)
`Monospace`	Indicates text that is displayed on screen or entered by the user. Example: `pairdisplay -g oradb`
< > angle brackets	Indicates variables in the following scenarios:

Convention	Description
	• Variables are not clearly separated from the surrounding text or from other variables. Example: `Status-<report-name><file-version>.csv` • Variables in headings.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.

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

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

Conventions for storage capacity values

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

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

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

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems: • OPEN-V: 960 KB • Others: 720 KB
1 KB	1,024 (2^{10}) bytes
1 MB	1,024 KB or $1{,}024^2$ bytes
1 GB	1,024 MB or $1{,}024^3$ bytes
1 TB	1,024 GB or $1{,}024^4$ bytes
1 PB	1,024 TB or $1{,}024^5$ bytes
1 EB	1,024 PB or $1{,}024^6$ bytes

Accessing product documentation

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

Getting help

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

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

Comments

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

Thank you!

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Overview of Hitachi TrueCopy®

This chapter provides an overview of Hitachi TrueCopy® operations.

Hitachi TrueCopy®

Hitachi TrueCopy® (TC) provides a continuous, nondisruptive, host-independent remote data-replication solution for disaster recovery or data migration purposes. Using the TrueCopy Remote Replication software, you can create and maintain mirror images of production volumes at a remote location. TrueCopy Remote Replication software can be deployed with Hitachi Universal Replicator software's asynchronous replication capabilities to provide advanced data replication among multiple data centers. In addition, TrueCopy Remote Replication software can be integrated with Hitachi ShadowImage® Replication software to enable robust business-continuity solutions. This lets you create a remote copy of primary site or production data that is automatically updated for executing test and development tasks, or for operations against production data.

The TrueCopy primary storage system contains the primary volume (P-VOL) of a copy pair, and the secondary storage system contains the secondary volume (S-VOL). When the primary storage system accepts a write operation for a P-VOL, the data is written on the primary volume and then sent by the primary storage system to the secondary storage system through the dedicated data paths connecting the storage systems. Subsequent write operations are not accepted by the primary volume until acknowledgement is received from the secondary storage system for the previous write operation, ensuring that the data in the secondary volume stays synchronized with the primary volume.

To reduce the overhead associated with these remote copy activities and maximize data transfer, the primary storage system uses a special write command for TrueCopy remote copy operations. This command transfers the control parameters and the FBA-format data for consecutive updated records in a track using a single write operation. The special write command eliminates the overhead required for performing FBA-to-CKD and CKD-to-FBA conversions.

TrueCopy operations can be performed using the TrueCopy Remote Replication software on Hitachi Device Manager - Storage Navigator and the Command Control Interface (CCI) command-line interface software. This document describes and provides instructions for performing TrueCopy operations using the TrueCopy software on Device Manager - Storage Navigator. For details about using CCI to perform TrueCopy operations, see the user documentation for CCI.

System components

TrueCopy operations involve the storage systems and volumes at the primary site and secondary (remote) site, the physical communications paths

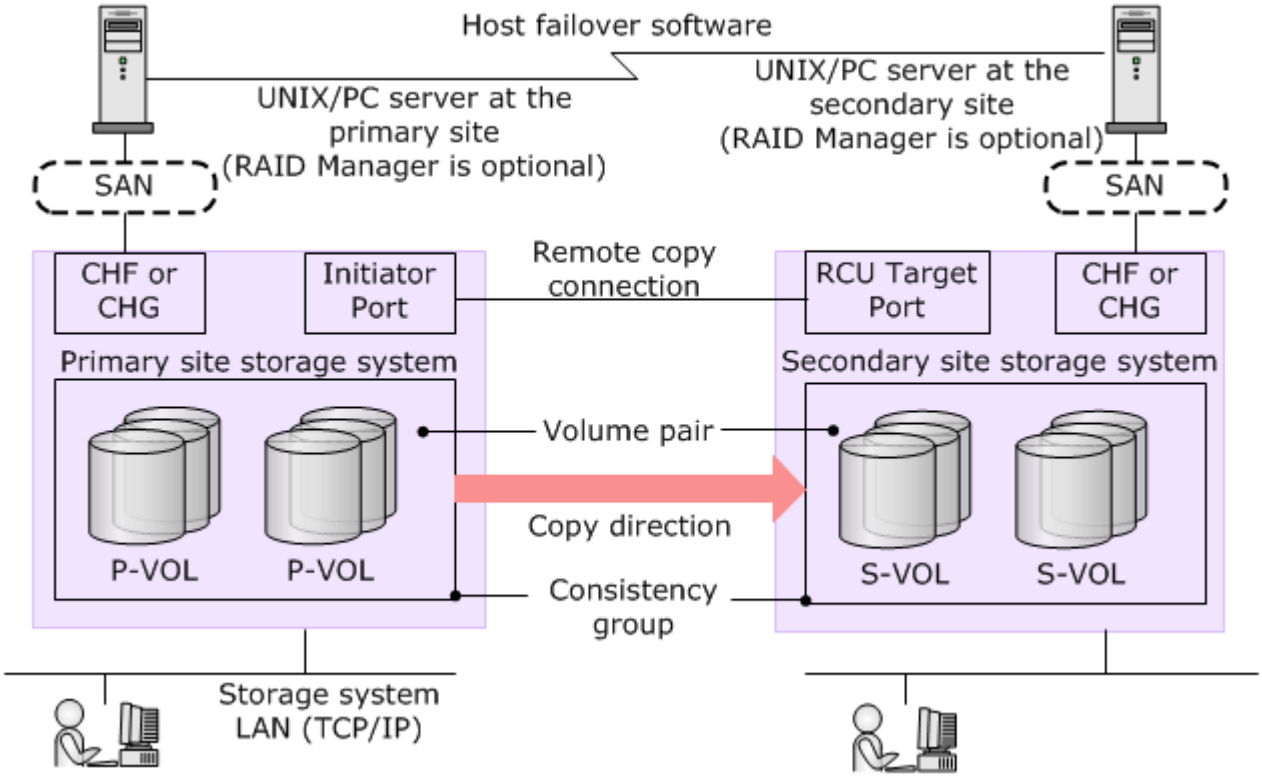
between these storage systems, and the TrueCopy software. A TrueCopy system configuration consists of the following components:

- **Primary and secondary storage systems:** The primary storage system contains the primary volumes and is connected to the hosts that access the primary volumes. The secondary storage system is connected to the primary storage system using the data paths. TrueCopy supports remote copy operations between various storage system models. This document provides instructions for performing TrueCopy operations.
- **Main control units (MCUs) and remote control units (RCUs):** The MCU is the control unit in the primary storage system that controls the P-VOLs of the TrueCopy pairs. The MCU communicates with the RCU through the dedicated remote copy connections. The MCU controls the host I/O operations to the P-VOLs as well as the TrueCopy remote copy operations between the P-VOLs and S-VOLs. The MCU also manages the TrueCopy pair status and configuration information.

  The RCU is the control unit in the secondary storage system that controls the S-VOLs of the TrueCopy pairs. The RCU assists in managing the TrueCopy pair status and configuration (for example, rejects write I/Os to S-VOLs). The RCU executes the remote copy operations issued by the MCU. The RCUs should be attached to a host system to allow sense information to be reported in case of a problem with a secondary volume or remote storage system and to provide disaster recovery capabilities.
- **Hosts:** The hosts at the primary site are connected to the primary storage system. Hosts at the secondary site are connected to the secondary storage system for use in disaster recovery operations. If it is not possible to have hosts at the secondary site, the host at the primary site must be in communication with the secondary system for disaster recovery operations.
- **Volumes:** The primary volumes (P-VOLs) on the primary storage system are copied to the secondary volumes (S-VOLs) on the secondary system. The P-VOLs contain the original data, and the S-VOLs are the mirrored volumes that contain the backup or duplicate data. During normal TrueCopy operations, the P-VOL remains available to all hosts at all times for read and write I/O operations and the secondary storage system rejects all host-requested write I/Os for the S-VOLs. The S-VOL write enable option allows write access to an S-VOL while the pair is split, and the S-VOL and P-VOL differential data is used to resynchronize the pair.
- **Data paths:** Dedicated data paths, also called remote copy connections, are used for data transfer between the primary and secondary storage systems. You should establish at least two independent remote copy connections (one per cluster) between each MCU and RCU to provide hardware redundancy for this critical communications path.
- **Hitachi TrueCopy® software:** The TrueCopy software must be installed on both the primary and secondary storage systems and is used to perform TrueCopy configuration and pair operations.

- **CCI:** The Command Control Interface (CCI) command-line interface software can also be used for TrueCopy configuration and pair operations as well as disaster recovery operations.

The following figure shows a typical TrueCopy environment.



Storage systems

TrueCopy operations take place between a primary storage system and a secondary storage system. The primary storage system communicates with the secondary storage system over dedicated Fibre Channel or iSCSI data paths called remote copy connections.

The primary storage system is responsible for the following:

- Managing host I/O operations to the P-VOL.
- Managing initial copy and update copy operations between the P-VOL and the S-VOL.
- Managing pair status and configuration information.

The secondary storage system is responsible for the following:

- Managing copy operations issued by the primary storage system to the S-VOL.

- Assisting in the management of pair status and configuration (for example, rejecting write I/Os to the S-VOL).

If the primary storage system is VSP G1000 and G1500, or VSP F1500, the secondary system can be VSP G1000 and G1500, or VSP F1500, VSP, VSP Gx00 models, VSP Fx00 models, HUS VM, or Universal Storage Platform V/VM.

For VSP G1000 and G1500, and VSP F1500, the VSP G1000 and G1500 CU can function simultaneously as a primary storage system for one or more P-VOLs and as a secondary storage system for one or more S-VOLs. This configuration requires that data paths and ports are configured for both copy directions.

VSP Gx00 models and VSP Fx00 models can connect only to other VSP Gx00 models and VSP Fx00 models as the secondary storage system.

Volume pairs

Each TrueCopy volume pair consists of the P-VOL, which contains the original data, and the S-VOL, which contains the synchronous copy of the data on the P-VOL. After creating a copy pair, you can use the TrueCopy software to split, resynchronize, and reverse resynchronize pairs, and you can delete pairs as needed to return the volumes to an unpaired status.

- When paired, the volumes are synchronized.
- When split, new data is sent to the P-VOL but not the S-VOL.

Note:
- It will continue writing to P-VOL but copying to S-VOL stops so that pair will not be synchronized.
- If setting S-VOL's write option as enable, Write access from host application of secondary site to S-VOL become possible. If not, it will hold the status at the time of pair split.
- When P-VOL and S-VOL is not synchronized, differential data will be saved as bitmap until P-VOL and S-VOL resynchronizes.
- If you resync pairs, only the data which is not synchronized will be transferred so it will save time for copying.

- When resynchronized, data that changed while the pair was split is copied to the S-VOL.
- When necessary, data in the S-VOL can be copied to the P-VOL.

During normal operations, the P-VOL remains available to the host for read and write I/O operations. The secondary system rejects write I/Os for the S-VOL. The S-VOL can only be written to when the pair is split and when the write-enable option is specified for the S-VOL. In this instance, S-VOL and P-

VOL track maps keep track of differential data and are used to resynchronize the pair.

Data path

TrueCopy operations are carried out between primary and secondary storage systems connected by a Fibre Channel or iSCSI interface. The data path, also referred to as the remote copy connection, connects ports on the primary storage system to the ports on the secondary storage system. Ports are assigned attributes that allow them to send and receive data.

One data path connection is required, but two or more independent connections are recommended for hardware redundancy.

Consistency groups

A consistency group is a group of pairs on which copy operations are performed simultaneously and in which the status of the pairs remains consistent. A consistency group can include pairs that reside in up to four primary and secondary systems.

You can issue a TrueCopy command to a consistency group to perform the operation on all pairs in the group at the same time. The status of the pairs changes at the same time, though this depends on the group options you have set. Some pair operations take priority under certain circumstances. For details, see Consistency group planning on page 68.

User interfaces

You can perform TrueCopy operations using one of the following user interfaces:

- Hitachi Device Manager - Storage Navigator (HDvM - SN) is is a browser-based graphical user interface (GUI) that allows you to perform TrueCopy operations from any LAN-attached computer.
  - The primary storage system must be LAN-attached to a Device Manager - Storage Navigator computer.
  - For disaster recovery purposes, the secondary storage system must be LAN-attached to a separate Device Manager - Storage Navigator computer at the secondary site so that you can perform operations on the secondary storage system in the event that the primary site is not available.
  - When you use virtual storage machine volumes, the physical LDEV ID, serial number, and the virtual information for the storage system are displayed on Device Manager - Storage Navigator. However, you cannot add remote connections by specifying the serial number of the virtual

storage machine or create pairs by specifying the virtual LDEV ID. When you perform TrueCopy operations using Device Manager - Storage Navigator, specify the physical LDEV ID and serial number of the storage system.

- Command Control Interface (CCI) is a command-line interface that allows you to perform TrueCopy operations by issuing commands to the storage system either from a client or server through the host Fibre Channel interface (in-band method) or from a LAN-attached computer (out-of-band method). CCI provides a scripting capability that enables you to automate replication operations. CCI is required for performing failover operations.

Failover software

Host failover software is used to transfer information between host servers at the primary and secondary sites and is a critical component of a disaster recovery solution.

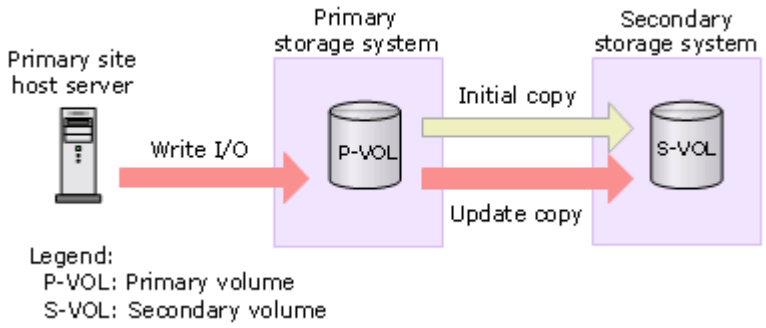
- When TrueCopy is used as a disaster recovery tool, host failover is required to ensure effective recovery operations.
- When TrueCopy is used as a data migration tool, host failover is recommended.

TrueCopy does not provide host failover functions. Use the failover software most suitable for your platform and requirements (for example, Microsoft Cluster Server).

Initial copy and update copy operations

When you create a copy pair, the initial copy operation is performed to copy all of the data in the P-VOL to the S-VOL. Once the pair is synchronized, the primary storage system performs update copy operations when it receives write I/Os for the P-VOL. The update copy operation ensures that host updates are performed on the P-VOL and the S-VOL at the same time.

The following figure illustrates the initial copy and update copy operations.



Initial copy operations

When you create a copy pair, the contents of the P-VOL are copied to the S-VOL track by track (not including diagnostic and unassigned alternate tracks). The initial copy operation synchronizes the P-VOL and S-VOL independently of host I/O processes.

If you know that the data in the P-VOL and S-VOL are already identical, or if the P-VOL does not yet contain any data, you can select the None initial copy option. When you select this option, the pair becomes synchronized (PAIR status) immediately. You can also specify the following options to control the impact of the initial copy operations on the storage system performance:

- **Copy Pace**. Specifies the number of tracks that are copied simultaneously before the P-VOL accepts another host I/O request. If more tracks are copied, the initial copy operation is completed more quickly. If fewer tracks are copied, storage system performance (for example, host I/O response time) is maintained at a higher level. You can set this option when you create pairs using Device Manager - Storage Navigator or CCI. The following table lists the values for the copy pace and the transfer size per remote I/O (RIO).

Copy pace	Transfer size
OPEN-V	
1	256 KB (256 KB x 1)
2	512 KB (256 KB x 2)
3	768 KB (256 KB x 3)
4	1024 KB (256 KB x 4)
Other than OPEN-V (VSP G1000, G1500, and VSP F1500)	
1	58 KB (58 KB x 1)
2	116 KB (58 KB x 2)
3	174 KB (58 KB x 3)
4	232 KB (58 KB x 4)
5	290 KB (58 KB x 5)
6	348 KB (58 KB x 6)
7	406 KB (58 KB x 7)
8	464 KB (58 KB x 8)
9	522 KB (58 KB x 9)
10	580 KB (58 KB x 10)
11	638 KB (58 KB x 11)

Copy pace	Transfer size
12	696 KB (58 KB x 12)
13	754 KB (58 KB x 13)
14	812 KB (58 KB x 14)
15	870 KB (58 KB x 15)

- **Maximum Initial Copy Activities**. Specifies the maximum number of concurrent initial copy operations. You can set this option only using Device Manager - Storage Navigator, and this option is set on the storage system and applies when you create pairs using any interface.
- **Initial Copy Priority**. Specifies the order in which the initial copy operations are performed. This option applies when you create more pairs at the same time than the maximum initial copy activity setting. You can set this option only when you create pairs using Device Manager - Storage Navigator.
- **Round Trip Time**. You can set the Copy Pace option using Device Manager - Storage Navigator or CCI. The other initial copy options are available only when you create pairs using Device Manager - Storage Navigator.

Update copy operations

When the primary storage system accepts a host write operation for a P-VOL, the primary storage system performs an update copy operation to write the data on both the P-VOL and the S-VOL. The primary storage system does not accept another write operation for the P-VOL until it receives confirmation from the secondary storage system that the write operation was completed successfully on the S-VOL. This ensures that the data on the P-VOL and S-VOL remains synchronized.

Update copy operations have a higher priority than initial copy operations. However, if an initial copy operation is in progress when the host issues a write operation to a P-VOL, the update copy operation must wait until the completion of the number of tracks specified in the copy pace setting. For example, if the copy pace setting is 15 tracks, the update copy must wait until all 15 tracks (1 cylinder) in the initial copy operation are copied. At that time the update copy operation is performed, and then the initial copy operation is resumed.

Pair status

The pair status is managed by the primary storage system which manages the P-VOLs.

- The primary storage system is able to change the pair status of the P-VOL and the S-VOL.

- The secondary storage system can change the pair status of the S-VOLs, but cannot change the pair status of the P-VOLs. The primary storage system detects the change of the pair status of S-VOL, and then change the status of P-VOL.
- The pair status changes as follows:
  - If the volume is not assigned to a TrueCopy pair, the volume status is SMPL.
  - When the initial copy begins to create a pair, the primary storage system changes the status of both volumes to *COPY* (volumes to be copying).
  - When the initial copy completes, the primary storage system changes the status of both volumes to *PAIR* (volumes become a pair).
  - When user splits the pair from the primary storage system or the secondary storage system, the status of the P-VOL and the S-VOL are changed to *PSUS (pair suspended-split: split by a command)*.
  - The primary storage system cannot keep the synchronization of the P-VOL and the S-VOL by some reasons, for example errors, the primary storage system changes the status of the P-VOL and the S-VOL to *PSUE (pair suspended-error: split by an error)*.
  - When the user removes the pair from the primary storage system, the primary storage system changes the status of the P-VOL and the S-VOL to *SMPL*.
  - When the user removes the pair from the secondary storage system, the secondary storage system changes the status of the S-VOL to *SMPL*, and then the primary storage system detects the removal of the pair at the secondary system (if the path is normal), the primary storage system changes the status of the P-VOL to *PSUS*.

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Requirements and specifications

This chapter provides basic system requirements.

In addition to the information here, Planning for TrueCopy on page 31 provides many specifications, recommendations, and restrictions for the elements of a TrueCopy system that require attention before setting up and using TrueCopy.

- System requirements and specifications

System requirements and specifications

The following table describes general system requirements.

Item	Requirement
Control unit (CU)	VSP G1000, G1500, and VSP F1500 • Number of CUs: 255 • Range of CUs: 0x00 to 0xfe VSP G200 • Number of CUs: 8 • Range of CUs: 0x00 to 0x07 VSP G400, G600 and VSP F400, F600 • Number of CUs: 16 • Range of CUs: 0x00 to 0x0F VSP F800 and VSP G800 • Number of CUs: 64 • Range of CUs: 0x00 to 0x3F
Supported emulation types	VSP G1000, G1500, and VSP F1500 • OPEN-3, OPEN-8, OPEN-9, OPEN-K, OPEN-E, OPEN-L, and OPEN-V VSP Gx00 models and VSP Fx00 models • Only OPEN-V
RAID levels supported	RAID 1, RAID 5, and RAID 6 configurations.
Supported storage systems	VSP G1000 and G1500, and VSP F1500 can be connected to: • VSP G1000: 80-01-01-00/00 or later • VSP G1500 and VSP F1500: 80-05-0x-00/00 or later • VSP G200: 83-01-21-20/*xx* or later • VSP F400, F600, VSP G400, G600: 83-01-21-40/*xx* or later • VSP G800, VSP F800: 83-01-21-60/*xx* or later • VSP: 70-06-16-00/00 or later • USP V/VM: 60-08-47-00/00 or later If pairs in a consistency group belong to multiple VSP G1000 and G1500, and VSP F1500 storage systems, USP V/VM cannot be used. If you are using a Dynamic Provisioning virtual volume (DP-VOL) with the data direct mapping attribute, you can only connect to VSP G1000 with microcode 80-03-30-00/00 or later, or VSP G1500 and VSP F1500 with microcode 80-05-0x-00/00 or later. Use VSP G1000 and G1500, and VSP F1500 with microcode 80-05-0x-00/00 or later at both the primary site and the secondary site so that you can perform operations at the secondary site during a disaster recovery. For details, see Requirements for pairing VSP G1000 and G1500, and VSP F1500 with other storage systems on page 34. • HUS VM: 73-03-07-00/00 or later VSP Gx00 models or VSP Fx00 models can be connected to: • VSP G200: 83-01-01-20/00 or later • VSP G400, G600: 83-01-01-40/00 or later • VSP G800: 83-01-21-60/00 or later • VSP F400, F600, F800: 83-02-0*x* or later • HUS VM: 73-03-39-00/00 or later, or 73-03-39-10/00 or later

Item	Requirement
	• VSP G1000: 80-04-*xx* or later • VSP G1500 and VSP F1500: 80-05-0x-00/00 or later If you are using a Dynamic Provisioning virtual volume (DP-VOL) with the data direct mapping attribute, you can only connect to VSP Gx00 models or VSP Fx00 models with firmware 83-02-0*x* or later. For disaster recovery, operation is done by the storage system at the secondary site, so it is recommended to useVSP Gx00 models or VSP Fx00 models for both primary and secondary sites. For more information, contact customer support.
TrueCopy	• Must be installed on the primary and secondary systems. • Separate license codes are required for each storage system. • Synchronous only. TrueCopy does not support Asynchronous. • For VSP G1000 and G1500, and VSP F1500, TrueCopy can co-exist with TrueCopy for Mainframe. For information about exceeding licensed capacity and license expiration, see the *System Administrator Guide* for your storage system.
Other required licenses	None. However, when combining TrueCopy and Dynamic Provisioning, the following licensed capacity limitations apply: • If using a DP-VOL for the TrueCopy P-VOL or S-VOL, the capacity of the allocated pages for the DP-VOL will be counted as the licensed capacity of TrueCopy. However, for the volume with capacity saving enabled, the TrueCopy licensed capacity is the capacity before saving. • If the actual licensed capacity exceeds the available licensed capacity, TrueCopy can be used as usual for 30 days. After 30 days, only split or release operations will be allowed.
Additional shared memory	• VSP G200 You can use TrueCopy only with shared memory in the basic part. Adding shared memory expands the capacity of the pairs being created. • VSP G400, G600, G800, VSP F400, F600, F800, VSP G1000, VSP G1500, and VSP F1500: Additional shared memory is a prerequisite in both the primary and secondary systems to use TrueCopy For information about adding shared memory and setting the TC dedicated area, contact customer support.
Supported host platforms	For the supported version, refer to the Hitachi Data Systems interoperability matrix at https://support.hds.com/en_us/interoperability.html. • AIX • HP-UX • OpenVMS • Red Hat Enterprise Linux • Solaris • SuSE Linux • VMware ESM • Windows Server
Data path	A maximum of eight data paths are supported from primary system CU to secondary system CU. The following interfaces with direct, switch, or channel extenders are available: • iSCSI

Item	Requirement
	• Fibre Channel For details, see Data path requirements and configurations on page 49.
Remote paths	Remote paths are established for each path group of primary and secondary storage systems. A maximum of 8 remote paths are supported for each path group, and a maximum of 64 path groups are supported. Multiple path groups can be used in the same combination of primary and secondary storage systems.

Path groups	A path group is a group of remote paths. You can use path groups to configure or change the configuration of multiple paths at the same time.
	
	• A maximum of 64 path groups can be set in a storage system.
	• The following values can be set as the path group ID:
	  ○ 0-255 (0 to FF in hexadecimal) when connected to VSP G1000 and G1500, and VSP F1500, VSP Gx00 models, VSP Fx00 models, or VSP. By default, 0 is set.
	  ○ 0 when connected to USP V/VM or HUS VM.
	
	• If iSCSI is used in a remote path, the Blocked Path Monitoring remote replica option must be set to at least 40 seconds (default). If Blocked Path Monitoring is less than 40 seconds, the path might be blocked due to a delay in the network such as many switches in a spanning tree protocol (STP) network or a long-distance connection.
	• The path group is specified during the create pair operation and cannot be changed by the resync pair operation.
	• Path groups can be created and specified using CCI. For details, see the configuration setting commands in the *Command Control Interface Command Reference* and the sample configuration definition files in *Command Control Interface Installation and Configuration Guide*.
	• When using CU Free, specify different paths and path groups for UR and URz secondary systems.

Maximum number of secondary systems	• A maximum of 64 secondary storage systems can be set for a storage system. This number includes the number of secondary storage systems specified by Universal Replicator or Universal Replicator for Mainframe. • To register secondary storage system for each system, specify the path group ID (0 to 255). By default, 0 is set. If you set the same path group ID as the secondary site storage system used by Universal Replicator or Universal Replicator for Mainframe, the same path as the secondary site storage system for Universal Replicator or Universal Replicator for Mainframe is used. If you assign different data paths and specify different path group IDs to register secondary site storage systems, you can use separate paths. • You can use CCI to specify path groups when you create path groups or pairs. For details, see description on configuration definition commands in the *Command Control Interface Command Reference*, and the configuration definition file in the *Command Control Interface User and Reference Guide*.

Pair volumes	• The P-VOL and S-VOL must be equal in size.
	• The maximum size of the P-VOL and S-VOL are:
	  ○ If DP-VOL, the same as the maximum size of the DP-VOL. For details, see the *Provisioning Guide* for your storage system.
	  ○ If internal VOL, 3,145,663 MB (6,442,317,824 blocks) each.
	  ○ If external VOL, 4,194,304 MB (8,589,934,592 blocks) each.

Item	Requirement
	• The minimum size for OPEN-V P-VOLs and S-VOLs is 46.875 MB (96,000 blocks). For all other emulation types, minimum size is 35.156 MB (72,000 blocks). • A P-VOL can be copied to only one S-VOL. • You need to set the same value for the T10 PI attribute of both P-VOL and S-VOL. • P-VOLs and S-VOLs can be shared with other Hitachi software product volumes. For details, see Volume types that can be shared with TrueCopy on page 88. • A volume (LDEV) from a parity group with accelerated compression enabled cannot be used directly as a pair volume. Such volumes must be used as pool volumes for an HDP or HDT pool. For more information, see Planning pairs and pair volumes on page 59.
Number of pairs	Limited per storage system. For details, see Maximum number of pairs supported on page 63.
Number of consistency groups	• VSP G200: Maximum: 16 (0x00 to 0x0F) • VSP G400, G600 and VSP F400, F600: Maximum: 64 (0x00 to 0x3F) • VSP G800 and VSP F800: Maximum: 128 (0x00 to 0x7F) • VSP G1000, VSP G1500, and VSP F1500: Maximum: 256 (0x00 to 0xFF)
Host failover software	• Required for disaster recovery. • Recommended for data migration. For details, see Host failover software on page 86.
Interfaces	• Device Manager - Storage Navigator is required. ○ The following HDvM - SN roles are required to operate: - Storage Administrator (Remote Copy) - Storage Administrator (System Resource Management) - Storage Administrator (Provisioning) ○ The primary system must be LAN-attached to a Device Manager - Storage Navigator computer. ○ The secondary system must be attached using a separate LAN at the secondary site. • CCI is optional. ○ A command device is required for each CCI instance. ○ When using virtual storage machine volumes, specify the logical device (LDEV) ID, serial number, and virtual information in the configuration definition file. ○ For information about setting up and using CCI, see the *Command Control Interface User and Reference Guide*.

3

Planning for TrueCopy

This chapter provides information and instructions for planning primary and secondary systems, pair volumes, data paths, and other elements.

- ☐ Storage system preparation
- ☐ Remote replication options
- ☐ Analyzing workload and planning data paths
- ☐ Data path requirements and configurations
- ☐ Planning pairs and pair volumes
- ☐ Consistency group planning
- ☐ Host failover software

Storage system preparation

The following preparations are required for the storage systems in a TrueCopy pair relationship.

- Device Manager - Storage Navigator must be LAN-attached to the primary system and the secondary system. For details, see the *System Administrator Guide* for your storage system.
- The primary and secondary systems must be set up for TrueCopy operations. For details, see Cache and shared memory requirements on page 32. Make sure to consider the amount of Cache Residency Manager data that will be stored in cache when determining the amount of cache for TrueCopy operations.
- Make sure that the storage system is configured to report sense information by connecting storage system and host. It is required to connect the host to both the primary and secondary systems. If dedicated host cannot be connected to secondary system, connect secondary system and host at primary site.
- If power sequence control cables are used, set the power select switch for the cluster to LOCAL to prevent the primary system from being powered off by the host. Make sure the S-VOL is not powered off during TrueCopy operations.
- Install the data path between the primary and secondary systems. Distribute data paths between different storage clusters and extenders or switches to provide maximum flexibility and availability. The remote paths between the primary and secondary systems must be different than the remote paths between the host and secondary system. For details, see Data path requirements and configurations on page 49.

Cache and shared memory requirements

Cache must be operable for the primary and secondary systems. If not, pairs cannot be created. The secondary system cache must be configured to adequately support TrueCopy remote copy workloads and any local workload activity.

Note the following:

- Hitachi Virtual Storage Platform G200:
  There are three types of shared memory: Basic, Extension1, and Extension2. Only Basic shared memory can be used with TrueCopy running on VSP G200. Adding shared memory expands the capacity of the pairs to be created.
- VSP G400, G600, G800 and VSP F400, F600, F800:
  Additional shared memory is a prerequisite in both the primary and secondary systems to use TrueCopy.

- VSP G1000, G1500, and VSP F1500 Additional shared memory is a prerequisite in both the primary and secondary systems to create TrueCopy pairs.
- Cache and shared memory that is no longer necessary can be removed.

Note: Neither cache nor shared memory can be added to or removed from the storage system when pair status is COPY. When either of these tasks is to be performed, first split any pairs in COPY status, and then resynchronize the pairs when the cache or shared memory operation is completed.

Adding and removing cache memory

Use the following workflow to add or remove cache memory in a storage system in which TC pairs already exist:

1. Identify the status of the TC volumes in the storage system.
2. If a TC volume is in the COPY status, wait until the status changes to PAIR, or split the TC pair.
   Do not add or remove cache memory when any volumes are in the COPY status.
3. When the status of all volumes has been confirmed, cache memory can be added to or removed from the storage system by your service representative. Contact customer support for adding or removing cache memory.
4. After the addition or removal of cache memory is complete, resynchronize the pairs that you split in step 2.

Adding shared memory

Use the following workflow to add shared memory to a storage system in which TC pairs already exist:

1. Identify the status of the TC volumes in the storage system.
2. If a TC volume is in the *COPY* status, wait until the status changes to *PAIR*, or split the TC pair.
   Do not add shared memory when any volumes are in the *COPY* status.
3. When the status of all volumes has been confirmed, shared memory can be added to the storage system by your service representative. Contact customer support for adding shared memory.
4. After the addition of shared memory is complete, resynchronize the pairs that you split in step 2.

Removing shared memory (TC/UR/GAD)

Use the following workflow to remove shared memory from a storage system in which TC/UR/GAD pairs already exist:

1. Identify the status of all volumes.
2. If a volume is used by a TC/UR/GAD pair, delete the pair.
   Do not remove shared memory when any volume is used by a TC/UR/GAD pair.

Note: In the following cases, you do not need to delete the TC pairs, because there is no dedicated area for TC, such as bitmap areas:

- VSP G200: Shared memory is added in Extension2.
- VSP G400, G600, G800: Shared memory is added in Extension4.

3. When the status of all volumes has been confirmed, shared memory can be removed from the storage system by your service representative. Contact customer support for removing shared memory.

Removing shared memory (64KLDEV Extension)

Use the following workflow to remove shared memory when you have the 64KLDEV Extension installed:

1. Identify the status of all volumes with an LDEV ID of 0x4000 or higher.
2. If a volume with an LDEV ID of 0x4000 or higher is used by a TC pair, delete the TC pair.
   Do not remove shared memory when you have the 64KLDEV Extension installed if any volume with an LDEV ID of 0x4000 or higher is used by a TC pair.
3. When the status of all volumes with an LDEV ID of 0x4000 or higher has been confirmed, contact customer support to remove the shared memory.

Requirements for pairing VSP G1000 and G1500, and VSP F1500 with other storage systems

You can pair VSP G1000 and G1500, and VSP F1500 volumes with volumes in the following storage systems:

- VSP
- USP V/VM
- VSP Gx00 models
- VSP Fx00 models
- HUS VM

Contact customer support for information regarding the supported microcode versions.

Note:

- If the volumes are in a consistency group consisting of multiple VSP G1000 and G1500, and VSP F1500 systems, USP V/VM cannot be used.
- When using a previous model storage system at the secondary site (for example, VSP or USP V/VM), make sure the primary and secondary storage systems have unique serial numbers.

- When specifying the VSP G1000 and G1500, or VSP F1500 serial number using CCI, add a "3" at the beginning of the serial number. For example, if the serial number is 12345, enter 312345.

When connecting to VSP Gx00 models or VSP Fx00 models, the CTG ID for the P-VOL and the S-VOL must be the same. The range of values for the ID is as follows:

- When connecting to VSP G200: 0 to 15
- When connecting to VSP G400, G600 or VSP F400, F600: 0 to 63
- When connecting to VSP G800 or VSP F800: 0 to 127

System option modes

To provide greater flexibility, the storage systems have additional operational parameters called system option modes (SOMs) that allow you to tailor the storage system to your unique operating requirements. The SOMs are set on the service processor (SVP) by your service representative. Review the SOMs for your storage system, and work with your service representative to ensure that the appropriate SOMs for your operational environment are configured on your storage system.

The following table lists and describes the SOMs that apply to global-active device, TrueCopy, and TrueCopy for Mainframe. For a complete list of SOMs, see the *System Administrator Guide* for your storage system.

Note: The SOM information might have changed since this document was published. Contact customer support for the latest SOM information.

Mode	Category	Description	Default	MCU/RCU
448	Universal Replicator Universal Replicator for Mainframe	When the SVP detects a blocked path: **Mode 448 = ON:** An error is assumed and the mirror is immediately suspended. **Mode 448 = OFF (default):** If the path does not recover within a specified period of time, an error is assumed and the mirror is suspended. **Note:** Mode 448 setting is available only when mode 449 is set to OFF.	OFF	-
449	Universal Replicator Universal Replicator for Mainframe	This mode is used to enable and disable detection of communication failures between the MCU and RCU. **Mode 449 = ON (default):** On the MCU side, checking read journal disruption from RCU is disabled, and monitoring read journal failures is disabled on the RCU side. **Mode 449 = OFF:** Detecting communication failures between the MCU and RCU is enabled.	ON	MCU

Mode	Category	Description	Default	MCU/RCU
		Notes: **1.** This mode applies when disabling the detection of communication failures between the MCU and RCU in UR/URz configuration is required. **2.** When this mode is set to ON, SOM 448 does not work. **3.** This mode setting is not changed by microcode upgrade. **4.** This mode is not effective for remote paths between an Initiator port on the MCU and a Target port on the RCU. **5.** While a path from the RCU to MCU is disconnected, if the UR/URz pair remains in Suspending or Deleting status, recover it in accordance with the procedure in Recovery from UR/URz Failure in TROUBLE SHOOTING section of Maintenance Manual.		
689	TrueCopy TrueCopy for Mainframe global-active device	Allows you to slow the initial copy and resync operations when the write-pending rate on the RCU exceeds 60%. **Mode 689 = ON:** The initial copy and resync copy operations are slowed down when the Write Pending rate on RCU exceeds 60%. If the CLPR write pending rate where the initial copy target secondary volume belongs to is not over 60% but that of MP PCB where the S-VOL belongs to is over 60%, the initial copy operation is slowed down. **Mode 689 = OFF (default):** The initial copy and resync copy operations are not slowed down when the Write Pending rate on RCU exceeds 60% (the same as before). **Notes:** **1.** This mode can be set online. **2.** The micro-programs on both MCU and RCU must support this mode. **3.** This mode should be set when requested by the user. **4.** Setting this mode to ON is recommended when GAD is installed, as the performance degradation is more likely to occur due to active-active I/Os. **5.** If the write-pending status remains at 60% or higher on the RCU for a long time, it takes extra time for the initial copy and resync copy to be completed due to the slower copy operations. **6.** Do not set this mode if the primary or secondary system is connected to USP V/VM with microcode earlier than 60-02-xx-xx/xx. If this mode is applied and the write-pending rate reaches 60%, pair suspend might occur.	OFF	Both

Mode	Category	Description	Default	MCU/RCU
		7. As this mode is enabled per storage system, in an environment where TC and GAD are used, this mode is applied to both program products. When GAD is installed in a storage system that already uses TC, TC initial copy might take longer time.		
769	TrueCopy TrueCopy for Mainframe Universal Replicator Universal Replicator for Mainframe	This mode applies only to VSP G1x00 and VSP F1500. Controls whether the retry operation is executed or not when a path creation operation is executed. (The function applies to both of CU FREE path and CU single path for Open and Mainframe). **Mode 769 = ON:** The retry operation is disabled when the path creation operation is executed (retry operation is not executed). **Mode 769 = OFF (default):** The retry operation is enabled when the path creation operation is executed (retry operation is executed). **Notes:** **1.** Apply this mode when the following three conditions are met: • SOM 114 is set to OFF (operation of automatically switching the port is disabled). • HMO 49 and HMO 50 are set to OFF (60-07-51-00/00 and later, 70-02-31-00/00 and later). • TPC-R or CSM is used (it is not applied in normal operation). **2.** When SOM 769 is set to ON, SOM 114, HMO 49 and HMO 50 must not be set to ON. **3.** In either of the following cases, the path creation operation might fail after automatic port switching is executed. • SOM 114 is set to ON. • HMO 49 and HMO 50 are set to ON.	OFF	Both
784	TrueCopy TrueCopy for Mainframe Global-active device	This mode can reduce the MIH watch time of RI/O for a TCz, TC, or GAD pair internally so that update I/Os can continue by using an alternate path without MIH or time-out occurrence in the environment where Mainframe host MIH is set to 15 seconds, or Open host time-out time is short (15 seconds or less). The mode is effective at initial pair creation or Resync operation for TCz, TC, or GAD. (Not effective by just setting this mode to ON.) This mode is applied to TCz, TC, and GAD. The mode supports Fibre remote copy paths but not iSCSI.	OFF	Both

Mode	Category	Description	Default	MCU/RCU
		Mode 784 = ON: The MIH time of RIO is internally reduced so that, even though a path failure occurs between storage systems in the environment where host MIH time is set to 15 seconds, update I/Os can be processed by using an alternate path promptly, lowering the possibility of host MIH occurrence. **Mode 784 = OFF (default):** The operation is processed in accordance with the TCz, TC, or GAD specification. **Notes:** **1.** This mode is applied to the environment where Mainframe host MIH time is set to 15 seconds. **2.** This mode is applied to the environment where OPEN host time-out time is set to 15 seconds or less. **3.** This mode is applied to reduce RI/O MIH time to 5 seconds. **4.** This function is available for all the TCz, TC, and GAD pairs on the storage system, unable to specify the pairs that are using this function or not. **5.** To apply the mode to TCz, MCU and RCU must be USP V/VM or later models and micro-program must be the support version on both sides. **6.** For a TCz, TC, or GAD pair with the mode effective (RI/O MIH time is 5 seconds), the setting of RI/O MIH time made at RCU registration (default is 15 seconds, which can be changed within range from 10 to 100 seconds) is invalid. However, RI/O MIH time displayed on Device Manager - Storage Navigator and CCI is not "5 seconds" but is what set at RI/O registration. **7.** If a failure occurs on the switched path between storage systems, Mainframe host MIH or Open server time-out may occur. **8.** If an MP to which the path between storage systems belongs is overloaded, switching to an alternate path delays and host MIH or time-out may occur. **9.** If an RI/O retry occurs due to other factors than RI/O MIH (5 sec), such as a check condition report issued from RCU to MCU, the RI/O retry is performed on the same path instead of an alternate path. If a response delay to the RI/O occurs constantly on this path due to path failure or link delay, host MIH or time-out may occur due to response time accumulation for each RI/O retried within 5 seconds. **10.** Even though the mode is set to ON, if Mainframe host MIH time or Open host time-out time is set to 10 seconds or less, host MIH		

Mode	Category	Description	Default	MCU/RCU
		or time-out may occur due to a path failure between storage systems. **11.** Operation commands are not available for promptly switching to an alternate path. **12.** The mode works for the pair for which initial pair creation or Resync operation is executed. **13.** Micro-program downgrade to an unsupported version cannot be executed unless all the TCz, TC, and GAD pairs are suspended or deleted. **14.** For operational specifications in each combination of MCU and RCU of TCz/TC, contact customer support (see SOM784 sheet). **15.** For GAD pairs, the mode is effective if the microcode version supports GAD. **16.** The mode does not support iSCSI paths between storage systems. When iSCSI is used for paths between storage systems, the time to switch to an alternate path cannot be reduced. For this, if a failure occurs on a path between storage systems in an environment where host time-out time is short, a time-out may occur on the host side. A time-out may also occur on the host side when a failure occurs on an iSCSI path between storage systems if storage system paths of Fibre and iSCSI coexist in an environment where host time-out time is short so that the configuration where storage system paths of Fibre and iSCSI coexist is not supported too.		
1015	Universal Replicator Universal Replicator for Mainframe	When a delta resync is performed in a 3DC multi-target configuration with TC and UR, this mode is used to change the pair status to PAIR/Duplex directly and then complete the delta resync. If the delta resync fails and all differential data items are copied, the pair status changes to COPY/Pending regardless of the SOM 1015 setting, and then it changes to PAIR/Duplex. When the existing delta resync function is required (pair status changes to COPY/Pending and then to PAIR/Duplex), set this mode to ON before performing delta resync. If SOM 1015 is set (ON or OFF) while delta resync is being peformed, the setting is not applied. **Mode 1015 = ON:** The pair status changes to COPY/Pending and then to PAIR/Duplex when a delta resync is performed in a 3DC multi-target configuration. **Mode 1015 = OFF (default):** The pair status changes directly to PAIR/Duplex when a delta resync is performed in a 3DC multi-target configuration. **Notes:**	OFF	MCU

Mode	Category	Description	Default	MCU/RCU
		1. The pair status changes directly to PAIR/Duplex when this mode is OFF (default). Set this mode to ON only when the status change to COPY/Pending and then PAIR/Duplex is required. **2.** Set this mode on the site of TC S-VOL in TC-UR 3DC configuration. If site switch by delta resync might occur, set this mode on both TC primary and secondary sites. **3.** For microcode versions and storage system models that do not support this mode, even if this mode is set to OFF on L site of TC-UR delta configuration, the behavior does not change but the status changes to COPY/Pending and then the delta resync is completed. **4.** Regardless of the remote command device setting, the copy status does not change to COPY/Pending and then the delta resync is completed. **5.** If a delta resync fails, all-data copy works. In this case, the pair status changes to COPY/Pending and then the delta resync is completed even when this mode is set to OFF. **6.** When this mode setting is default (OFF), a delta resync operation is completed without pair status change to COPY/Pending. Therefore, if an operation depends on the pair status changing to COPY/Pending, such as running the CCI pairevtwait command, set this mode to ON. **7.** When this mode setting is default (OFF) (pair status changes directly to PAIR/Duplex), SIMs and SSBs that are reported due to a pair status change to COPY/Pending are not reported. **8.** If this mode is set to ON or OFF during delta resync, the setting is not applied. Change this mode setting before delta resync. **9.** During delta resync, downgrading the microcode to a version that does not support this mode is disabled in TC-UR delta configuration. If microcode downgrade is disabled (FunctionID:0701) when delta resync is not in process, suspend the UR pair and then retry the microcode replacement.		
1050	Global-active device TrueCopy TrueCopy for Mainframe Universal Replicator	This mode applies only to VSP G1x00 and VSP F1500. This mode enables creation of pairs using user capacity in excess of 1.8 PB per system by managing differential BMP in hierarchical memory for pair volumes whose capacity is 4 TB (open) or 262,668 cyl (mainframe) or less.	OFF	Both

Mode	Category	Description	Default	MCU/RCU
	Universal Replicator for Mainframe	Mode 1050 = ON: For pair volumes of 4 TB (open)/ 262,668 cyl (mainframe) or less, differential BMP is managed in hierarchical memory that performs caching to CM/PM using HDD as a master and enables creation of pairs using user capacity in excess of 1.8 PB per system. For microcode 80-02-4x and later, you should use hierarchical memory for all remote copy pairs. Using SOMs 1050 and 1058 enables the use of hierarchical memory for volumes of 4 TB or less, which increases the total amount of replicated capacity above 1.8 PB. **WARNING**: If you allocate more than 1.8 PB of replicated capacity for volumes of 4 TB or less and then later want to return to using shared memory, you will have to delete some pairs to reduce the total replicated capacity for volumes of 4 TB or less to below 1.8 PB. **Mode 1050= OFF (default):** For pair volumes of 4 TB (open)/262,668 cyl (mainframe) or less, differential BMP is managed in SM as usual so that the user capacity to create pairs is limited to 1.8 PB per system. Also, differential MPB management can be switched from the hierarchical memory to SM by performing a resync operation for pairs whose volume capacity is 4 TB (open)/ 262,668 cyl (mainframe) or less. **Notes:** **1.** This mode is related to SOM 1058. **2.** The hierarchical memory is used for volumes over 4 TB (open)/262,668 cyl (mainframe) even when the mode is set to OFF. **3.** When the mode is turned OFF after operating with the mode set to ON, if resynchronizing pairs whose volume capacity is 4 TB (open)/ 262,668 cyl (mainframe) or less managed in the hierarchical memory, the pair resync operation might fail due to lack of the SM capacity. **4.** If a pair resync operation fails, the pairs exceeding 1.8 PB of user capacity need to be deleted. **5.** Open non-DP-VOLs do not support hierarchical memory differential management so that the mode cannot be applied. **6.** To downgrade the microcode, the procedure described in Maintenance Manual (Function ID 01:03 described in 03 MICRO-FC) is required. Refer to the manual before applying the mode. **7.** Apply this mode when you want to create pairs using user capacity exceeding 1.8 PB per system.		

Mode	Category	Description	Default	MCU/RCU
		8. Depending on the I/O pattern, I/O response might be affected. **9.** Depending on the condition, initial copy time might be affected. **10.** The differential BMP managed in hierarchical memory does not use the shared memory, but the differential data is managed in a pool with which the volumes are associated. For the pool capacity necessary for the differential data management, refer to the "Differential data" section in the user guide. **11.** Before using this SOM to increase pair volumes on the storage system, check the resources on the storage system to make sure all performance requirements are met.		
1058	Global-active device TrueCopy TrueCopy for Mainframe Universal Replicator Universal Replicator for Mainframe	This mode applies only to VSP G1x00 and VSP F1500. This mode can change differential BMP management from SM to hierarchical memory so that the number of pairs to be created on a system and user capacity used for pairs increase. • For mainframe systems, all pairs can be managed in hierarchical memory so that pairs can be created by all LDEVs. • For open systems, pairs that can only be managed in SM use SM so that the number of pairs that can be created using non-DP-VOLs increases. **Mode 1058 = ON:** When SOM 1050 is ON: • By resynchronizing mainframe VOLs of 262,668 cyl or less, the differential BMP management is switched from SM to hierarchical memory. Hierarchical memory management remains as is. • By resynchronizing open VOLs (DP-VOLs only) of 4 TB or less, the differential BMP management is switched from SM to hierarchical memory. Hierarchical memory management remains as is. When SOM 1050 is OFF: • By resynchronizing mainframe VOLs of 262,668 cyl or less, the differential BMP management is switched from hierarchical memory to SM. SM management remains as is. • By resynchronizing open VOLs (DP-VOLs only) of 4 TB or less, the differential BMP management is switched from hierarchical memory to SM. SM management remains as is. **Mode 1058 = OFF (default):**	OFF	Both

Mode	Category	Description	Default	MCU/RCU
		When SOM 1050 is ON: The differential BMP management does not change by resynchronizing pairs. When SOM 1050 is OFF: • By resynchronizing mainframe VOLs of 262,668 cyl or less, the differential BMP management is switched from hierarchical memory to SM. SM management remains as is. • By resynchronizing open VOLs (DP-VOLs only) of 4 TB or less, the differential BMP management is switched from hierarchical memory to SM. SM management remains as is. For microcode 80-02-4x and later, you should use hierarchical memory for all remote copy pairs. Using SOMs 1050 and 1058 enables the use of hierarchical memory for volumes of 4 TB or less, which increases the total amount of replicated capacity above 1.8 PB. **WARNING**: If you allocate more than 1.8 PB of replicated capacity for volumes of 4 TB or less and then later want to return to using shared memory, you will have to delete some pairs to reduce the total replicated capacity for volumes of 4 TB or less to below 1.8 PB. **Notes:** **1.** Depending on the I/O pattern, I/O response might be affected. **2.** Depending on the condition, initial copy time might be affected. **3.** The mode is related to SOM1050. **4.** Open non-DP-VOLs do not support hierarchical memory differential management so that the mode cannot be applied. **5.** To downgrade the microcode, the procedure described in Maintenance Manual Function ID 01:03 described in 03 MICRO-FC. is required. Refer to the manual before applying the mode. **6.** This mode is applied when increasing the number of pairs that can be created on a system or the user capacity for pairs is desired. **7.** The differential BMP managed in hierarchical memory does not use the shared memory, but the differential data is managed in a pool with which the volumes are associated. For the pool capacity necessary for the differential data management, refer to "Differential data" in the manuals for TC, UR, and GAD. Before using this SOM to increase pair volumes on the storage system, reexamine the resource on the storage system to make sure all performance requirements are met.		

Mode	Category	Description	Default	MCU/RCU
		8. Before using this SOM to increase pair volumes on the storage system, re-examine the resource on the storage system to make sure all performance requirements are met.		

Remote replication options

Synchronous copy operations affect the I/O performance on the host and on the primary and secondary systems. TrueCopy provides options for monitoring and controlling the impact of copy operations and for maximizing the efficiency and speed of copy operations to achieve the best level of backup data integrity. You can set the following remote replication options:

- Round trip time option on page 44
- Minimum number of remote paths option on page 47
- Maximum initial copy activities option on page 47
- Blocked path monitoring option on page 48
- Blocked path SIM monitoring option on page 48
- Services SIM of remote copy option on page 48

To optimize performance you also need to determine the proper bandwidth for your workload environment. For details, see Analyzing workload and planning data paths on page 49.

Round trip time option

When you set up the TrueCopy association between the primary and secondary systems, you specify a time limit in milliseconds (ms) for data to travel from the P-VOL to the S-VOL, which is called the round trip (RT) time. RT time is used to control the initial copy pace while update copy operations are in progress.

Note:

- If the difference between the RT time and the remote I/O response time is significant, the storage system slows down or can even interrupt the initial copy operation.
  An example of a significant difference is 1 ms RT time and 500 ms remote I/O response time.
- If the difference between the RT time and the remote I/O response time is insignificant, initial copying is allowed to continue at the specified pace.
  An example of an insignificant difference is 1 ms RT time and 5 ms remote I/O response time.
- You can adjust the RT time when the distance between the primary and secondary systems is long, or when there is a delay caused by the line

equipment. There can be a delay in completing the initial copy operation if it is performed with the default RT time instead of the appropriate value.
- The default RT time is 1 ms.

RT time can be set between 1 ms and 500 ms, depending on the following scenarios:

The following equation lets you set the appropriate RT time, in ms:

round-trip-time =

round-trip-time-between-the-primary-and-secondary-storage-systems × *number-of-responses* + *initial-copy-response-time* (ms)

If the physical path between the primary and secondary storage systems uses Fibre Channel technology, the number of responses depends on the host mode option (HMO) 51 setting.

Host mode option 51	Number of responses
OFF	2
ON	1

When HMO 51 is OFF (default), you must double the RT time because each data transfer between the primary and secondary storage systems involves two response sequences for each command issued.

When HMO 51 is ON, you do not need to double the value of the RT time, because the sequence is one response for each command issued.

If the physical path between the primary and secondary storage systems is an iSCSI, the number of response sequence is determined in proportion to the initial copy speed because the transferred data is divided into 64KB.

Initial copy speed	Number of responses
1	6
2	10
3	14
4	18

- Use the **`ping`** command when setting the RT time, or contact customer support. If you do not use channel extenders between the primary and secondary systems, specify "1".
- The *initial-copy-response-time* is the response time required for multiple initial copy operations.

Use the following equation in the table to determine the initial copy response time of the initial copy pace, the number of maximum initial copy, and the bandwidth of the channel extender communication lines between the primary and secondary systems.

Initial copy response time equation
Initial-copy-response-time = (1MB ÷ *data-path-speed-between-primary-and-secondary-systems* in MB/ms[1]) × (*initial-copy-pace*[2] ÷ 4) × (*maximum-initial-copy-activities*[3] ÷ number of *data-paths-between-the-primary-and-secondary-systems*[4])
Note: **1.** When you connect the primary system and secondary system without channel extenders, set the data path speed between the primary and secondary systems to one of the following values according to link speed: • 2 Gbps: 0.17 MB/ms • 4 Gbps: 0.34 MB/ms • 8 Gbps: 0.68 MB/ms • 10 Gbps: 0.85 MB/ms (VSP G1000, G1500, and VSP F1500) • 16 Gbps: 1.36 MB/ms • 32 Gbps: 2.72 MB/ms (VSP Gx00 models, VSP Fx00 models) **2.** For details about *initial-copy-pace*, see the next table. **3.** For *maximum-initial-copy-activities*, use the value set up per storage system. The default is 64. **4.** Even if the maximum initial copy activities or the number of *data-paths-between-primary-and-secondary-systems* is larger than 16, specify it as 16.

The following table shows the initial copy pace used in the initial copy response time equation.

Interface	**When executing initial copy only**		**When executing initial copy operations and update copy at the same time**	
	When initial copy pace specified at the time of pair creation is 1 to 4	**When initial copy pace specified at the time of pair creation is 5 to 15**	**When initial copy pace specified at the time of pair creation is 1 to 2**	**When initial copy pace specified at the time of pair creation is 3 to 15**
Device Manager - Storage Navigator	User-specified value	4	User-specified value	2
CCI	User-specified value	4	User-specified value	2

The following table shows examples for RT time settings for multiple initial copy operations.

Round trip time between primary and secondary system (ms)	Data path speed between primary and secondary systems (MB/ms)	Number of data paths between primary and secondary systems	Initial copy pace	Maximum initial copy activities	Round trip time specified (ms)
0	0.1	4	4	64	160
30	0.1	4	4	64	220
100	0.1	4	4	64	360

Minimum number of remote paths option

When you set up the TC association between the primary and secondary systems, you specify the minimum number of remote paths to the secondary system using the Minimum Number of Paths option (range = 1-8, default = 1). If the number of remote paths in Normal status drops below the specified minimum, the primary storage system splits the pairs to prevent remote copy operations from impacting host performance in the primary storage system.

- To maintain host performance in the primary storage system, set the minimum number of remote paths to at least 2 to ensure that remote copy operations are performed only when multiple paths are available.
- To continue remote copy operations even when there is only one remote path in Normal status, set the minimum number of remote paths to 1. Use this setting only when keeping pairs synchronized is more important than maintaining high performance in the primary storage system.

Note: You can use the fence level option to keep a P-VOL and S-VOL synchronized even if the pair is split because the number of remote paths drops below the minimum setting. The fence level setting, which you specify when you create a pair, determines whether the P-VOL continues to accept write I/Os after the pair is split due to an error. For details, see Allowing I/O to the P-VOL after a split: Fence Level options on page 61.

Maximum initial copy activities option

TC initial copy activities can impact the performance of the primary site, depending on the amount of I/O activity and the number of pairs being created at the same time. The maximum initial copy activities option allows you to specify the maximum number of concurrent initial copy operations that the storage system can perform. For example, when the maximum initial copy activities is set to 64 and you add 65 TC pairs at the same time, the primary system starts the first 64 pairs and will not start the 65th pair until one of the first 64 pairs is synchronized.

You can also enable or disable the CU option for the maximum initial copy activities setting. If the CU option is enabled, you can specify the maximum

concurrent initial copy operations for each CU (range = 1-16, default = 4), and if it is disabled, you cannot specify the setting separately for each CU. If the CU option is enabled and you set a value larger than the system setting for maximum initial copy activities for a CU, the system setting for maximum initial copy activities is observed.

You can specify the maximum initial copy activities option only using the TC software. This option cannot be specified using CCI.

The default maximum initial copy activities setting is 64 volumes. You can set a number from 1 to 512. If the maximum initial copy activities setting is too large, pending processes in the secondary site can increase, and this can impact the remote I/O response time to the update I/Os. You can change this setting using the Edit Remote Replica Options window. For instructions, see Setting the remote replication options on page 107.

Blocked path monitoring option

The blocked path monitoring setting allows you to specify the time (in seconds) for the system to monitor blocked paths. The range is from 2 to 45 seconds. The default is 40 seconds.

If all paths become monitored because of a path error, an MIH might occur in the host. Therefore, the time you specify must be less than the host's MIH timer setting.

If iSCSI is used in a remote path, the blocked path monitoring option must be set to at least 40 seconds (default). If blocked path monitoring is less than 40 seconds, the path might be blocked due to a delay in the network such as many switches in a spanning tree protocol (STP) network or a long distance connection.

Blocked path SIM monitoring option

The blocked path SIM monitoring setting allows you to specify the time (in seconds) for the system to monitor SIMs reported for blocked paths. The range is from 2 to 100 seconds. The default is 70 seconds.

The blocked path SIM monitoring setting must be larger than the blocked path monitoring setting.

Services SIM of remote copy option

The services SIM of remote copy option allows you to specify whether services SIMs are reported to the host. During TC operations, the primary and secondary storage systems generate a service SIM each time the pair status of the P-VOL or S-VOL changes for any reason, including normal status transitions (for example, when a newly created pair becomes synchronized). SIMs generated by the primary storage system include the P-VOL device ID

(byte 13), and SIMs generated by the secondary storage system include the S-VOL device ID (byte 13).

If you enable the services SIM of remote copy option for the storage system, all CUs will report services SIMs to the host. If desired, you can enable this option at the CU level to configure specific CUs to report services SIMs to the host.

Analyzing workload and planning data paths

You can optimize copy operations and system performance by carefully planning bandwidth, number of data paths, number of host interface paths, and number of ports. Check with customer support for more information.

- Analyze write-workload. You need to collect workload data (MB/s and IOPS) and analyze your workload to determine the following parameters:
  - Amount of bandwidth
  - Number of data paths
  - Number of host interface paths
  - Number of ports used for TrueCopy operations on the primary and secondary systems

  Thorough analysis and careful planning of these key parameters can enable your system to operate free of bottlenecks under all workload conditions.
- If you are setting up TrueCopy for disaster recovery, make sure that secondary systems are attached to a host server to enable both the reporting of sense information and the transfer of host failover information. If the secondary site is unattended by a host, you must attach the secondary storage systems to a host server at the primary site so that the system administrator can monitor conditions at the secondary site.

Data path requirements and configurations

A data path must be designed to adequately manage all possible amounts of data that could be generated by the host and sent to the P-VOL and S-VOL. This topic provides requirements and planning considerations for the following key elements of the data path:

- Bandwidth requirements on page 50
- Fibre Channel requirements on page 50
- Supported data path configurations for Fibre Channel on page 51
- iSCSI requirements and cautions on page 57
- Ports on page 58

Note:

- Create at least two independent data paths (one per cluster) between the primary and secondary systems for hardware redundancy for this critical element.
- When creating more than 4,000 pairs, restrict the number of pairs so that a maximum of 4,000 pairs use one physical path to distribute the loads on the physical paths.
- In a disaster recovery scenario, the same write-workload will be used in the reverse direction. Therefore, when planning TrueCopy for disaster recovery, configure the same number of secondary-to-primary data paths as primary-to-secondary copy paths to maintain normal operations during disaster recovery. Reverse direction paths must be set up independently of the primary-to-secondary paths.
- When you set up secondary-to-primary data paths, specify the same combination of CUs or CU Free and the same path group ID as specified for the primary-to-secondary paths.

Bandwidth requirements

Sufficient bandwidth must be present to handle data transfer of all workload levels. The amount of bandwidth required for your TrueCopy system is based on the amount of I/O sent from the host to the primary system. You determine required bandwidth by measuring write-workload. Workload data is collected using performance monitoring software. Consult customer support for more information.

Fibre Channel requirements

The primary and secondary systems must be connected using multimode or single-mode optical fibre cables. As shown in the following table, the cables and data path relay equipment required depend on the distance between the P-VOL and S-VOL storage systems.

Distance	Fibre cable type	Data path relay equipment
0 km to 1.5 km (4,920 feet)	Multimode shortwave Fibre Channel interface cables.	Switch is required for 0.5 km to 1.5 km.
1.5 km to 10 km (6.2 miles)	Single-mode longwave[2] optical fibre cables.	Not required.
10 km to 30 km (18.6 miles)	Single-mode longwave[2] Fibre Channel interface cables.	Switch is required.
Greater than 30 km (18.6 miles)[1]	Communications lines are required.	Approved third-party channel extender products.[3]

Notes:

1. TrueCopy operations typically do not exceed 30 km.
2. Longwave cannot be used for FCoE.
3. For more information about approved channel extenders, contact HDS (see Getting help on page 13.

With Fibre Channel connections, no special settings are required for the physical storage system.

Direct connections up to 10 km with single-mode longwave Fibre Channel interface cables are supported. Link speed determines the maximum distance you can transfer data and still achieve good performance. The following table shows maximum distances at which performance is maintained per link speed, over single-mode longwave Fibre Channel.

Link speed	Distance maximum performance maintained
1 Gbps	10 km
2 Gbps	6 km
4 Gbps	3 km
8 Gbps	2 km
16 Gbps	1 km
32 Gbps (VSP Gx00 models or VSP Fx00 models)	0.6 km

Customer support can provide the latest information about the availability of serial-channel TrueCopy connections.

Supported data path configurations for Fibre Channel

Three Fibre Channel configurations are supported for TrueCopy:

- Direct connection on page 52
- Switch connection on page 54
- Extender connection on page 56

LUN Manager is used to set port topology.

For direct and switch connections, host I/O response time can be improved on long distance direct connections (longwave, less than 10km/6.2 miles) by improving the I/O response time between storage systems and by using host mode options 49 and 50, or 51. The following table describes these options for the open package. A Hitachi Data Systems-approved channel extender is required. For more information on host mode options, see the *Provisioning Guide* for your storage system.

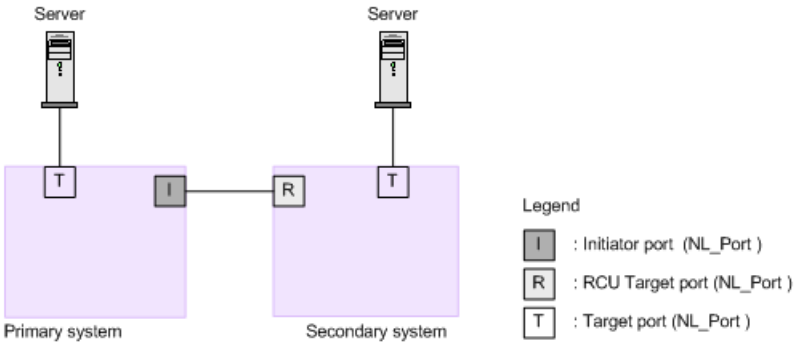
No	Host mode options	Description
49	BB Credit Set Up Option 1	Fixes higher values of buffer-to-buffer credits (BBCs) to increase data transfer size over long distances.[1] This host mode option must be used in conjunction with host mode option 50.[2]
50	BB Credit Set Up Option 2	Fixes higher values of buffer-to-buffer credits (BBCs) to increase data transfer size over long distances.[1] This host mode option must be used in conjunction with host mode option 49.[2]

No	Host mode options	Description
51	Round Trip Set Up Option	Improves host I/O response time for long distance switch connections.[2]

Notes:
1. Up to 10 km for direct connection and 100 km for switch connection.
2. The microcode or firmwaresupporting these functions must be installed on both the primary and secondary systems.

Direct connection

The following figure shows a direct connection, in which two devices are connected directly together.



As shown in the following table, Fab settings, topology settings, and available link speed depend on the settings of the packages and protocols used for the storage system connections, as well as whether the host mode option 51 is used.

Note: If you connect storage systems using iSCSI, host mode option settings become invalid.

If you are using VSP Gx00 models or VSP Fx00 models, see the following information.

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
4HF8	8 GbpsFC	OFF	OFF	FC-AL	• 2 Gbps • 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
2HF16	16 GbpsFC	OFF	OFF	FC-AL	• 2 Gbps

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
					• 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
4HF32R[1]	16 GbpsFC	OFF	OFF	FC-AL	• 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
	32 GbpsFC	OFF	OFF	FC-AL	• 8 Gbps
		ON	OFF	Point-to-Point	• 8 Gbps • 16 Gbps • 32 Gbps
2HS10S	10 Gbps iSCSI	N/A	N/A	N/A	10 Gbps
2HS10B	10 Gbps iSCSI (10G BASE-T)	N/A	N/A	N/A	• 10 Gbps • 1 Gbps

Notes:

1. 4HF32R (4 ports, FC 32 Gbps Ready Package) supports multiple transfer speed protocol. Depending on the mounted SFP parts, you can use either the 16 Gpbs or 32 Gbps protocol.

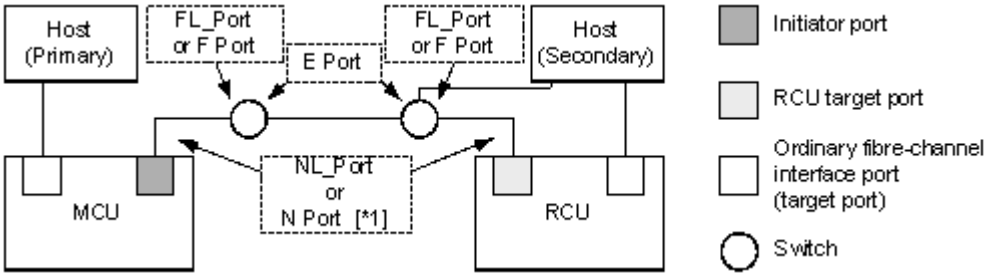
If you are using VSP G1000 and G1500, and VSP F1500, see the following information.

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
16FC8	8 GbpsFC	OFF	OFF	FC-AL	• 2 Gbps • 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
8FC16	16 GbpsFC	OFF	OFF	FC-AL	• 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
16FC16	16 GbpsFC	OFF	OFF	FC-AL	• 4 Gbps • 8 Gbps
		ON	OFF	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
8IS10	10 GbpsiSCSI	N/A	N/A	N/A	10 Gbps

Switch connection

The following figure shows a switch connection.



Some switch vendors require F port connectivity (for example, McData ED5000).

As shown in the following table, Fab settings, topology settings, and available link speed depend on the settings of the packages and protocols used for the storage system connections, as well as whether the host mode option 51 is used.

If you are using VSP Gx00 models or VSP Fx00 models, see the following information.

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
4HF8	8 GbpsFC	OFF	ON	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
		ON	ON	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
2HF16	16 GbpsFC	OFF	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
		ON	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
4HF32R[1]	16 GbpsFC	OFF	ON	Point-to-Point	• 4 Gbps • 8 Gbps

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
					• 16 Gbps
		ON	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
	32 GbpsFC	OFF	ON	Point-to-Point	• 8 Gbps • 16 Gbps • 32 Gbps
		ON	ON	Point-to-Point	• 8 Gbps • 16 Gbps • 32 Gbps
2HS10S	10 Gbps iSCSI	N/A	N/A	N/A	• 10 Gbps
2HS10B	10 Gbps iSCSI (10 GBASE-T)	N/A	N/A	N/A	• 10 Gbps • 1 Gbps
Notes: **1.** 4HF32R (4 ports, FC 32 Gbps Ready Package) supports multiple transfer speed protocol. Depending on the mounted SFP parts, you can use either the 16 Gpbs or 32 Gbps protocol.					

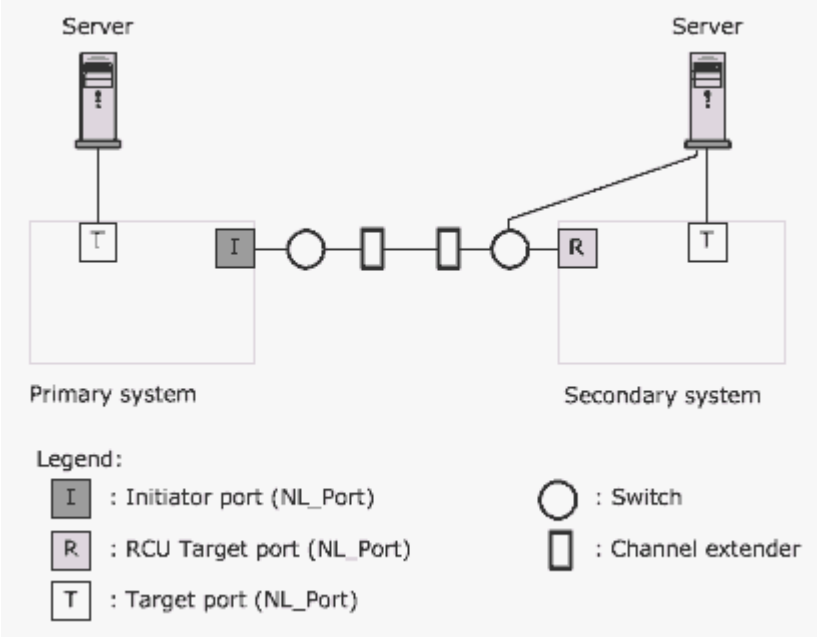
If you are using VSP G1000 and G1500, and VSP F1500, see the following information.

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
16FC8	8GbpsFC	OFF	ON	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
		ON	ON	Point-to-Point	• 2 Gbps • 4 Gbps • 8 Gbps
8FC16	16GbpsFC	OFF	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
		ON	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
16FC16	16GbpsFC	OFF	ON	Point-to-Point	• 4 Gbps • 8 Gbps • 16 Gbps
		ON	ON	Point-to-Point	• 4 Gbps • 8 Gbps

Package name	Protocol	Host mode option 51	Fab	Initiator port and RCU target port topology	Available link speed
					• 16 Gbps
16FE10	10GbpsFCoE	OFF	ON	Point-to-Point	• 10 Gbps
		ON	ON	Point-to-Point	• 10 Gbps
8IS10	10GbpsiSCSI	N/A	N/A	N/A	10 Gbps

Extender connection

The following figure shows an extender connection, in which channel extenders and switches are used to connect the devices across large distances. Make sure that the extender supports remote I/O. For more information contact customer support.



Set the Fabric to ON for the initiator port and the RCU target port, and then set the topology to Point-to-Point.

Caution: Data traffic might concentrate on one switch when you perform the following actions:

- Use a switch to connect the primary system and the secondary systems with an extender
- Gather several remote copy paths in one location

If you are using a Hitachi switch to make the connection, contact customer support.

iSCSI requirements and cautions

For the iSCSI interface, direct, switch, and channel extender connections are supported. The following table lists the requirements and cautions for systems using iSCSI data paths. For details about the iSCSI interface, see the *Provisioning Guide* for your storage system.

Item	Requirement
iSCSI front-end director	The 8IS10 (10 Gbps) front-end director (FED) is required for remote copy connections.
Remote paths	Add only remote paths of the same protocol to a single path group. Make sure that Fibre Channel and iSCSI remote paths are not mixed in a path group. If iSCSI is used in a remote path, the blocked path monitoring remote replica option must be set to at least 40 seconds (default). If blocked path monitoring is less than 40 seconds, the path might be blocked due to a delay in the network such as many switches in a spanning tree protocol (STP) network or a long distance connection. For instructions, see Setting the remote replication options on page 107.
Physical paths	• Before replacing Fibre Channel or iSCSI physical paths, remove the TC pair and the remote path that are using the physical path to be replaced. • It is recommended that you use the same protocol in the physical paths between the host and the storage system and between storage systems. As in the example below, if protocols are mixed, set the same or a greater command timeout value between the host and a storage system than between storage systems. Example: - Physical path between the host and a storage system: Fibre Channel - Physical path between storage systems: iSCSI
Ports	• When the parameter settings of an iSCSI port are changed, the iSCSI connection is temporarily disconnected and then reconnected. To minimize the impact on the system, change the parameter settings when the I/O load is low. • If you change the settings of an iSCSI port connected to the host, a log might be output on the host, but this does not indicate a problem. In a system that monitors system logs, an alert might be output. If an alert is output, change the iSCSI port settings, and then check if the host is reconnected. • When you use an iSCSI interface between storage systems, disable Delayed ACK in the Edit Ports window. By default, Delayed ACK is enabled. If Delayed ACK is enabled, it might take time for the host to recognize the volume used by a TC pair. For example, when the number of volumes is 2,048, it takes up to 8 minutes. • Do not change the default setting (enabled) of Selective ACK for ports. • In an environment in which a delay occurs in a line between storage systems, such as long-distance connections, you must set an optimal window size of iSCSI ports in storage systems at the primary and secondary sites after verifying various sizes. The maximum value you can set is 1,024 KB. The default window size is 64 KB, so you must change this setting. • iSCSI ports do not support fragment processing (dividing a packet). When the maximum transmission unit (MTU) of a switch is smaller than that of

Item	Requirement
	an iSCSI port, packets might be lost, and data cannot be transferred correctly. The MTU value for the switch must be the same as or greater than the MTU value for the iSCSI port. For details of the MTU setting and value, see the user documentation for the switch. The MTU value for the iSCSI port must be greater than 1500. In a WAN environment in which the MTU value is 1500 or smaller, fragmented data cannot be transferred. In this case, lower the maximum segment size (MSS) of the WAN router according to the WAN environment, and then connect to an iSCSI port. Alternatively, use a WAN environment in which the MTU value is greater than 1500. • When using a remote path on the iSCSI port for which virtual port mode is enabled, use the information about the iSCSI port that has virtual port ID (0). You cannot use virtual port IDs other than 0 as a virtual port. • On VSP Gx00 models and VSP Fx00 models, a port can be used for connections to the host (target attribute) and to a storage system (initiator attribute). However, to minimize the impact on the system, if a failure occurs either on the host or in a storage system, you should connect the port for the host and for the storage system to separate CHBs.
Network setting	• Disable the spanning tree setting for a port on a switch connected to an iSCSI port. If the spanning tree function is enabled on a switch, packets do not loop through a network when the link is up or down. When this happens, packets might be blocked for about 30 seconds. If you need to enable the spanning tree setting, enable the Port Fast function of the switch. • In a network path between storage systems, if you use a line that has a slower transfer speed than the iSCSI port, packets are lost, and the line quality is degraded. Configure the system so that the transfer speed for the iSCSI ports and the lines is the same. • Delays in lines between storage systems vary depending on system environments. Validate the system to check the optimal window size of the iSCSI ports in advance. If the impact of the line delay is major, consider using devices for optimizing or accelerating the WAN. • When iSCSI is used, packets are sent or received using TCP/IP. Because of this, the amount of packets might exceed the capacity of a communication line, or packets might be resent. As a result, performance might be greatly affected. Use Fibre Channel data paths for critical systems that require high performance.

Ports

Data is transferred along the data path from the initiator ports on the primary storage system to the RCU target ports on the secondary storage systems. The amount of data each of these ports can transfer is limited.

Therefore, you must know the amount of data that will be transferred (that is, the write-workload) during peak periods. You can then ensure that bandwidth meets data transfer requirements, that the primary storage system has a sufficient number of initiator ports, and that the secondary storage system has a sufficient number of RCU target ports to handle peak workload levels.

Port requirements (VSP G1000, G1500, and VSP F1500)

Data is sent from the primary storage system port through the data path to the port on the secondary storage system.

- One secondary system port can be connected to a maximum of 16 ports on a primary system.
- The number of remote paths that can be specified does not depend on the number of ports configured for TrueCopy. You can specify the number of remote paths for each remote connection.
- Do not add or delete a remote connection or add a remote path at the same time that the SCSI path definition function is in use.

Port attributes (VSP G1000, G1500, and VSP F1500)

Plan and define the following Fibre Channel port attributes for TrueCopy:

- Initiator ports, which send data. One initiator port can be connected to a maximum of 64 RCU target ports. Configure initiator ports on both the primary and secondary systems for TrueCopy disaster recovery operations.
- RCU target ports, which receive data. Configure RCU target ports on both the primary and secondary systems for TrueCopy disaster recovery operations.
- Target port: Connects the storage system and a host. When the host issues a write request, the request is sent to a volume on the system through a target port on the storage system. Target ports must be configured on the primary system for TrueCopy operations.
- External port: Required for Universal Volume Manager copy operations. This port is not used for TrueCopy copy operations. This port can be changed to a target, initiator, or RCU target port.

Planning pairs and pair volumes

This section discusses requirements, options, and settings you need for setting up pairs and pair volumes. You begin by:

- Identifying data and volumes at the primary site that you want to protect with a backup
- Setting up volumes at the secondary site that will hold copied data.

The following helps ensure that the pairs you create fit your requirements.

- Pair volume requirements and recommendations on page 60
- Allowing I/O to the S-VOL on page 61
- Allowing I/O to the P-VOL after a split: Fence Level options on page 61
- Differential data on page 62
- Maximum number of pairs supported on page 63
- Options and settings for number of pairs copied, and their priority, during the initial copy and resync operations. For details, see Initial copy priority option and scheduling order on page 66

Pair volume requirements and recommendations

The following is provided to help you prepare TrueCopy volumes:

- A volume can be assigned to only one pair.
- Logical units on the primary and secondary storage systems must be defined and formatted prior to pairing.
- The P-VOL and S-VOL must be equal in size.
- TrueCopy requires a one-to-one relationship between the P-VOL and S-VOL. The P-VOL cannot be copied to more than one S-VOL, and an S-VOL cannot have more than one P-VOL.
- Logical Unit (LU) types
  - (VSP G1000, G1500, and VSP F1500) TrueCopy supports the basic LU types that can be configured on VSP G1000 and G1500, and VSP F1500 (for example, OPEN-3, OPEN-E, OPEN-8, OPEN-9, OPEN-L, and OPEN-V).
  - (VSP Gx00 models and VSP Fx00 models) TrueCopy supports only OPEN-V.
  - Pair volumes must consist of LUs of the same type and capacity (for example, OPEN-3 to OPEN-3). The P-VOL and S-VOL LU types display in Device Manager - Storage Navigator.
  - (VSP G1000, G1500, and VSP F1500) Multi-platform volumes (for example, 3390-3A/B/C) cannot be assigned to pairs. Contact customer support for the latest information about supported devices for your platform.
- TrueCopy operates on volumes rather than on files. Multi-volume files require special attention. For complete duplication and recovery of a multi-volume file (for example, a large database file that spans several volumes), make sure that all volumes of the file are copied to TrueCopy S-VOLs.
- TrueCopy pair volumes can be shared with non-TrueCopy Hitachi software products. For details, see Sharing TrueCopy volumes on page 87.
- TrueCopy supports Virtual LVI/LUN. This allows you to configure LUs that are smaller than standard LUs. When custom-size LUs are assigned to a TrueCopy pair, the S-VOL must have the same capacity as the P-VOL. Device Manager - Storage Navigator displays the size of P-VOLs and S-VOLs.
- Before creating multiple pairs during the Create Pairs operation, make sure to set up S-VOL LDEVs to allow the system to correctly match them to P-VOLs.

  You must do this because, even though you select multiple volumes as P-VOLs, you specify just one S-VOL. The system automatically assigns subsequent secondary system LDEVs as S-VOLs based on the option you specify for Selection Type. These are the options:
  - Interval: The interval you specify will be skipped between LDEV numbers in the secondary system.

For example, suppose you specify LU 01 as the initial (base) S-VOL, and specify 3 for Interval. This results in secondary system LDEV 04 being assigned to the next P-VOL, 07 assigned to the subsequent P-VOL, and so on. To use Interval, you set up secondary system LDEV numbers according to the interval between them.

- Relative Primary Volume. The difference is calculated between the LDEV numbers of two successive P-VOLs. S-VOLs are assigned according to the closest LUN number.
  For example, if the LUN numbers of three P-VOLs are 1, 5, and 6 and you set LUN numbers for the initial S-VOL (Base Secondary Volume) at 2, the LUN numbers of the three S-VOLs will be set at 2, 6, and 7, respectively.

- Because the contents of the P-VOL and S-VOL are identical, the S-VOL can be considered a duplicate of the P-VOL. Because the host operating system does not allow duplicate volumes, the host system administrator must take precautions to prevent system problems related to duplicate volumes. You must define the S-VOLs so they do not auto mount or come online to the same host at the same time as the P-VOLs.
  TrueCopy does not allow the S-VOL to be online (except when the pair is split). If the S-VOL is online, the TrueCopy paircreate operation will fail.

Caution: When P-VOLs and S-VOLs are connected to the same hosts, define the S-VOLs to remain offline even after the hosts are restarted. If a pair is released and a host is subsequently restarted, the S-VOL should remain offline to prevent errors due to duplicate volumes.

Allowing I/O to the S-VOL

The secondary system rejects write I/O to the S-VOL, unless the Secondary Volume Write option is enabled. Then, read and write I/O is allowed to the S-VOL while the pair is split. In this instance, S-VOL and P-VOL track maps keep track of differential data and are used to re-synchronize the pair. Enabling Secondary Volume Write is done during the pairsplit operation.

- You can write to S-VOL when the split operation is performed from the primary system.
- When you resync a pair with the Secondary Volume Write option enabled, the secondary system sends S-VOL differential data to the primary system. This data is merged with P-VOL differential data, and out-of sync tracks are determined and updated on both systems, thus ensuring proper resynchronization.

Allowing I/O to the P-VOL after a split: Fence Level options

You can specify whether the host is denied access or continues to access the P-VOL when the pair is split due to an error. This is done with the Primary

Volume Fence Level setting. You specify one of the following Fence Level options during the initial copy and resync operations. You can also change the Fence Level option outside these operations.

- Data – the P-VOL is fenced if an update copy operation fails. This prevents the host from writing to the P-VOL during a failure. This setting should be considered for the most critical volumes for disaster recovery. This setting reduces the amount of time required to analyze the consistency of S-VOL data with the P-VOL during disaster recovery efforts.
- Status – the P-VOL is fenced only if the primary system is not able to change S-VOL status to Suspend when an update copy operation fails. If the primary system successfully changes S-VOL pair status to Suspend, subsequent write I/O operations to the P-VOL will be accepted, and the system will keep track of updates to the P-VOL. This allows the pair to be resynchronized quickly. This setting also reduces the amount of time required to analyze S-VOL consistency during disaster recovery.
- Never – the P-VOL is never fenced. This setting should be used when I/O performance outweighs data recovery. "Never" ensures that the P-VOL remains available to applications for updates, even if all TrueCopy copy operations have failed. The S-VOL might no longer be in sync with the P-VOL, but the primary system keeps track of updates to the P-VOL while the pair is suspended. Host failover capability is essential if this fence level setting is used. For disaster recovery, the consistency of the S-VOL is determined by using the sense information transferred by host failover or by comparing the S-VOL contents with other files confirmed to be consistent.

Differential data

Differential data is managed with bitmaps in units of tracks. Tracks that receive a write instruction while a pair is being split are managed as differential bitmaps.

With storage systems, data is stored in units of tracks using bitmaps, and is then used to resynchronize the pair.

- If your primary system is other than VSP G1000 and G1500, and VSP F1500, and the secondary system is VSP G1000 and G1500, or VSP F1500, specify track as the differential data management unit in the primary system. VSP G1000 and G1500, and VSP F1500 support only tracks. Therefore, if you specify cylinders, TCz pairs cannot be created.
- If you use CCI, even though CCI allows you to specify track or cylinder, only track will be used by VSP G1000 and G1500, and VSP F1500 storage systems.
- If you are making a TC pair with DP-VOL whose size is larger than 4,194,304 MB (8,589,934,592 blocks), the differential data is managed by the pool to which the TC pair volume is related. In this case, additional pool capacity (up to 4 pages, depending on the software configuration) is required for each 4,123,168,604,160-byte increase in user data.

Note: The following procedure is to release the differential data (pages) managed by the pool:

1. Delete all the pairs that use the V-VOL for which you want to release the pages.
2. Set system option mode 755 to OFF.
   This action enables zero pages to be reclaimed.
3. Restore the blocked pool.
4. Release the V-VOL pages.
   For Device Manager - Storage Navigator, use the Reclaim Zero Pages window.
   For CCI, use the **`raidcom modify ldev`** command.

You need to release differential data pages when you downgrade to the microcode or firmware version that does not support TC pair creation using DP-VOLs larger than 4,194,304 MB. The amount of time it takes to release differential data pages depends on the number of specified volumes, DP-VOL capacity, the number of allocated pages, and the storage system's workload. It also depends on the type of storage system. In some cases, it could take days to release all the differential data pages.

- After you create a TC pair with DP-VOL whose size is larger than 4,194,304 MB (8,589,934,592 blocks), data management might fail due to the insufficient pool capacity. In this case, all the P-VOL data is copied to the S-VOL in units of tracks when you perform the TC pair resync operation.

Maximum number of pairs supported

The maximum number of TrueCopy pairs is as follows:

- VSP G200: 2,048
- VSP G400, G600 or VSP F400, F600: 4,096
- VSP G800 or VSP F800: 16,384
- VSP G1000 and G1500, and VSP F1500: 65,280

If CCI is used, a command device must be defined for each product, therefore the maximum numbers of pairs is as follows:

- VSP G200: 2,047
- VSP G400, G600 or VSP F400, F600: 4,095
- VSP G800 or VSP F800: 16,383
- VSP G1000 and G1500, and VSP F1500: 65,279

The number of LDEVs, not the number of LUs, is used to determine the maximum number of pairs.

Calculating the maximum number of pairs

It is necessary to calculate the maximum number of pairs you can have on the storage system. The maximum number is based on the following:

- The number of cylinders in the volumes, which must be calculated.
- The number of bitmap areas required for a TrueCopy volume, which is calculated using the number of cylinders.
  If the volume size is larger than 4,194,304 MB (8,589,934,592 blocks), the bitmap area is not used. Therefore, you do not need to calculate the maximum number of pairs when creating TC pairs with a DP-VOL whose size is larger than 4,194,304 MB (8,589,934,592 blocks).

Note: In the following formulas: for `ceil()`, round up the result within the parentheses to the nearest integer, and for `floor()`, round down the result within the parentheses to the nearest integer.

Procedure

1. Calculate the number of cylinders.
   a. Calculate the system's number of logical blocks, which is the volume capacity measured in blocks.
      ```
      Number of logical blocks = Volume capacity (bytes) / 512
      ```
   b. Calculate the number of cylinders.

      For OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L, OPEN-K:

      ```
      Number of cylinders = ceil ( (ceil (Number of logical
      blocks / 96) ) / 15)
      ```

      For OPEN-V:

      ```
      Number of cylinders = ceil ( (ceil (Number of logical
      blocks / 512) ) / 15)
      ```
2. Calculate the number of bitmap areas per volume.
   In the following calculation, differential data is measured in bits. 122,752 bits is the amount of differential data per bitmap area.

   For OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L, OPEN-K, and OPEN-V:

   ```
   Number of bitmap areas = ceil ( (Number of cylinders × 15) /
   122,752)
   ```

   Note: Performing this calculation for multiple volumes can result in inaccuracies. Perform the calculation for each volume separately, and then total the bitmap areas. The following examples show correct and incorrect calculations. Two volumes are used: one volume of 10,017 cylinders, and another volume of 32,760 cylinders

Correct calculation

```
ceil ((10,017 × 15) / 122,752) = 2

ceil ((32,760 × 15) / 122,752) = 5
```

Total: 7

Incorrect calculation

```
10,017 + 32,760 = 42,777 cylinders

ceil ((42,777 × 15) / 122,752) = 6
```

Total: 6

---

3. Calculate the maximum number of pairs, which is restricted by the following:

- The number of bitmap areas required for TrueCopy (calculated above).
- The total number of bitmap areas in the storage system. The number of bitmap areas is as follows:

  VSP G200: 36,000
  VSP G400, G600, G800, and VSP F400, F600, F800: 65,536
  VSP G1000, VSP G1500, and VSP F1500: 65,536

  Bitmap areas are also used by TrueCopy for Mainframe, Universal Replicator, Universal Replicator for Mainframe, and global-active device.
  Therefore, when you use these software applications together, reduce the number of bitmap areas for each software application from the total number of bitmap areas for the storage system before calculating the maximum number of pairs for TrueCopy in the following formula.
  Also, when TrueCopy and Universal Replicator, Universal Replicator for Mainframe share the same volume, regardless of whether the shared volume is primary or secondary, reduce the number of bitmap areas for each software application from the total number of bitmap areas for the storage system before calculating the maximum number of pairs for TrueCopy in the following formula. For more information on calculating the number of bitmap areas required for each software application, see the relevant user guide.

Use the following formula:

```
Maximum number of pairs = floor (Total number of bitmap areas
in the storage system / Required number of bitmap areas)
```

(VSP G1000, G1500, and VSP F1500) If the calculated maximum number of pairs exceeds the total number of LDEVs of the storage system, and the total number of LDEVs of the storage system is less than 65,280,

then the total number of LDEVs of the storage system becomes the maximum number of pairs.

(VSP Gx00 models and VSP Fx00 models) Calculate the maximum number of pairs using the already calculated necessary number of bitmap areas and the number of bitmap areas in storage systems listed in the following table. The number of bitmap areas in a storage system is determined by the storage system model and the availability of control memory extended for TC.

Extension status of control memory for TC	Number of bitmap areas in storage systems
No Extension	Depends on the model: • VSP G200: 3,712 • VSP G400, G600, G800 or VSP F400, F600, F800: 0
With Extensions	Depends on the model: • VSP G200: 36,000 • VSP G400, G600, G800 or VSP F400, F600, F800: 65,636

Initial copy priority option and scheduling order

When you create multiple pairs at the same time and you specify more pairs than the maximum initial copy activities setting, you can control the order in which the initial copy operations are performed using the Initial Copy Priority option.

The following two examples illustrate how to use the Initial Copy Priority option.

Note: The Initial Copy Priority option can be specified only by using the TrueCopy software. When you create pairs using CCI, the initial copy operations are performed according to the order in which the commands are issued.

Example 1: Creating more pairs than the Maximum Initial Copy Activities setting

In this example, you are creating four pairs at the same time, and the Maximum Initial Copy Activities option is set to 2. To control the order in which the pairs are created, you set the Initial Copy Priority option in the Create TC Pairs window as shown in the following table.

P-VOL	Initial Copy Priority setting
LDEV 00	2
LDEV 01	3
LDEV 02	1

P-VOL	Initial Copy Priority setting
LDEV 03	4

The following table shows the order in which the initial copy operations are performed and the Initial Copy Priority settings for the P-VOLs.

Order of the initial copy operations	P-VOL	Initial Copy Priority setting
1	LDEV 02	1
2	LDEV 00	2
3	LDEV 01	3
4	LDEV 03	4

Because the Maximum Initial Copy Activities setting is 2, the initial copy operations for LDEV 02 and LDEV 00 are started at the same time. When one of these initial copy operations is completed, the initial copy operation for LDEV 01 is started. When the next initial copy operation is completed, the initial copy operation for LDEV 03 is started.

Example 2: New pairs added with initial copy operations in progress

In this example, you have already started the initial copy operations for the four pairs shown above (LDEVs 00-03) with the Maximum Initial Copy Activities option set to 2, and then you create two more pairs (LDEVs 10 and 11) while the initial copy operations for the first four pairs are still in progress. To control the order in which the pairs are created, you set the Initial Copy Priority option for the new pairs as shown in the following table.

P-VOL	Initial Copy Priority setting
LDEV 10	2
LDEV 11	1

The two new initial copy operations are started after all four of the previously scheduled initial copy operations are completed. The following table shows the order in which the initial copy operations are performed for all six pairs and the Initial Copy Priority setting for each pair.

Order of the initial copy operations	P-VOL	Initial Copy Priority setting	Remarks
1	LDEV 02	1	Previously scheduled.
2	LDEV 00	2	Previously scheduled.
3	LDEV 01	3	Previously scheduled.
4	LDEV 03	4	Previously scheduled.

Order of the initial copy operations	P-VOL	Initial Copy Priority setting	Remarks
5	LDEV 11	1	Scheduled later.
6	LDEV 10	2	Scheduled later.

Consistency group planning

You determine which storage system pairs to include in each consistency group based on business criteria for keeping the status consistent across a group of pairs, and for performing specific operations at the same time on all pairs in the group.

Consistency groups allow you to perform one operation on all pairs in the group at the same time. Consistency groups also ensure that all pairs are managed in a consistent status.

A consistency group has the following characteristics:

- A maximum of four storage system pairings can be placed in one consistency group.
- A consistency group can consist of the following:
  - TC pairs only using one primary and one secondary storage system
  - TC pairs only using more than one primary and secondary storage system
  - TCz pairs only using one primary and one secondary storage system
  - TCz pairs only using more than one primary and secondary storage system
  - Both TC and TCz pairs using one primary and one secondary storage system
  - Both TC and TCz pairs using more than one primary and secondary storage system

Note: If you connect with VSP Gx00 models or VSP Fx00 models, the CTG ID for the P-VOL and S-VOL in a pair must match:

- Connecting with VSP G200: Set CTG ID between 0 and 15.
- Connecting with VSP G400, G600, VSP F400, F600: Set CTG ID between 0 and 63.
- Connecting with VSP G800 or VSP F800: Set CTG ID between 0 and 127.

Consistency group for pairs in one primary and one secondary storage system

You can create, update, and copy TC pairs or both TC pairs and TCz pairs in a consistency group of one primary storage system and one secondary storage system.

(VSP Gx00 models, VSP Fx00 models)

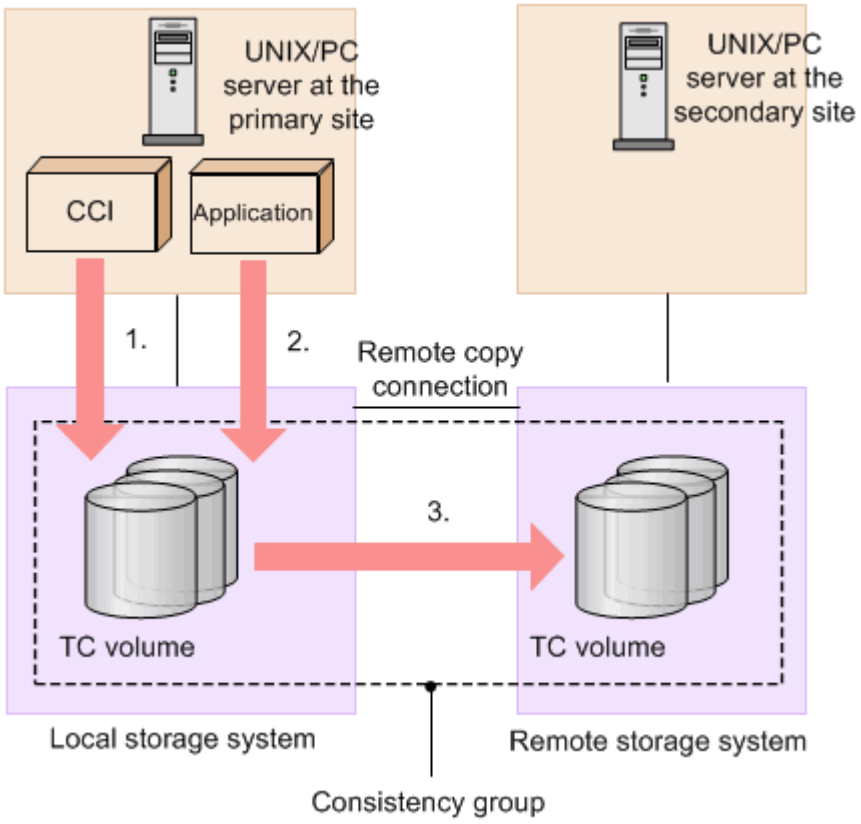


Figure notes:

1. The TC pair is created in the consistency group specified from CCI.
2. I/O requests are received from each application in the open-system server to update data in each volume.
3. The TC copy operation is performed in the consistency group.
   For information on creating a TC pair and assigning it to a consistency group using CCI, see the *Command Control Interface User and Reference Guide* and the *Command Control Interface Command Reference*.

(VSP G1000, G1500, and VSP F1500) TC and TCz pairs between one primary system and secondary system can be placed in the same consistency group, as shown in the following figure.

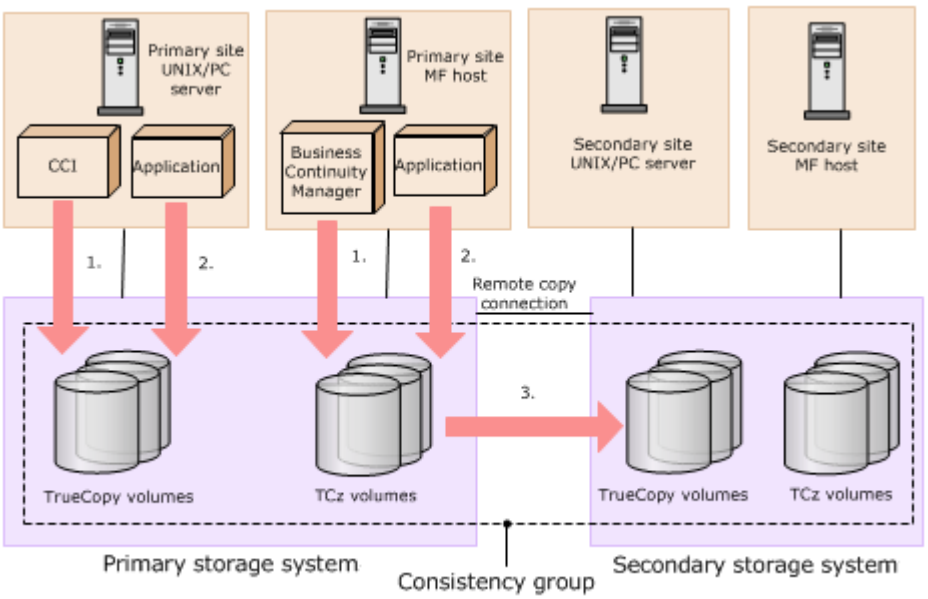


Figure notes:

1. TC pairs are assigned to a consistency group using CCI.
   TCz pairs are assigned to a consistency group using Business Continuity Manager (BCM)
2. Open and mainframe volumes (P-VOLs) receive I/O requests from their applications at the primary (main) site, and data in the volumes is updated.
3. TC or TCz runs copy operations in the consistency group.
   For information on creating a TC pair and assigning it to a consistency group using CCI, see the *Command Control Interface User and Reference Guide* and the *Command Control Interface Command Reference*.
   For information on creating a TCz pair and assigning it to a consistency group using BCM, see the *Hitachi Business Continuity Manager User Guide* and the *Hitachi Business Continuity Manager Reference Guide*.

Consistency group for pairs in multiple primary and secondary storage systems

You can create, update, and copy TC pairs or both TC pairs and TCz pairs in a consistency group of multiple primary storage systems and multiple secondary storage systems.

(VSP Gx00 models, VSP Fx00 models)

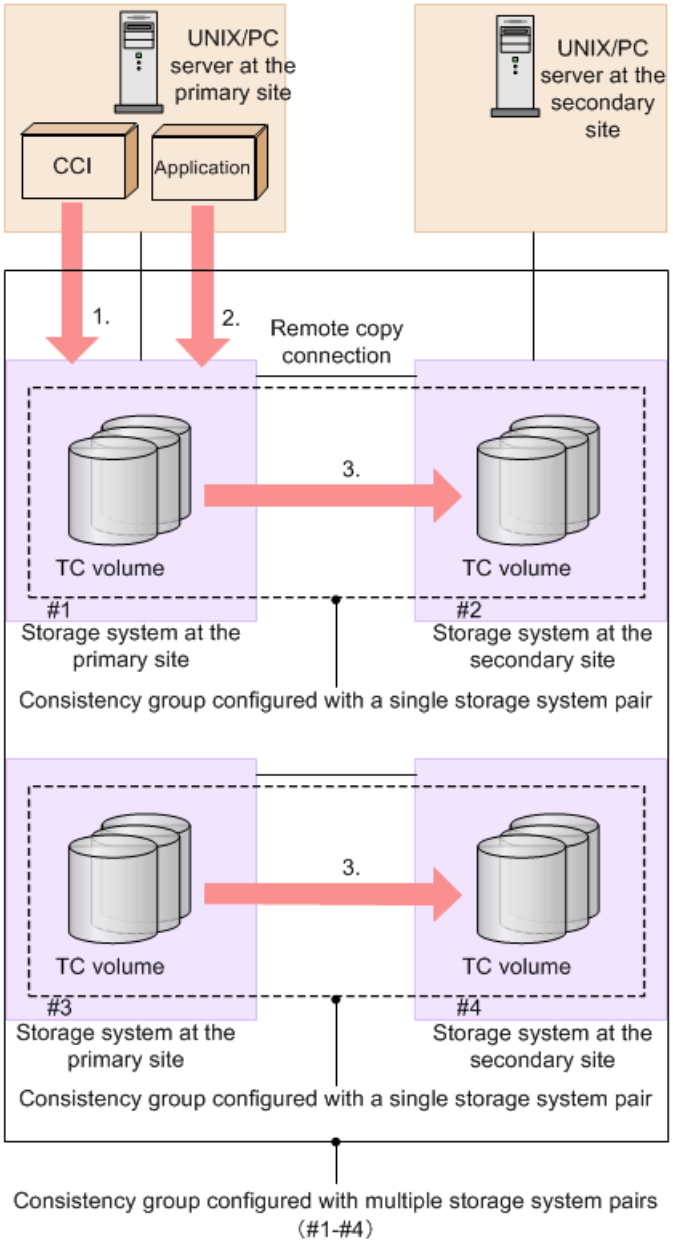


Figure notes:

1. CCI uses a consistency group that consists of multiple primary and secondary storage systems. Business Continuity Manager cannot be used with multiple systems.
2. I/O requests are received from each application in the open-system server to update data in each volume.
3. The TC copy operation is performed in the consistency group.
   When a pair is created, the pair is assigned to a consistency group. For information on creating consistency groups of multiple primary and secondary storage systems and assigning TC pairs to a consistency

group, see the *Command Control Interface Installation and Configuration Guide* and the *Command Control Interface Command Reference*.

(VSP G1000, G1500, and VSP F1500) TC and TCz pairs in multiple primary and secondary systems can be placed in the same consistency group. A maximum of four storage system pairings can be placed in the same consistency group.

In a consistency group for multiple primary and secondary storage systems, you cannot use Business Continuity Manager to perform operations, including registrations, for TrueCopy for Mainframe pairs.

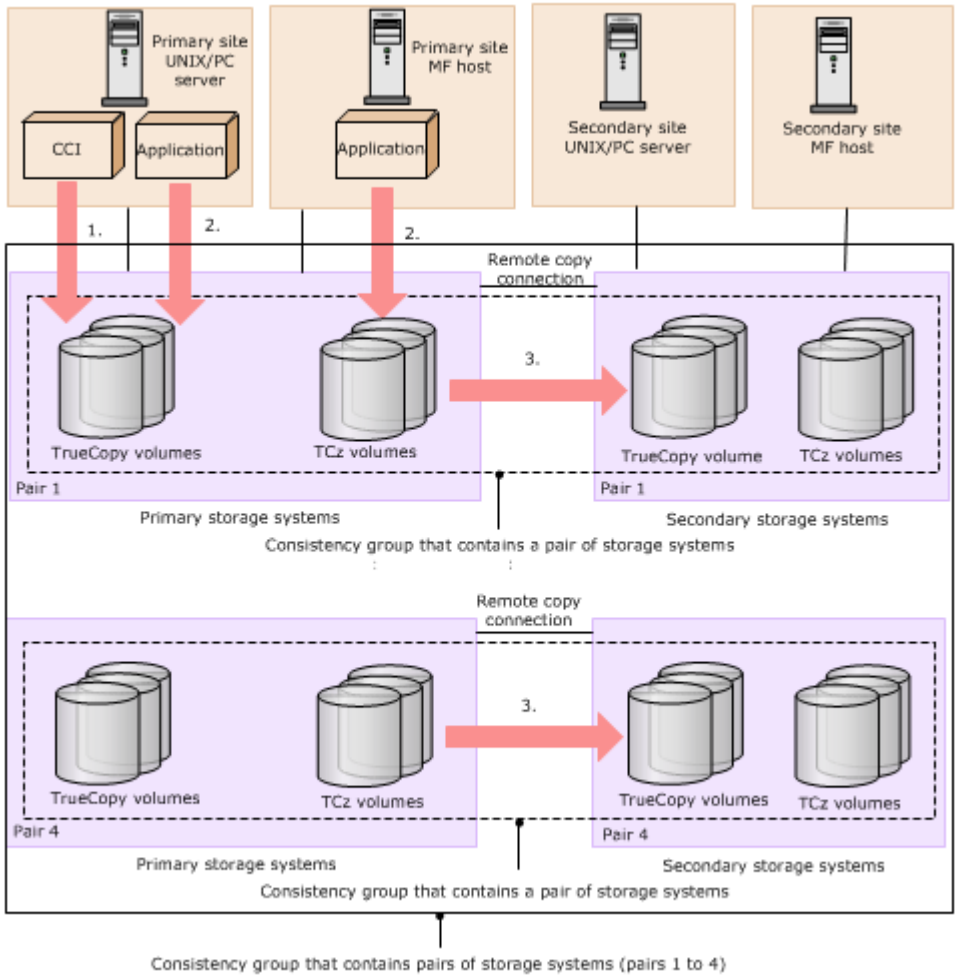


Figure notes:

1. CCI manages the consistency group that contains multiple storage systems.

2. Open and mainframe primary volumes (P-VOLs) receive I/O requests from their applications at the primary (main) site, and data in the volumes is updated.
3. TrueCopy or TrueCopy for Mainframe runs the copy operation in the consistency group.

When the open or mainframe host system guarantees the update order, data consistency in P-VOLs and S-VOLs is ensured. When the host system does not guarantee update order, data consistency is not ensured.

System configurations for consistency groups

Data consistency between secondary volumes in a consistency group of multiple primary and secondary storage systems is guaranteed for various system configurations.

System configuration	Update sequence of data in a higher system*	Guaranteed range of data consistency between secondary volumes
VSP Gx00 models, VSP Fx00 models	Update sequence of data is guaranteed between servers	TC secondary volumes in multiple storage systems at secondary sites
(VSP G1000, G1500, and VSP F1500) Open server/mainframe host mixed	Update sequence of data is guaranteed between open servers and mainframe hosts	TC, TCz secondary volumes in multiple storage systems at secondary sites
	Update sequence of data is not guaranteed between open servers and mainframe hosts	No consistency between TC and TCz secondary volumes
	Update sequence of data is guaranteed between open servers	TC secondary volumes in multiple storage systems at secondary sites
	Update sequence of data is guaranteed between mainframe hosts	TCz secondary volumes in multiple storage systems at secondary sites
(VSP G1000, G1500, and VSP F1500) Open server only	Update sequence of data is guaranteed between open servers	TC secondary volumes in multiple storage systems at secondary sites
(VSP G1000, G1500, and VSP F1500) Mainframe host only	Update sequence of data is guaranteed between mainframe hosts	TCz secondary volumes in multiple storage systems at secondary sites
* If the update sequence of data in a higher system is not guaranteed (data update sequence is unnecessary), data consistency between secondary volumes is not guaranteed.		

Registering pairs to a new consistency group when creating a new TC pair

You can configure a consistency group of multiple primary and secondary storage systems when creating new TC pairs.

The consistency group of multiple primary and secondary storage systems can consist of TC pairs only.

Procedure

1. Create configuration definition file C for a configuration of multiple primary and secondary storage systems.

Use CCI to create the configuration definition file.

2. Specify the consistency group for registration, and register TC or TCz pairs using configuration definition file C created in step 1.

Registering pairs to a new consistency group when creating a new TC or TCz pair

You can configure a consistency group of multiple primary and secondary storage systems when creating new TC or TCz pairs.

The consistency group of multiple primary and secondary storage systems can consist of a combination of TC and TCz pairs.

Procedure

1. Create configuration definition file C for a configuration of multiple primary and secondary storage systems.

   Use CCI to create the configuration definition file.
2. Specify the consistency group for registration, and register TC or TCz pairs using configuration definition file C created in step 1.

Registering pairs to a new consistency group when using existing TC pairs

You can configure a consistency group of multiple primary and secondary storage systems when using existing TC pairs.

The consistency group of multiple primary and secondary storage systems consists of TC pairs only.

Procedure

1. Create CCI configuration definition file A.
2. In CCI, split pairs using CCI configuration definition file A created in step 1.
3. In CCI, resume pair operation using CCI configuration definition file A without specifying a consistency group.
4. In CCI, split pairs using CCI configuration definition file A.
5. Create CCI configuration definition file C for a configuration of multiple pairs of storage systems.
6. In CCI, register pairs to a consistency group, and resume pair operation using CCI configuration definition file C.

Next steps

After removing existing TC pairs, you can use the procedure to register pairs to a new consistency group when creating TC pairs.

Registering pairs to a new consistency group when using existing TC or TCz pairs

You can configure a consistency group of multiple primary and secondary storage systems when using existing TC or TCz pairs.

The consistency group of multiple primary and secondary storage systems consists of a combination of TC and TCz pairs.

Procedure

1. Create CCI configuration definition file A.
2. In CCI, split pairs using CCI configuration definition file A created in step 1.
3. In CCI, resume pair operation using CCI configuration definition file A without specifying a consistency group.
4. In CCI, split pairs using CCI configuration definition file A.
5. Create CCI configuration definition file C for a configuration of multiple pairs of storage systems.
6. In CCI, register pairs to a consistency group, and resume pair operation using CCI configuration definition file C.

Next steps

After removing existing TC or TCz pairs, you can use the procedure to register pairs to a new consistency group when creating TC or TCz pairs.

Registering pairs to an existing consistency group when creating a new TC pair

You can register TC pairs in a consistency group of multiple primary and secondary storage systems to an existing consistency group when you create a new TC pair.

The consistency group of multiple primary and secondary storage systems consist of TC pairs.

Procedure

1. Add information of a TC pair you want to add to CCI configuration definition file B to create CCI configuration definition file C.
2. In CCI, create a TC pair using CCI configuration definition file C.

Registering pairs to an existing consistency group when creating a new TC or TCz pair

You can register TC or TCz pairs in a consistency group of multiple primary and secondary storage systems to an existing consistency group when you create a new TC or TCz pair.

The consistency group of multiple primary and secondary storage systems consist of a combination of TC and TCz pairs.

Procedure

1. Add information of a TC or TCz pair you want to add to CCI configuration definition file B to create CCI configuration definition file C.
2. In CCI, create a TC or TCz pair using CCI configuration definition file C.

Registering pairs to an existing consistency group when using existing TC pairs

You can register TC pairs in a consistency group of multiple primary and secondary storage systems to an existing consistency group when using existing TC pairs.

The consistency group of multiple primary and secondary storage systems consist of TC pairs.

Procedure

1. Create CCI configuration definition file A.
2. In CCI, split pairs using CCI configuration definition file A.
3. In CCI, resume pair operation using CCI configuration definition file A without specifying a consistency group.
4. In CCI, split pairs using CCI configuration definition file A.
5. Use CCI configuration definition file B to split pairs in the existing configuration of multiple primary and secondary storage systems.
6. Add information of the TC pair you want to add to CCI configuration definition file B for the existing configuration of multiple primary and secondary storage systems to create CCI configuration definition file C.
7. In CCI, create a TC pair using CCI configuration definition file C.

Next steps

After deleting existing TC pairs, you can use the procedure to register pairs to an existing consistency group when creating TC pairs.

Registering pairs to an existing consistency group when using existing TC or TCz pairs

You can register TC or TCz pairs in a consistency group of multiple primary and secondary storage systems to an existing consistency group when using existing TC or TCz pairs.

The consistency group of multiple primary and secondary storage systems consists of a combination of TC and TCz pairs.

Procedure

1. Create CCI configuration definition file A.
2. In CCI, split pairs using CCI configuration definition file A.
3. In CCI, resume pair operation using CCI configuration definition file A without specifying a consistency group.
4. In CCI, split pairs using CCI configuration definition file A.
5. Use CCI configuration definition file B to split pairs in the existing configuration of multiple primary and secondary storage systems.
6. Add information of the TC or TCz pair you want to add to CCI configuration definition file B for the existing configuration of multiple

primary and secondary storage systems to create CCI configuration definition file C.

7. In CCI, create a TC or TCz pair using CCI configuration definition file C.

Next steps

After deleting existing TC or TCz pairs, you can use the procedure to register pairs to an existing consistency group when creating TC or TCz pairs.

Consistency group requirements

Requirements are provided for the following consistency group (CTG) configurations.

- Consistency group for pairs in one primary and one secondary storage system on page 68
- Consistency group for pairs in multiple primary and secondary storage systems on page 70

Requirements for a CTG for one primary and one secondary system

- A pair can be assigned to one consistency group only.
- (VSP G1000, G1500, and VSP F1500) A maximum of 256 (00 to FF) consistency groups can be created. A maximum of 8,192 pairs can be registered to a consistency group.
- (VSP Gx00 models and VSP Fx00 models) For the maximum number of consistency groups and the maximum number of TC pairs that you can create, see *System requirements* and *Maximum number of supported pairs*.
- (VSP G1000, G1500, and VSP F1500) TC pairs and TCz pairs can be contained in a consistency group.

Note: If a storage system other than VSP G1000 and G1500, and VSP F1500 is used in primary site or secondary site, the maximum number of pairs in the consistency group and the maximum number of consistency groups for the other storage system model must be met. See the manual for the corresponding storage system.

- Assign a consistency group ID in a range from 00-FF. The ID must be unused.
- When using a volume in a virtual storage machine, if you want to create a consistency group of one primary and one secondary storage system, use volumes in the same virtual storage machine to create a pair. If you register a pair created using different virtual storage machine volumes to a consistency group, the consistency group is regarded as a consistency group of multiple primary and secondary storage systems.
- TrueCopy pairs can be in the same consistency group as TrueCopy for Mainframe pairs. Use the same consistency group ID for both types.

Determine the consistency group ID by using CCI and Business Continuity Manager in advance. Use an unused consistency group ID.
Before defining pairs in CCI, specify the consistency group ID. In Business Continuity Manager, use the Copy Group Attributes (TC) window to set the consistency group ID, and then define pairs. For details about the Copy Group Attributes (TC) window, see the *Business Continuity Manager User Guide*.

- When assigning pair volumes that belong to a virtual storage machine to a consistency group consisting of one primary and one secondary system, all the P-VOLs in the consistency group must belong to the same virtual storage machine.
- If you use Command Control Interface to resynchronize a TCz pair in an open/mainframe consistency group with one primary system and secondary system, all pairs in the consistency group are resynchronized. A TC pair is also resynchronized with the others, even if its TC S-VOL is being accessed by a host. Make sure to check the status of all pairs in the consistency group before resynchronizing.
- If you use Command Control Interface to delete a TCz pair in an open/mainframe consistency group with one primary system and secondary system, only the TCz pairs are deleted. Use CCI to delete the TC pairs.
- (VSP G1000, G1500, and VSP F1500)To set or use TrueCopy Synchronous pairs with TC open/MF consistency groups specified, you must install TrueCopy Synchronous. In addition, TrueCopy consistency groups and open/MF consistency groups described in the Hitachi TrueCopy® for Mainframe User Guide are the same. For details about TrueCopy open/MF consistency groups, see the Hitachi TrueCopy® for Mainframe User Guide.

Related references

- System requirements and specifications on page 26
- Maximum number of pairs supported on page 63

Requirements for a CTG for multiple primary and secondary systems

- All requirements for a consistency group between one primary and one secondary system apply to a consistency group between multiple primary and secondary systems.
- The primary and secondary systems must be VSP G1000 and G1500, or VSP F1500, or VSP, or HUS VM, VSP Gx00 models, or VSP Fx00 models. No other models can be used.
- A consistency group can consist of a maximum of four primary and four secondary (paired) systems.
- The microcode or firmware for both primary and secondary systems must support consistency groups between multiple primary and secondary systems. If it does not, pair creation results in failure.
  - If a storage system at the primary site does not support the consistency group functionality for multiple primary and secondary storage systems,

a pair for a consistency group of one primary and one secondary storage system is created.
    - If a storage system at the secondary site does not support the consistency group functionality for multiple primary and secondary storage systems, no pairs can be created.
- You must install the CCI version that supports a consistency group containing multiple primary systems and secondary systems.
- Pair operations can be performed only from CCI. Pair operations from Device Manager - Storage Navigator is not supported.
- Cascade configurations with Universal Replicator pairs are not supported.
- (VSP G1000, G1500, and VSP F1500) Compatible FlashCopy® configurations are not supported.
- You can assign pair volumes that belong to multiple virtual storage machines to a consistency group consisting of multiple primary and secondary systems.

Assigning pairs to a consistency group

The procedure to assign pairs depends on the number of storage systems in the consistency group.

Assigning pairs belonging to one primary system and secondary system

The method for assigning pairs to a consistency group differs according to the management software used to create the pairs:

- When using Device Manager - Storage Navigator, only consistency group 127 is supported. For details, see Consistency group 127 on page 84.
- When using CCI, see the *Command Control Interface User and Reference Guide*
- When using Business Continuity Manager, see the *Business Continuity Manager User Guide*

Assigning pairs belonging to multiple primary and secondary systems

Assigning pairs in multiple primary and secondary systems to a consistency group depends on whether you are:

- Using a new CTG on page 79
- Using an existing CTG on page 80

You can use CCI when creating and assigning pairs to a consistency group on multiple storage systems. Business Continuity Manager is not supported for this configuration.

Using a new CTG

You can assign new pairs or existing pairs to a new consistency group.

To assign new pairs to a new consistency group

1. Create CCI configuration definition file C for a multiple primary and secondary system configuration.
2. Perform the paircreate operation according to configuration definition file C created in Step 1.

To assign existing pairs to a new consistency group

1. Create CCI configuration definition file A with which to use CCI for pair operations.
2. Perform the pairsplit operation according to configuration definition file A created in Step 1.
3. Perform the pairresync operation without designating a consistency group. Do this using configuration definition file A.
4. Perform the pairsplit operation again using configuration definition file A.
5. Create CCI configuration definition file C for the multiple primary and secondary system configuration.
6. Perform the pairresync operation and register them to configuration definition file C.

Tip: After deleting existing pairs, you can perform steps to assign new pairs to a new consistency group.

Using an existing CTG

You can assign new pairs or existing pairs to an existing consistency group.

To assign new pairs to an existing consistency group

1. Add pair information to the existing configuration definition file B, which consists of pairs in multiple storage systems.
2. Copy and create CCI configuration definition file C.
3. Perform the paircreate operation and register them to configuration definition file C.

To assign existing pairs to an existing consistency group

1. Create CCI configuration definition file A to use with CCI for pair operations.
2. Perform the pairsplit operation on pairs that you want to register in the existing CTG with multiple systems. Do this using configuration definition file A.
3. Perform the pairresync operation without designating a consistency group. Do this using configuration definition file A.
4. Perform the pairsplit operation again using configuration definition file A.
5. Perform the pairsplit operation to the existing configuration definition file B, which consists of the pairs in the multiple primary and secondary system configuration.
6. Add pair information to existing configuration definition file B.

7. Delete then re-create the pairs, registering them in configuration definition file C.

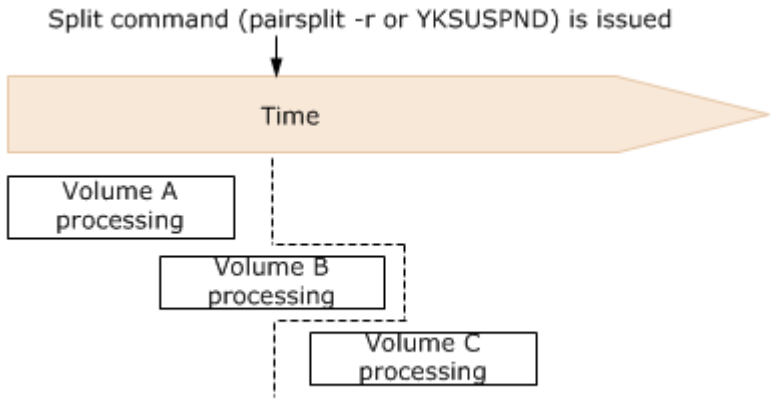
Tip: After deleting existing pairs, you can perform steps to assign new pairs to an existing consistency group.

Split behaviors for pairs in a CTG

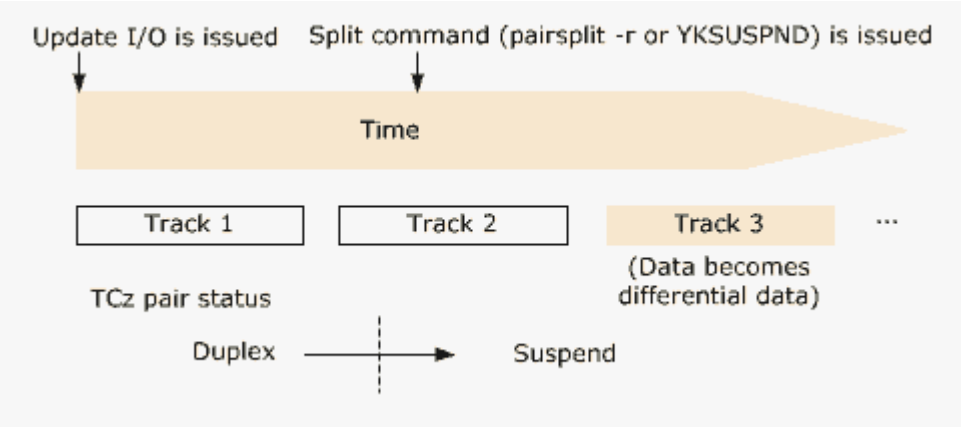
When the pairs in a consistency group receive updates while in the process of being split or suspended, or when they are about to be split or suspended, S-VOL data consistency is managed as follows:

- If I/O processing is in progress on pairs in the same consistency group, and the split or suspend operation begins, the I/O processing completes first, and then the split/suspend operation is performed.

  The following figure shows that I/O processing is completed first, and then the pair split operation for the pair on Volume B is completed.



The following figure shows data in track 2 being copied to the S-VOL, and the data in track 3 becomes differential data. In this case, track 2 is used for I/O processing to the volume in the consistency group when the split command is issued to the pair.



- If a split operation is in progress when I/O processing on the pairs begins, the split operation on the pairs is given priority. After the pair is split, the I/O processing begins.
- Data consistency cannot be ensured when all of the following conditions exist:
  - A port is blocked.
  - A split command is in progress.
  - I/O processing begins.

  In such a case, resynchronize the consistency group, and then issue the split command again.

Host access after split

You can specify settings for read/write access to the P-VOL/P-VOL and S-VOL/S-VOL in consistency groups after pairs are split. These settings are specified using CCI or Business Continuity Manager.

- The CCI settings for TC are optional.
- (VSP G1000, G1500, and VSP F1500) The Business Continuity Manager settings for TCz are required.

The following tables show the effects of the settings on read and write access.

Interface	Setting	TC P-VOL		TCz P-VOL	
		Read	Write	Read	Write
CCI	Write access prohibited	Y	N	Y	N
	No option selected	Y	Y	Y	Y
(VSP G1000, G1500, and VSP F1500) Business Continuity Manager	Write access prohibited	Y	N	Y	N
	Write access permitted	Y	Y	Y	Y

Interface	Setting	TC S-VOL		TCz S-VOL	
		Read	Write	Read	Write
CCI	Read access permitted	Y	N	N	N
	Read/Write access permitted	Y	Y	Y	Y
	No option selected	Y	N	N	N
(VSP G1000, G1500, and VSP F1500) Business Continuity Manager	Write access prohibited	Y	N	N	N
	Write access permitted	Y	Y	Y	Y

Pair status before and after a split operation (VSP G1000, G1500, and VSP F1500)

Pairs in the same consistency group must be in PAIR/Duplex status when you begin the split operation in order to maintain consistency. Otherwise, when the operation completes, pair status will be inconsistent.

This is shown in the following table, in which font angle indicates the following:

- Italics font: Pair status before the split operation on the consistency group
- Regular font: Status after the split operation

For CCI

Pair statuses		TCz pairs		
		All = Duplex	Some = Duplex, some = Suspend	All = Suspend
TC pairs	*All = PAIR*	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend
	Some = PAIR, some = PSUS	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend
	All = PSUS	TC: PSUS TCz: Duplex	TC: PSUS TCz: Duplex/Suspend	TC: PSUS TCz: Suspend

For BCM

Pair statuses		TCz pairs		
		All = Duplex	Some = Duplex, some = Suspend	All = Suspend
TC pairs	*All = PAIR*	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend
	Some = PAIR, some = PSUS	TC: PSUS	TC: PSUS	TC: PSUS

Pair statuses		TCz pairs		
		All = Duplex	Some = Duplex, some = Suspend	All = Suspend
		TCz: Suspend	TCz: Suspend	TCz: Suspend
	All = PSUS	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend	TC: PSUS TCz: Suspend

Consistency group 127

When you create pairs using Device Manager - Storage Navigator, they can be assigned to only one consistency group, 127. (You can also use CCI to assign pairs to CTG 127.) With CTG 127, you can ensure the following:

- When a pair is split or suspended for any reason, you can ensure that all P-VOLs in the group become suspended.
- If data paths between the secondary and primary system fail, you can ensure that all S-VOLs are placed in PSUE status.

For more information, see CTG 127 behavior and restrictions when a pair is suspended on page 84.

Procedure

1. Turn Function Switch 30 On.
   - Turn on the switch in the primary and secondary systems to get the desired result in each system.
   - Turn on the switch in the system where you want the behavior: either consistent P-VOL suspensions for the primary system, or consistent S-VOL PSUE status for the secondary system.
2. Create the pairs and assign them to CTG 127.
   - In CCI, assign the pairs to this group number when you create the pairs.
   - In Device Manager - Storage Navigator, pairs are automatically assigned to CTG 127 when the pairs are created and function switch 30 is On.

CTG 127 behavior and restrictions when a pair is suspended

Note the following behaviors and restrictions regarding the consistent suspending of all P-VOLs when a pair suspends.

- When a failure occurs or if a pair is suspended by CCI, all P-VOLs will be suspended.
- When P-VOLs and S-VOLs are registered in CTG 127, and both volumes are paired bidirectionally, all of the target pair volumes are registered in CTG 127 when takeover takes place.
- The maximum number of pairs in CTG 127 is 4,096.

- For P-VOLs to be suspended, a failure must occur, and then a write I/O operation must occur in any of the pairs.
- When P-VOL status is PAIR and S-VOL status is PSUE, if a write I/O is executed, all P-VOLs registered in CTG 127 are suspended by failure.
  When P-VOL status is PAIR and S-VOL status is PSUE, you can restore PAIR status to the S-VOL by suspending the P-VOL and then resynchronizing the pair. With CCI, use the -l option.
- When the S-VOL is suspended due to an intermittent communication failure, the P-VOL might not be suspended (P-VOL with no I/O processing stays in PAIR).

CTG 127 behavior and restrictions when the data path fails

Note the following behaviors and restrictions regarding the consistent changing of all S-VOLs to PSUE status when the secondary system is disconnected.

- S-VOLs must be in PAIR or COPY status in order to change to PSUE status. They cannot be in PSUS or SSUS status.
- All connections to the primary system must be disconnected.
  S-VOLs cannot be changed to PSUE status if the MinimumPath field is set to a value other than 1 on the primary system (RCU Option dialog box).
- Changing status to PSUE might take up to 10-minutes if there are many pairs.
- All S-VOLs will be changed to PSUE even if all data paths are recovered in the middle of the process.
- If the data paths are disconnected for a short time (less than one minute), S-VOLs might not change to PSUE status because the storage system does not detect the disconnection.
- After a power outage, all S-VOLs registered in CTG 127 will be changed to PSUE status.
- If write I/O is executed when the P-VOL is in PAIR status and the S-VOL is in PSUE status, the secondary system does not accept updates, and the primary system suspends the P-VOL.
- Remote I/O (RIO), which is issued during the change to PSUE status, is accepted by the secondary system.
- When the status of a pair is changing to PSUE:
  - It cannot be resynchronized.
  - It cannot be created and registered in CTG 127.
  However, a pair can be deleted when status is changing to PSUE.
- In a bidirectional configuration, if all data paths for the primary system of the reverse direction pair are disconnected when pair status is changing to PSUE, the disconnection might not be detected.
- If all the data paths for TrueCopy pairs are disconnected, but the paths used for UR pairs are connected, failure suspend does not occur and S-VOLs cannot be changed to PSUE status.

- If you turn off the power of the primary system when S-VOLs are in PAIR status, all the data paths for the primary system will be disconnected and all the S-VOLs registered in CTG 127 will be changed to PSUE status.

Resynchronizing and removing pairs using Business Continuity Manager (VSP G1000, G1500, and VSP F1500)

When you resynchronize the TrueCopy for Mainframe pair in the Open/MF consistency group which consists of one pair of the primary storage system and the secondary storage system by Business Continuity Manager, all pairs in the consistency group are resynchronized. If the host is accessing the S-VOL of the TrueCopy pair, the TrueCopy pair is also resynchronized simultaneously. Resynchronize the pair after you reconfirm the status of all TrueCopy pairs and all TrueCopy for Mainframe pairs in the consistency group.

When you remove the TrueCopy for Mainframe pair in the Open/MF consistency group which consists of one pair of the primary storage system and the secondary storage system by Business Continuity Manager, only the TrueCopy for Mainframe pairs in the consistency group are removed. If you want to remove the TrueCopy pair simultaneously, you must remove the pairs by CCI.

Host failover software

Host failover software transfers information between host servers at the primary and secondary sites. It is a critical component of a disaster recovery solution.

- When TrueCopy is used as a disaster recovery tool, host failover is required to ensure effective recovery operations.
- When TrueCopy is used as a data migration tool, host failover is recommended.

TrueCopy does not provide host failover functions. Use the failover software most suitable for your platform and requirements (for example, Microsoft Cluster Server).

4

Sharing TrueCopy volumes

This chapter helps you plan TrueCopy (TC) pair volumes when they are shared with non-TC volumes. All the software products that can be used with TC are discussed here.

- Volume types that can be shared with TrueCopy
- Cache Residency Manager (VSP G1000, G1500, and VSP F1500)
- Data Retention Utility
- Dynamic Provisioning
- Global storage virtualization
- LUN Manager
- Performance Monitor
- ShadowImage
- Universal Replicator
- Virtual LUN
- Volume Migration

Volume types that can be shared with TrueCopy

The following table lists the types of volumes by software product and indicates whether the volume can also be used as a TC P-VOL or a TC S-VOL.

Volume type	Used as TC P-VOL?	Used as TC S-VOL?
Active flash		
DP-VOL	Yes	Yes
Pool-VOL	No	No
Cache Residency Manager (VSP G1000, G1500, and VSP F1500)		
Cache Residency Manager volume	Yes	Yes
Virtual LUN		
Virtual LUN volume	Yes	Yes
Thin Image (TI) [6]		
P-VOL in all statuses except RCPY	Yes	Yes
P-VOL in RCPY status	No	No
V-VOL	No	No
Pool-VOL	No	No
Cross-OS File Exchange		
Volume usable by both mainframe and open systems	No	No
Data Retention Utility		
Volume with Read/Write attribute	Yes	Yes
Volume with Read Only attribute	Yes	Yes
Volume with Protect attribute	Yes	Yes
Volume that is disabled for use as an S-VOL	Yes	No
Dynamic Provisioning		
DP-VOL	Yes	Yes
Pool-VOL	No	No
V-VOL with capacity saving enabled	Yes	Yes
Deduplication system data volume	No	No
Dynamic Tiering		
DP-VOL	Yes	Yes
Pool-VOL	No	No
Global-active device (GAD)		
P-VOL	No	No
S-VOL	No	No
Quorum disk	No	No
Volume with reserve attribute for S-VOL	No	No
Global storage virtualization		

Volume type	Used as TC P-VOL?	Used as TC S-VOL?
Volumes in a virtual storage machine[1]	Yes	Yes
LUN Manager		
Volume to which a path is defined	Yes	Yes
Volume to which no path is defined	No	No
Volume to which LUN security is applied	Yes	Yes
ShadowImage (SI)		
P-VOL in PSUS (Delete pair to RCU) status	Yes	Yes[7]
P-VOL in COPY(RS-R)/RCPY status	No	No
SI P-VOL is also used as a UR P-VOL or S-VOL	No	No
P-VOL (none of the above)	Yes	Yes[7]
S-VOL in PSUS (Delete pair to RCU) status	Yes	No
S-VOL (none of the above)	No	No
Reserved volume (VSP G1000, G1500, and VSP F1500)	No	No
Universal Replicator (UR)		
P-VOL in COPY status	No	No
P-VOL in PAIR status	Yes[2, 8]	No[3]
P-VOL in PSUS (Delete pair to RCU) status	Yes[2, 8]	No[9]
P-VOL in PSUE (pair suspended-error) status	Yes[2, 8]	No[98]
S-VOL in COPY status	No	No
S-VOL in PAIR status	No	No
S-VOL in PSUS (Delete pair to RCU) status	Yes[2]	No
S-VOL in SSWS status	Yes[2]	No
S-VOL in PSUE (pair suspended-error) status	Yes[2]	No
Journal Volume (VSP Gx00 models and VSP Fx00 models)	No	No
Universal Volume Manager		
Mapped external volume	Yes	Yes
Virtual Partition Manager (VPM)		
Volume belonging to the Virtual Partition Manager CLPR	Yes	Yes
Volume Migration[5]		
Source volume (when volume migration is in progress)	Yes. (If the source volume is a P-VOL, volume migration will stop.)	Yes. (If the source volume is an S-VOL, volume migration will stop.)[4]
Source volume (after volume migration is finished)	Yes	Yes
Target volume	No	No
Reserved volume (VSP G1000, G1500, and VSP F1500)	No	No

Volume type	Used as TC P-VOL?	Used as TC S-VOL?

Notes:

1. The volume whose virtual LDEV ID is deleted cannot be used as pair volume of TC.
2. In a 3DC multi-target or 3DC cascade configuration with the three UR sites, the volume shared with two UR pairs cannot be used with TC. Likewise, a volume used with TC cannot be used as a volume shared with two UR pairs.
3. (VSP G1000, G1500, and VSP F1500) The volume can be used only when you resynchronize a TC pair or perform a CCI horc takeover operation. The volume can also be used if the applicable UR pair belongs to a journal registered by selecting 2DC Cascade for Journal Type Option in the **Create Journals** window.
4. If the TC S-VOL is a DP-VOL, the TC pair cannot be created. Create the TC pair after completing volume migration or stopping the Volume Migration operation.
5. For more information about using Volume Migration, contact customer support.
6. (VSP G1000, G1500, and VSP F1500) For the node volume and the leaf volume of Thin Image, see the description of S-VOL, not P-VOL.
7. (VSP Gx00 models and VSP Fx00 models) When both TrueCopy P-VOL and S-VOL are Dynamic Provisioning virtual volumes (DP-VOL), the TC S-VOL cannot be used as a P-VOL of a ShadowImage pair.
8. (VSP G1000, G1500, and VSP F1500) Cannot be used if the TC pair belongs to a journal registered by selecting 2DC Cascade for Journal Type Option in the **Create Journals** window.
9. (VSP G1000, G1500, and VSP F1500) The volume can be used only when you resynchronize a TC pair or perform a CCI horctakeover operation. The volume cannot be used if the UR pair belongs to a journal registered by selecting 2DC Cascade for Journal Type Option in the **Create Journals** window.

Cache Residency Manager (VSP G1000, G1500, and VSP F1500)

The volumes which set the Cache Residency Manager can be assigned as the TrueCopy pair. You can perform Cache Residency Manager operations on TC P-VOLs and S-VOLs. For more information, see the *Performance Guide*.

Data Retention Utility

You can create a TC pair using volumes that have been assigned the access attribute by the Data Retention Utility (DRU). However, you cannot specify a volume with the "S-VOL Disable" attribute as a TC S-VOL.

The following table shows whether a DRU volume with the specified access attribute can be used as a TC P-VOL or S-VOL.

DRU access attribute	Availability of TC P-VOL or S-VOL	
	P-VOL	S-VOL
Read/Write	Yes	Yes
Read Only	Yes	Yes
Protect	Yes	Yes

DRU access attribute	Availability of TC P-VOL or S-VOL	
	P-VOL	S-VOL
S-VOL Disable	Yes	No
Read Only and S-VOL Disable	Yes	No
Protect and S-VOL Disable	Yes	No

The following tables show TC volumes and status with Data Retention Utility operations that can be performed using Device Manager - Storage Navigator.

TC Volume	PAIR status	DRU operation				
		Changing access attribute				Referring access attribute
		Read/Write	Read Only	Protect	S-VOL Disable	
P-VOL	SMPL	Yes	Yes	Yes	Yes	Yes
	COPY	Yes	Yes	Yes	Yes	Yes
	PAIR	Yes	Yes	Yes	Yes	Yes
	PSUS	Yes	Yes	Yes	Yes	Yes
	PSUE	Yes	Yes	Yes	Yes	Yes
S-VOL	SMPL	Yes	Yes	Yes	Yes	Yes
	COPY	No	No	No	No	Yes
	PAIR	No	No	No	No	Yes
	PSUS	Yes	Yes	Yes	Yes	Yes
	PSUE	Yes	Yes	Yes	Yes	Yes

The following tables show TC volumes and status with the Data Retention Utility operations that can be performed using Device Manager - Storage Navigator and CCI.

TC Volume	PAIR status	DRU operation				
		Changing access attribute				Referring access attribute
		Read/Write	Read Only	Protect	S-VOL Disable	
P-VOL	SMPL	Yes	Yes	Yes	Yes	Yes
	COPY	Yes	Yes	Yes	Yes	Yes
	PAIR	Yes	Yes	Yes	Yes	Yes
	PSUS	Yes	Yes	Yes	Yes	Yes
	PSUE	Yes	Yes	Yes	Yes	Yes
S-VOL	SMPL	Yes	Yes	Yes	Yes	Yes

TC Volume	PAIR status	DRU operation				
		Changing access attribute				Referring access attribute
		Read/Write	Read Only	Protect	S-VOL Disable	
	COPY	Yes	Yes	Yes	No	Yes
	PAIR	Yes	Yes	Yes	No	Yes
	PSUS	Yes	Yes	Yes	Yes	Yes
	PSUE	Yes	Yes	Yes	Yes	Yes

Dynamic Provisioning

You can create a Universal Replicator pair by specifying a DP-VOL (Dynamic Provisioning virtual volume). DP-VOLs can be assigned to both the TC P-VOL and S-VOL, or to one of them. However, the following restrictions apply:

- A V-VOL with capacity saving enabled can be used as a P-VOL or S-VOL of a TC pair. However, a deduplication system data volume cannot be used as a P-VOL or S-VOL of a TC pair.
- Data compressed or deduplicated by the capacity saving function is copied to a volume after compression and deduplication are released. The capacity saving function is not performed immediately for copied data. Before creating or resynchronizing a TC pair, make sure that the available capacity in the copy destination volume is greater than the used capacity in the copy origination volume before capacity saving. For details, see the *Provisioning Guide* for your storage system.
- If you create a TC pair using a volume for which the capacity saving function is used, compressed or deduplicated data is copied. Because of this, copy or I/O performance might be degraded.
- When the capacity saving function is used, management information is stored in a pool. As a result, there could be a difference between a P-VOL and an S-VOL in the number of used pages or licensed capacity.
- You can use DP-VOLs that are also used in a ShadowImage pair, or in a Volume Migration migration plan. Before creating the TC pair, delete the SI pair, or disable the Volume Migration setting. After the pair is created, re-create the pair or migration plan.
- When a DP-VOL has pages allocated to an S-VOL, used pool capacity is temporarily larger than the actual capacity because pages must be reallocated in the DP-VOL. Therefore, before creating the pair, make sure of the following:
  - DP-VOL pool capacity is sufficient.
  - Pool-VOLs that are added to a pool are not blocked. If Pool-VOLs are blocked, restore the volume status and then create the pair.
- Regarding page and license capacity:

    - If a pair does not include a DP-VOL, volume capacity is counted toward TC license capacity. For a DP-VOL with the data direct mapping attribute, volume capacity will be counted towards TC license capacity.
      If a pair includes a DP-VOL, only the allocated page capacity of volume capacity is counted toward TC license capacity.
      However, if capacity saving is enabled, the capacity before saving is counted towards the TC licensed capacity.
      If a DP-VOL and a non-DP-VOL are included in a pair, the page capacity and/or license capacity counted in the P-VOL and the S-VOL might be different. This applies even when both P-VOL and S-VOL include DP-VOLs, because the page capacity of the P-VOL or the S-VOL changes by a relocated pool or released page or other action.
- When you migrate data from a P-VOL in an earlier storage system to a DP-VOL S-VOL, the DP-VOL S-VOL might consume the same page capacity as the P-VOL.

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

Related references

- System requirements and specifications on page 26

Global storage virtualization

Pairs can be created using volumes in a virtual storage machine. Note the following:

- Though Device Manager - Storage Navigator displays the virtual LDEV ID of a volume belonging to a virtual storage machine, make sure when running pair operations in Device Manager - Storage Navigator that you specify the physical LDEV ID of the volume.
- A volume's virtual ID used with TrueCopy cannot be deleted.

LUN Manager

- LUN Manager operations do not affect TC operations.
- Volumes that are under secure ports and/or that are assigned to host groups or iSCSI targets can also be assigned to TC pairs.
- Volumes that are assigned to TC pairs can also be assigned to secure ports and host groups or iSCSI targets for LUN Manager.
- TC S-VOLs cannot be accessed by any UNIX/PC server host except when the pair is split.

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

Performance Monitor

Performance Monitor software provides detailed information about I/O activity and hardware performance in the storage system. Storage system usage and performance data is collected and displayed by Performance Monitor. This information helps you to:

- Identify the optimum timing for performing TC operations.
- Determine the best locations for the TC S-VOL (for example, parity groups with less-frequently accessed volumes to avoid bottlenecks of backend activity).
- Monitor system performance during TC operations and during testing activities.

See the *Performance Guide* for your storage system for more information.

ShadowImage

ShadowImage volumes can be assigned to TC pairs, and TC volumes can be assigned to SI pairs. The following table shows the configurations that are possible.

TC volume	SI P-VOL	SI S-VOL
P-VOL	Yes	Yes
S-VOL	Yes	No

Note the following when sharing TC volumes with SI volumes.

- L1 and L2 SI pairs can be shared with TC volumes. Both node and leaf S-VOLs are considered secondary volumes by TC.
- SI is recommended for in-system copy operations. However, if SI is not installed, TC can be used to copy within the same storage system. This configuration requires at least one fibre channel or iSCSI cable loop.
- The SI Quick Restore can be performed when the TC pair is suspended. For information about the Quick Restore operation, see the *Hitachi ShadowImage® User Guide*.

Configurations with ShadowImage P-VOLs

TC can share an SI P-VOL in three configurations:

- In the following figure, the TC P-VOL also functions as an SI P-VOL. This configuration allows you to use SI for on-site data backup in case of TC failure. Or, the TC S-VOL can be used to provide remote backup of the SI P-VOL in case of an SI failure.

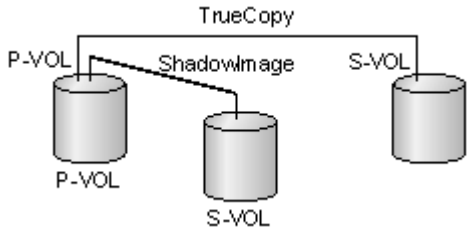


Figure 1 Shared TC P-VOL with SI P-VOL

In this configuration, you can only delete TC pairs when the SI P-VOL status is COPY(RS-R)/RCPY. The following table shows possibilities of TC pair operations according to the SI P-VOL status.

SI P-VOL status	TC pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
COPY(PD)/COPY COPY(SP)/COPY COPY(RS)/COPY	Yes	Yes	Yes	Yes	Yes
PAIR	Yes	Yes	Yes	Yes	Yes
PSUS(SP)/PSUS	Yes	Yes	Yes	Yes	Yes
PSUS PSUE	Yes	Yes	Yes	Yes	Yes
COPY(RS-R)/RCPY	No	No	No	Yes	No

- In the following figure, the TC S-VOL also functions as an SI P-VOL. In this configuration, SI provides another (or several more) backup copies of a TC P-VOL.

  When an SI P-VOL is shared with the TC S-VOL, the write operation to the TC P-VOL takes a longer time than normal. This is especially true when the SI pair is in the PSUS(SP)/PSUS status and is caused by the SI copying process. The processing time is increased by the processing time for SI added to the normal TC unit copy processing. The processing time might be increased by dozens of milliseconds with the addition of SI.

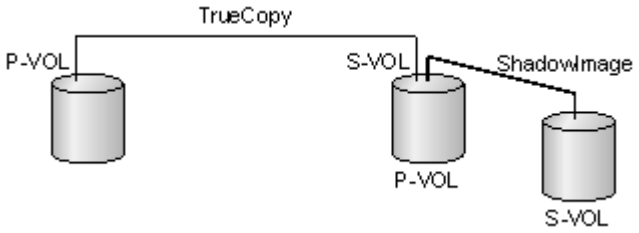


Figure 2 Shared TC S-VOL with SI P-VOL

In this configuration, you can only delete TC pairs when the SI P-VOL status is COPY(RS-R)/RCPY. The following table shows possibilities of TC pair operations according to the SI P-VOL status.

SI P-VOL status	TC pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
COPY(PD)/ COPY COPY(SP)/ COPY COPY(RS)/ COPY	Yes*	Yes	Yes	Yes	Yes
PAIR	Yes*	Yes	Yes	Yes	Yes
PSUS(SP)/ PSUS	Yes*	Yes	Yes	Yes	Yes
PSUS PSUE	Yes*	Yes	Yes	Yes	Yes
COPY(RS-R)/ RCPY	No	No	No	Yes	No
* When the P-VOL and the S-VOL of a TrueCopy pair are used as the DP-VOL of Dynamic Provisioning, if you share the P-VOL of a ShadowImage pair with the S-VOL of the TrueCopy pair, you must delete the ShadowImage pair before creating the TrueCopy pair. For details, see Dynamic Provisioning on page 92.					

- In the following figure, the configurations shown in the previous two figures are combined. Both the TC P-VOL and S-VOL function as SI P-VOLs, providing multiple copies at the primary and secondary sites.

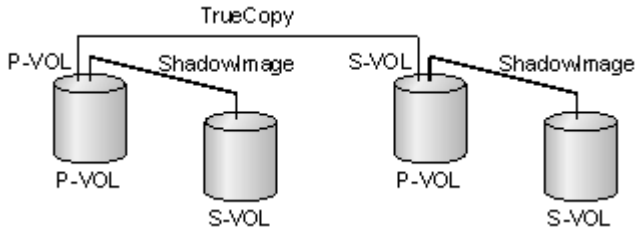


Figure 3 Shared TC P-VOL, S-VOL with multiple SI P-VOLs

In this configuration, you can only delete TC pairs when the SI P-VOL status is COPY(RS-R)/RCPY. The following table shows possibilities of TC pair operations according to the SI P-VOL status.

SI P-VOL status	TC pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
COPY(PD)/ COPY COPY(SP)/ COPY COPY(RS)/ COPY	Yes*	Yes	Yes	Yes	Yes
PAIR	Yes*	Yes	Yes	Yes	Yes
PSUS(SP)/ PSUS	Yes*	Yes	Yes	Yes	Yes
PSUS PSUE	Yes*	Yes	Yes	Yes	Yes
COPY(RS-R)/ RCPY	No	No	No	Yes	No
*(VSP Gx00 models and VSP Fx00 models) If the TC P-VOL and TC S-VOL are DP-VOLs, the TC S-VOL cannot be used as the SI P-VOL.					

Configurations with ShadowImage S-VOLs

In the following figure, an SI S-VOL also functions as a TC P-VOL. This configuration requires that the SI pair is split before the TC pair is created.

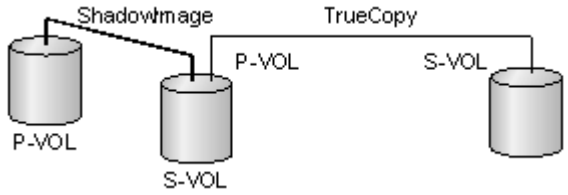


Figure 4 Shared SI S-VOL with TC P-VOL

In this configuration, before creating a TC pair, you must set the SI in the PAIR status, split the SI pair, and then set it in the PSUS status. The following table shows possibilities of TC pair operations according to the SI S-VOL status.

SI S-VOL status	TC pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
COPY(PD)/ COPY	No	No	No	Yes	No

SI S-VOL status	TC pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
COPY(SP)/ COPY COPY(RS)/ COPY					
PAIR	No	No	No	Yes	No
PSUS(SP)/ PSUS	No	No	No	Yes	No
PSUS PSUE	Yes	Yes	Yes	Yes	No
COPY(RS-R)/ RCPY	No	No	No	Yes	No

Status reporting and data currency

The following table shows the pair status that is reported for different combinations of shared volumes.

Number of TC pairs	Number of SI S-VOLs	Pair status
0	0	It does not display in pair list.
0	1	SI pair status
0	2 or more	SI pair status for the S-VOL with lowest LUN.
1	0	TC pair status
1	1	TC pair status
1	2 or more	TC pair status

- TC pair status is reported to the host if you query the TC P-VOL or S-VOL. To obtain the SI pair status, query the SI P-VOL pair.
- SI supports multiple S-VOLs for each of its P-VOLs, but when you issue a pair status query, the status is returned only for the pair whose S-VOL has the lowest LUN. To check pair status for the other S-VOLs, direct a host query to the specific S-VOL using the S-VOL's LUN in the host command. Device Manager - Storage Navigator displays the status of all S-VOLs.

The following table shows when data is current on a shared TC/SI volume based on the pair statuses.

TC pair status	SI pair status					
	COPY (PD)/ COPY	PAIR	COPY (SP)/ COPY	PSUS	COPY (RS)/COPY, COPY(RS-R)/RCPY	PSUE
COPY	Not Current	Not Current	Not Current	Current	Not Current	Not Current
PAIR	Not Current	Not Current	Not Current	Current	Not Current	Not Current
PSUS (Delete pair to RCU)/ PSUE (pair suspended-error)	Not Current	Current	Current	Current	Current	Not Current

Universal Replicator

TC and Universal Replicator can share the same pair volumes. Using a combined TC and Universal Replicator configuration can extend disaster recovery options to a third data center.

Like TC, a Universal Replicator pair maintains a copy of the production volume in a second location. However, unlike TC, the Universal Replicator S-VOL is asynchronous, and the secondary system can be located much greater distances from the primary and secondary TC sites.

Creating both a TC and a Universal Replicator backup ensures that a copy in a third location is available in the event that the primary site or one of the systems fails.

Configurations consisting of TC and Universal Replicator pair volumes are covered extensively in the *Hitachi Universal Replicator User Guide*.

Virtual LUN

Virtual LUN volumes can be assigned to TC pairs, with the following restrictions:

- The S-VOL must have the same capacity as the P-VOL.
- When performing Virtual LUN operations on an existing TC P-VOL or S-VOL, you must release the pair first to return the volume to SMPL status.

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

Volume Migration

The following table specifies when TC volumes can be used as Volume Migration volumes.

Volume/pair status	Used as Volume Migration volume?
P-VOL/S-VOL in COPY status	No
P-VOL/S-VOL in PAIR status	Yes
P-VOL/S-VOL in PSUS status	Yes

Restrictions

The following restrictions must be followed when a TC volume in PAIR status is used as a Volume Migration volume:

- Set I/O rates less than 50 IOPS while migrating volumes. If the I/O rate is more than 50 IOPS, volumes might not be migrated.
- If a data path failure occurs, remove the failure and then migrate the volume.
- If an external volume or a DP-VOL is used, information from before the volume was migrated is displayed in the secondary system Device Manager - Storage Navigator window. If the Volume Migration is completed and the TC pair is split and resynchronized, the volume's information is updated.
- Do not migrate a P-VOL and S-VOL at the same time. If you do, a host I/O timeout error can occur.
- Do not change the status of a volume during migration. If you do, the status might not change.

5

TC configuration

This chapter provides instructions for configuring TrueCopy.

Configuration workflow

You must have Storage Administrator (Remote Copy) role to perform most TrueCopy operations using Device Manager - Storage Navigator.

Configuration consists of the following operations.

- Check prerequisites for each procedure.
- See Planning pairs and pair volumes on page 59.
- On the primary and secondary systems, install the data paths. See Data path requirements and configurations on page 49.
- (VSP G1000, G1500, and VSP F1500) On the primary and secondary systems, define the Fibre Channel or iSCSI port attribute (initiator port or RCU Target port) that will be used for TrueCopy operations. See Ports on page 58 and Defining port attributes (VSP G1000, G1500, and VSP F1500) on page 102 for details.
- On the primary system, create the TrueCopy association with the secondary system. See Adding remote connections on page 104. Remote paths between the systems are added during this procedure.

(VSP G1000, G1500, and VSP F1500) You can also perform these additional procedures prior to the initial copy:

- Add additional remote paths. For instructions, see Configuring additional remote paths on page 137.
- Specify the maximum number of volumes to copy at the same time. See Setting the remote replication options on page 107.
- Specify the number of volumes to copy at the same time. See Setting the remote replication options on page 107.

Unless otherwise stated, this user guide assumes a configuration in which the primary storage system connects to the P-VOL and the secondary storage system connects to the S-VOL. The local storage system refers to the storage system connected to the Device Manager - Storage Navigator client PC. The remote storage system refers to the system connected to the local storage system.

Defining port attributes (VSP G1000, G1500, and VSP F1500)

Initiator and RCU target ports must be set up on the primary and secondary systems for TrueCopy command and data transfer.

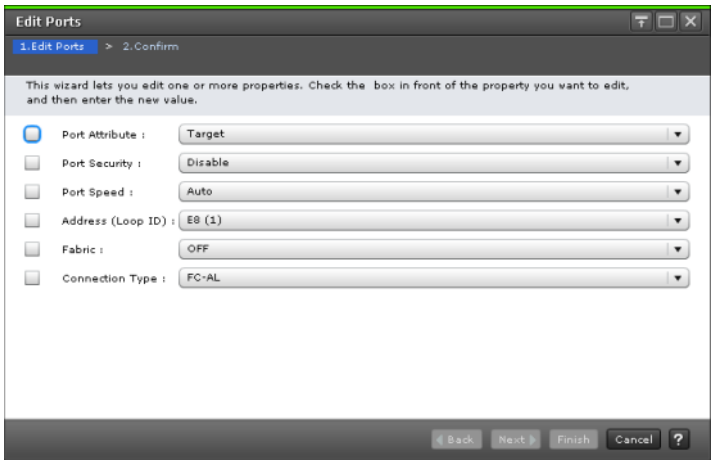
Before you begin

- Storage Administrator (System Resource Management) is required.

- The number of hosts connected to a target port must be limited to 128 or fewer to avoid disconnection.
- See Ports on page 58 for information about target, initiator, and RCU target ports.
- If you are changing a target port to an initiator port, prepare the port for the change as follows:
  - Confirm that the port is offline.
  - Disconnect the port from the host.
  - Remove all channel paths to the port.
- If you are changing a Fibre channel port or iSCSI port from an initiator port to a target or RCU target port, prepare the port for the change as follows:
  - Release all pairs using the ports.
  - Delete the paths from the initiator port to the remote storage system.
  - Disconnect the connection from the local storage system to the remote storage system. See Deleting remote connections on page 140.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab, select the port to be changed, and click **Edit Ports**.
4. In the **Edit Ports** window, select a **Port Attribute**: **Initiator** or **RCU Target**.



   For all other settings, see the *Provisioning Guide for Open Systems*.
5. Click **Finish**.
6. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
7. Click **Apply** to save your settings.

Adding remote connections

You can configure the storage systems for TrueCopy by adding a remote connection from the primary to the secondary system. Adding the connection and setting up remote paths prepares the systems for TC commands and operations.

Depending on the system configuration, remote connection from the secondary storage system to the primary storage system is also added. For VSP Gx00 models and VSP Fx00 models, perform this procedure in the primary storage system.

Caution: Do not add or delete a remote connection or add a remote path at the same time that the SCSI path definition function is in use.

Before you begin

- The local and remote systems must be ready for TC operations. See Storage system preparation on page 32.
- The data path must be set up. See Data path requirements and configurations on page 49.
- (VSP G1000, G1500, and VSP F1500) The port attributes on the local and remote systems must be configured for TrueCopy. See Defining port attributes (VSP G1000, G1500, and VSP F1500) on page 102.
- The remote system serial number, LDKC, controller ID, path group ID, and port numbers are required.

Note: When using CCI (including Raidcom), the VSP G1000 and G1500, and VSP F1500 serial numbers require a prefix of "3".

- One of the fields, Round Trip Time, is covered extensively in Round trip time option on page 44.
- Another field, Minimum Number of Paths, is also covered in more detail in Minimum number of remote paths option on page 47.
- Remote path settings are required to perform TC pair operations and check pair status in Device Manager - Storage Navigator. Make sure to complete the procedure. If you cancel remote path settings, you will be unable to perform operations and check status.
- Operations involving remote paths cannot be performed when changing the microcode or firmware. Make sure a microcode or firmware change completes before beginning operations involving remote paths.
- When using virtual storage machine volumes, make sure to specify the physical serial number of the storage system, not the serial number of the virtual storage machine.

- Operations involving remote paths cannot be performed if changing the microcode or firmware is interrupted due to an error or operation cancellation. Make sure a microcode or firmware change completes before beginning operations involving remote paths.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. In the **Remote Connections** window, click the **Connections (To)** tab.
4. In the **Connections (To)** tab, click **Add Remote Connection**.
5. (VSP G1000, G1500, and VSP F1500) In the **Add Remote Connection** window, select the **Connection Type**:
   - For TC, select **System** (connects system by system).
   - For TCz, select **CU** (connects CU by CU).

   Note: When using virtual storage machine volumes, make sure to specify the physical serial number of the storage system, not the serial number of the virtual storage machine.

6. In the **Remote Storage System** box, specify the following:
   a. For **Model**, select the storage system model and number. Select 7 for VSP G1000 and G1500, and VSP F1500, 6 for VSP, 5 for USP V/VM, 19 for HUS VM, and 18 for VSP Gx00 models and VSP Fx00 models.
   HUS VM (19) and VSP Gx00 and VSP Fx00 (18) can be selected only when **System** is selected for **Connection Type**.
   b. For **Serial Number**, enter one of the following remote storage system serial numbers.
   - VSP G1000 and G1500, and VSP F1500: 1 to 99999 (5 digits)
   - VSP or USP V/VM: 1 to 99999 (5 digits)
   - HUS VM: 200001 to 265535 (6 digits)
   - VSP Gx00 models and VSP Fx00 models: 400001 to 499999 (6 digits)

   Note: When using virtual storage machine volumes, make sure to specify the serial number of the physical storage system, not the serial number of the virtual storage machine.

7. In the **Remote Paths** box, specify the following:
   a. For **Path Group ID**, select the path group ID (00-FF). A storage system can have a maximum of 64 registered path group IDs.
   b. For **Minimum Number of Paths**, select the minimum number of paths between the remote storage and local storage system. If the

number of paths drops below the minimum, the local storage system splits the pair.

The range is 1-8, and the default is 1.

c. In the path ports boxes, select the ports used by the remote path.

You can add more remote paths by clicking the **Add Path** button. See Configuring additional remote paths on page 137 for more information.

Note: Set 1 for Minimum Number of Paths if the local storage system has a TrueCopy pair that contains critical data for disaster recovery. By setting 1, you can continue TrueCopy operation even when there is only one path to the remote storage system.

To maintain high performance operation in the local storage system, set 2 or a greater value (8 as the maximum number of paths for a path group) for Minimum Number of Paths.

If the number of paths goes below the minimum number of paths and the TrueCopy pair is split, deciding whether to fence the P-VOL of the pair (to reject all write I/Os) is determined according to the primary volume fence level.

8. In **Select Type**, select the port type.
9. Select the port to use for the local storage system and the remote storage system. If you selected **iSCSI** for the port type, enter the IP address and the TCP port number for the port of the remote storage system. To add a path, click **Add Path**. If necessary, you can add a path later in the **Add Remote Paths** window.
10. Click **Options** to access additional settings, which are optional.
    a. For **RIO MIH Time**, enter an interval in seconds that, if exceeded, causes the data-transfer operation to be reported as failed by the system. The range is 10-100 seconds, and the default is 15. RIO MIH means "remote I/O missing interrupt handler".
    b. For **Round Trip Time**, enter a time limit for data copy from P-VOL to S-VOL in ms. The range is 1-500 ms, and the default is 1.
11. Click **Finish**.
12. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
13. Click **Apply** to save your settings.

    If you selected **Go to tasks window for status**, the **Tasks** window is displayed.

Related references

- Allowing I/O to the P-VOL after a split: Fence Level options on page 61

Setting the remote replication options

The remote replication options include the storage system options and the CU options. For details, see Remote replication options on page 44.

- Maximum initial copy activities
- Blocked path monitoring
- Blocked path SIM monitoring

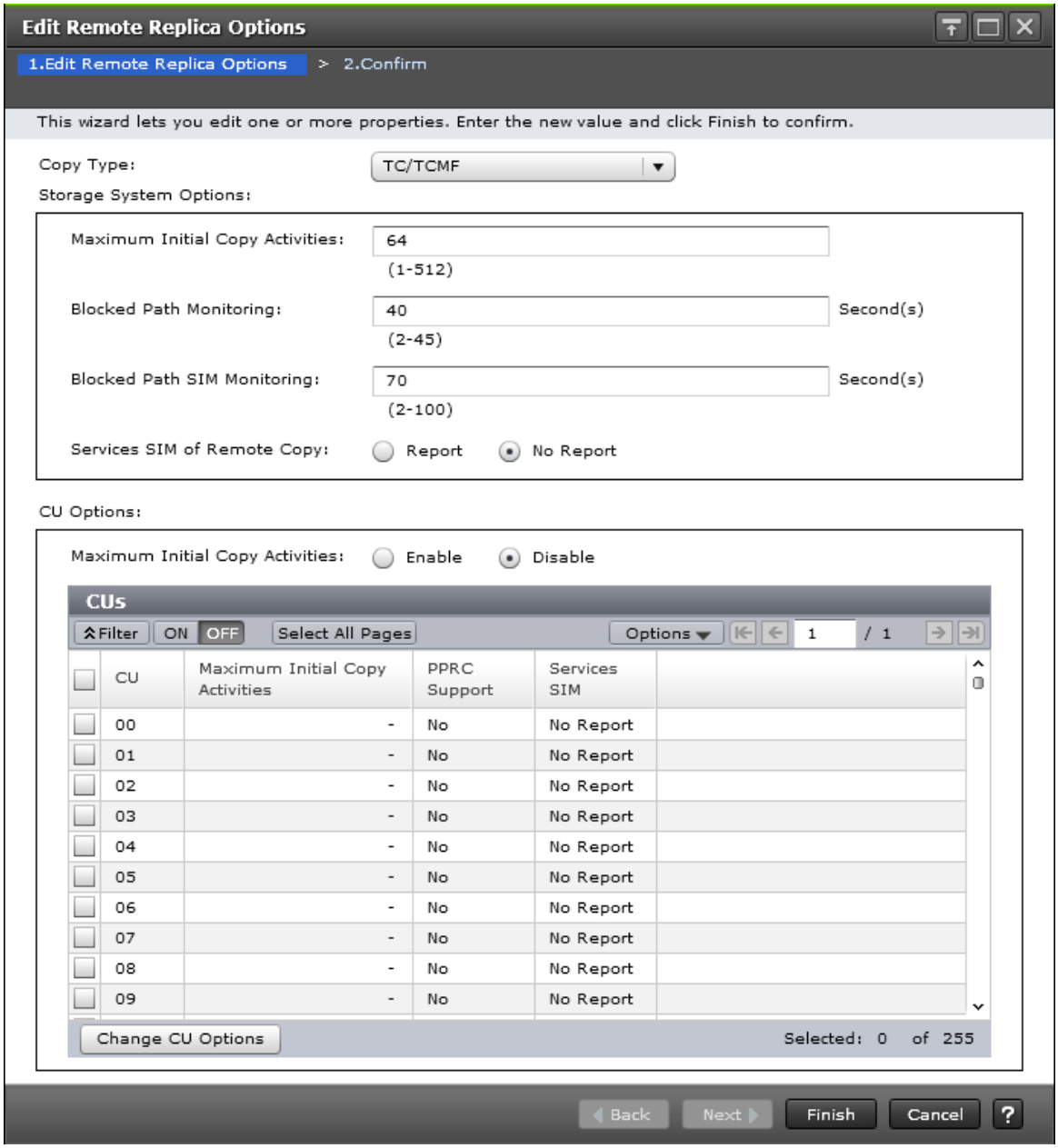
Note: If iSCSI is used in a remote path, the blocked path monitoring remote replica option must be set to at least 40 seconds (default). If blocked path monitoring is less than 40 seconds, the path might be blocked due to a delay in the network such as many switches in a spanning tree protocol (STP) network or a long distance connection.

Before you begin

You must have the role of Storage Administrator (Remote Backup Management).

Procedure

1. Open the **Replication** window.
   a. Click **Storage Systems**, and then expand the Storage Systems tree.
   b. In the Storage Systems tree, click **Replication**.
2. In the **Replication** window, click **Edit Options > Remote Replication**.
3. In the **Edit Remote Replica Options** window, for **Copy Type**, select **TC** or **TC/TCMF**.



4. Change **Storage System Options** as needed. Settings apply to the storage system.
   a. For **Maximum Initial Copy Activities**, specify the number of volumes to be copied concurrently per initial copy operation.

      The range is from 1 to 512 volumes. The default is 64. The default setting might not limit the impact on performance, depending on your number of data paths, pairs, and so on. You should consider these factors when making a selection. When you change the maximum initial copy activities setting, the new setting applies to pairs created or resynchronized after the setting was changed, not to existing pairs.

If the value is too large, the number of pending processing in a remote storage system increases, and the response time of a remote I/O for the update I/O might be affected. For example, if you set 64 for **Maximum Initial Copy Activities**, and register 65 TrueCopy pairs, the local storage system starts creating the 64 pairs first. It does not start creating the 65th pair before one of the pairs is synchronized.

b. For **Blocked Path Monitoring**, enter the number of seconds for the system to monitor blocked paths. The range is 2-45 seconds, and the default is 40.

   If all paths become monitored because of path error, an MIH may occur in the host. Therefore, the time you specify must be less than the host's MIH timer setting.

c. For **Blocked Path SIM Monitoring**, enter the number of seconds for the system to monitor SIMs reported for blocked paths. The range is from 2 to 100 seconds.

d. For **Services SIM of Remote Copy**, specify whether or not services SIMs in the remote CU are reported to the host.

5. Change **CU Options** as needed. Settings apply to the selected CU only.

   a. Select the **CU** with the options to be changed, and then click **Change CU Options**. If you do not want to change CU options, click **Finish**.

   b. In the **Change CU Options** dialog box, for **Maximum Initial Copy Activities**, specify the number of volumes to be copied concurrently per initial copy operation for the CU. The range is from 1 to 16 volumes.

      This option is available only when **Maximum Initial Copy Activities** is **Enable**.

   c. For **Services SIM of Remote Copy**, specify whether or not services SIMs in the remote CU are reported to the host.

   d. Click **OK**.

6. In the **Edit Remote Replica Options** window, click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings.

Completing SIMs for TC (VSP G1000, G1500, and VSP F1500)

When the cause of a SIM for TC has been resolved, you need to complete the SIM by using the Complete SIMs (TC) window. Completing the SIM changes the SIM status to Completed and removes the SIM alert from the header of the Device Manager - Storage Navigator window.

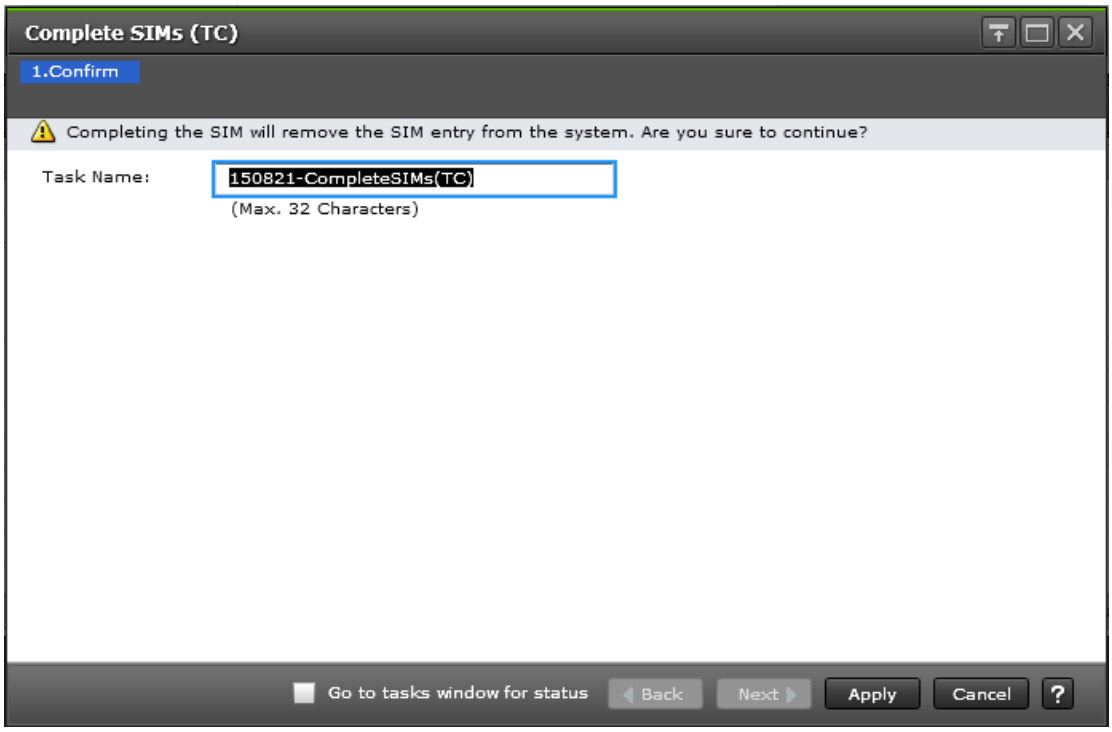
Note: Performing this task completes all uncompleted SIMs for both TC and TCz operations. If the cause of any of the SIMs has not been resolved, new SIMs will be issued.

Before you begin

- Required role: Storage Administrator (System Resource Management)

Procedure

1. Resolve the cause of the SIM.
2. Open the **Complete SIMs (TC)** window.
   In Device Manager - Storage Navigator:
   a. From the Device Manager - Storage Navigator menu, click **Actions**.
   b. Click **Remote Replication > Complete SIMs (TC)**.



3. If desired, select **Go to tasks window for status**.
4. Click **Apply**.
   If you selected **Go to tasks window for status**, the **Tasks** window is displayed.

6

TC pair operations

This chapter provides instructions for performing TrueCopy pair operations.

Pair operations workflow

You must have Storage Administrator (Remote Copy) role to perform TrueCopy operations.

Basic TrueCopy operations consist of the following operations.

- Check prerequisites for each procedure.
- Always check pair status. Each TrueCopy operation requires the pair to be in a specific status.
- Create a pair, in which the S-VOL becomes a duplicate of the P-VOL.
- Split a pair, which separates the P-VOL and S-VOL and allows read/write access to the S-VOL if desired.
- Resynchronize a pair, in which the S-VOL again mirrors the on-going, current data in the P-VOL.
- Delete a pair.

Disaster recovery procedures are discussed in Disaster recovery on page 149.

Note:

- To perform pair operations or check the pair status, LU paths must be established. If you intend to perform storage or replication management operations, make sure that pairs are deleted before removing LU path definitions.
- Pair operations cannot be performed when changing the microcode or firmware, nor if microcode or firmware changes are cancelled. If you start a microcode or firmware change, make sure it is complete before performing pair operations.
- Pair operations cannot be performed when changing the firmware, nor if firmware changes are cancelled. If you start a firmware change, make sure it is complete before performing pair operations.
- When any of the following conditions occur during TC pair duplication, sometimes the TC pair splits to prioritize refresh I/O rather than TC pair duplication.
  - The MP blade/MP unit processor operation rate which the P-VOL belongs is 70% or higher in the primary system.
  - Refresh I/O inflow for the P-VOL is large in the primary system.
  - MP blade/MP unit write-pending which S-VOL belongs is 65% or higher in the secondary system.

  When creating or resynchronizing TC pairs, be aware of the load of the storage systems at each site.

Checking pair status

Every TrueCopy operation requires that the pairs have a specific status. Before performing any operation, check the pair status.

- The prerequisite information for each operation includes the pair status requirements for the operation.
- To view pair status or review status definitions, see Monitoring pair status and license capacity on page 124.

Creating pairs

When you create a pair, the initial copy operation copies all data in the P-VOL to the S-VOL. The P-VOL remains available to the host for I/O operations during the initial copy operation.

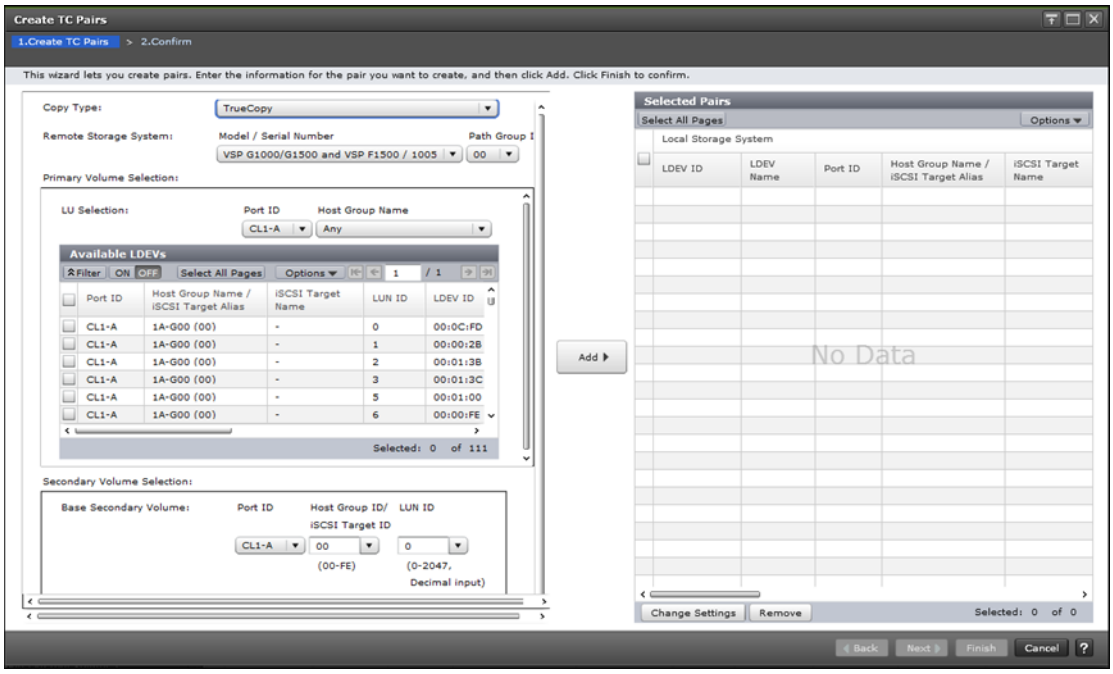
Before you begin

- Required role: Storage Administrator (Remote Backup Management)
- Required status: Both volumes must be simplex (unpaired).
- The initial copy must be performed from the primary system.
- S-VOLs must be offline to all hosts.
- (VSP G1000, G1500, and VSP F1500) Ports must be configured for TrueCopy. See Defining port attributes (VSP G1000, G1500, and VSP F1500) on page 102 for more information.
- The primary and secondary systems must be configured for TrueCopy. See Adding remote connections on page 104 for more information.
- The logical devices on the primary and secondary storage systems must be defined and formatted prior to pairing.
- The P-VOL capacity and S-VOL capacity must be the same (same number of blocks). To view the capacity in blocks, click Options > Capacity Unit > block in the **Logical Devices** window. If the capacity is displayed in GB or TB, a slight difference in P-VOL and S-VOL capacity might not be displayed.
- Stop Performance Monitor before the initial copy to avoid overloading with TCP/IP traffic.
- During this operation, you select P-VOLs and S-VOLs by port ID, Host Group ID or iSCSI Target ID, LUN, CU, and/or LDEV numbers.
- During this operation, you can specify multiple P-VOLs to be paired, but only one S-VOL. To plan how the system assigns subsequent S-VOLs, see the bullet, "When creating multiple pairs concurrently...." in Pair volume requirements and recommendations on page 60.
- During this operation, you can specify whether to fence the P-VOL when an error occurs. This is discussed in detail in Allowing I/O to the P-VOL after a split: Fence Level options on page 61.

- During this operation, you can specify the priority for initial copy operations. When performing more initial copy operations than specified for Maximum Initial Copy Activities (during configuration), see the discussion in Initial copy priority option and scheduling order on page 66.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, select the **TC Pairs** tab and click **Create TC Pairs**.
4. (VSP G1000, G1500, and VSP F1500) In the **Create TC Pairs** window, for **Copy Type**, select **TrueCopy**.



5. For **Remote Storage System**, select the following:
   - The **Model/Serial Number** and **Path Group ID** of the secondary system.

     Note: VSP Gx00 is displayed for VSP Gx00 models and VSP Fx00 models.

   - For **Path Group ID**, select the path group ID.
6. (VSP Gx00 models and VSP Fx00 models) In the **Primary Volume Selection** box, for **Selection Object**, select the port type for the local storage system.

7. In the **Primary Volume Selection** box, for **LU Selection**, select the **Port ID** and **Host Group Name** or **iSCSI Target Alias**. Selecting **Any** places all LUNs within the specified port in the **Available LDEVs** table. No further action is required at this time.

Note: Available LDEVs limitations:
- When using a virtual storage machine and VSP F1500, **Available LDEVs** displays physical LDEV information, not virtual.
- (VSP G1000, G1500, and VSP F1500) Nondisruptive migration volumes do not display in **Available LDEVs**.

8. In the **Secondary Volume Selection** box, specify the following:
   a. For **Base Secondary Volume**, select the initial S-VOL's **Port ID**, **Host Group ID/iSCSI Target ID**, and **LUN ID**. If you are selecting only one P-VOL, this LU is the secondary volume. If you select multiple P-VOLs for pairing, this LUN is the base S-VOL that is assigned to the first P-VOL and from which subsequent S-VOL LUNs are assigned to the list of P-VOLs.

   Caution: In USP V/VM and VSP, LUN IDs are displayed in hexadecimal numbers. In VSP G1000 and G1500, and VSP F1500, LUN IDs display in decimal or hexadecimal numbers. If you have selected the decimal notation, when assigning an S-VOL in a USP V/VM or VSP storage system, make sure to convert the hexadecimal LUN ID number to decimal.

   b. For **Selection Type**, select the method for assigning S-VOLs when multiple primary volumes are selected.
      - For **Interval**, specify an interval the system skips between secondary system LU numbers.
      - For **Relative Primary Volume**, the system assigns secondary system LU numbers based on proximity to P-VOL LU numbers.
9. Click **Options** to define the following optional settings:
   a. For **Primary Volume Fence Level**, specify whether the primary system allows or rejects write operations to the P-VOL when the pair is split due to an error.
      - **Data**: The P-VOL cannot be written to.
      - **Status**: The P-VOL can be written to if the primary system can change the S-VOL status to Suspend. If the primary system is not able to change the S-VOL status to Suspend, the P-VOL cannot be written to.
      - **Never**: The P-VOL can always be written to.
   b. For **Initial Copy Type**, specify whether to copy data from P-VOL to S-VOL during the operation.

- **Entire Volume** creates the pair and copies data to the S-VOL. (Default).
- **None** creates the pair but data is not copied to the S-VOL. This requires that data in the P-VOL and S-VOL are already identical.

c. For **Copy Pace**, specify the number of tracks to be copied per remote I/O during the operation. The default is 15 (fast copy pace). For OPEN-V, to change the copy pace, enter a number from 1 to 4. This option affects performance as follows:
   - The speed of 1 is a slow copy pace, and is used to reduce impact on host I/O.
   - The speeds of 2 and 3 are a medium copy pace.
   - The speed of 4 is a fast copy pace, and the host I/O performance might be degraded.

   (VSP G1000, G1500, and VSP F1500) Other than OPEN-V, to change the copy pace, enter a number from 1 to 15.
   - The speeds of 1 to 5 are a slow copy pace, and are used to reduce impact on host I/O.
   - The speeds of 6 to 10 are a medium copy pace.
   - The speeds of 11 to 15 are a fast copy pace, and the host I/O performance might be degraded.

d. For **Initial Copy Priority**, specify the scheduling order for the initial copy operation. The range is 1-256, and the default is 32.

   If you perform initial copy operation over the number of times set for **Maximum Initial Copy Activities** in the **Edit Remote Replica Options** window, you can set the order (priority) for the additional initial copy operations.

   The initial copy priority is determined within the range of the number of initial copy operations performed concurrently. Because of this, the additional initial copy operations are not performed until the first batch completes.

   If a time-out error occurs during this operation, the order specified in **Initial Copy Priority** may not run as expected. A time-out error can occur because of the CU configuration or data path error. Review the error, delete the pair with an error, and then retry the operation.

10. Back again in the **Primary Volume Selection** box, select the primary volume to be copied first and click **Add**. The volume and pair information moves to the **Selected Pairs** table.

In the **Selected Pairs** table, you can change pair options by selecting it and clicking **Change Settings**. Remove a pair by selecting it and clicking **Remove**.

11. Click **Finish**.

12. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.

13. Click **Apply** to save your settings.

Splitting pairs

You can split a pair, which suspends data copying to the S-VOL.

When a pair is split:

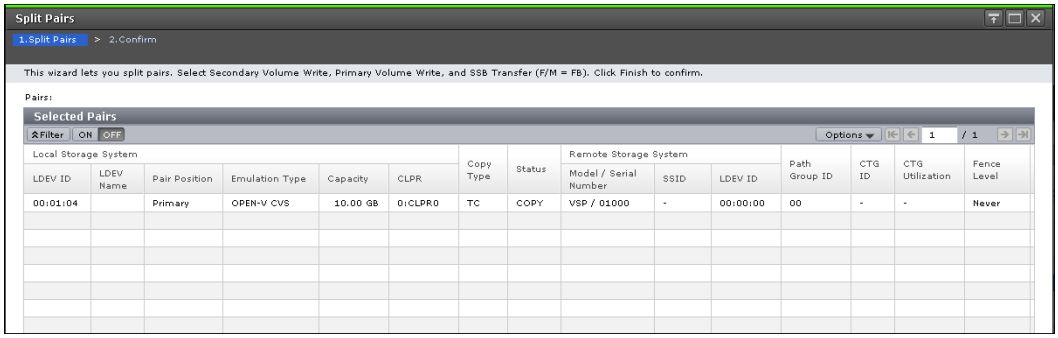
- I/O writes from the host continue to the P-VOL, but stop to the S-VOL.
- Any current update copy operation completes to the S-VOL, ensuring data consistency to the point of the split operation.
- Pair status changes to PSUS.
- The primary system records the updated tracks to the P-VOL that occur after the split as differential data. This data is copied to the S-VOL when the pair is resynchronized.
- (VSP Gx00 models and VSP Fx00 models) To access an S-VOL of which write option is enabled, the pair must be split.
- (VSP Gx00 models and VSP Fx00 models) When a pair is split, the secondary storage system completes pending copy operation before changing the pair status to ensure pair synchronization.
- You can set an option to block updates to the P-VOL while the pair is split. This results in the P-VOL and S-VOL staying synchronized.
- Another option is to enable system write to the S-VOL from a host. The secondary system records the updated tracks as differential bitmaps. When the pair is resynchronized, the secondary system sends the differential bitmaps to the primary system, which merges all differential bitmaps to determine which tracks are out-of-sync.

Before you begin

- Required role: Storage Administrator (Remote Backup Management)
- Required status: Pair status must be COPY or PAIR

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab, and then select the pair to be split.
4. In the **TC Pairs** tab, click **Split Pairs**.
5. In the **Split Pairs** window, ensure that the pair to be split appears in the **Selected Pairs** table.



6. For **Secondary Volume Write**, specify whether the host can write to the S-VOL while the pair is split.
   - **Enable** accepts host read and write I/Os to the S-VOL. Note the following:

     - If you plan to resynchronize the pair after the S-VOL has been written to while split, you must select **Depends on Primary Volume Fence Level** for the **Primary Volume Write** option, below. This ensures that P-VOL and S-VOL bitmaps are merged when the pair is resynchronized.

     - If you specify Enable for this option, and also need the P-VOL to continue accepting host I/O, make sure to select **Depends on Primary Volume Fence Level** for **Primary Volume Write**.

     Enable is only available when performing the split operation from the pair's primary storage system.
   - **Disable** (default) causes the host read and write I/Os to be rejected by the S-VOL while the pair is split.
7. For **Primary Volume Write**, specify whether writing to the P-VOL is enabled while the pair is split.
   - **Depends on Primary Volume Fence Level**: Writing to the P-VOL is based on fence level specified during the Create Pairs operation. This is the default.
   - **Disable**: Write I/Os to the P-VOL are rejected regardless of the fence level. Select this option to maintain synchronization of the P-VOL and S-VOL. Do not select this option if the P-VOL is necessary for host system operations.

     Disable is only available when performing the split operation from the pair's primary storage system.

Note: When the pair must be split and its P-VOL is required for system operations, you must select **Depends on Primary Volume Fence Level**, so that the P-VOL continues to accept I/Os.

8. Click **Finish**.

9. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
10. Click **Apply** to save your settings.

    After the pair is split, make sure that the TrueCopy pair is displayed correctly (in the PSUS status) in the **Remote Replication** window.

    To check the pair split operation status, click the update button at the upper right corner of the Device Manager - Storage Navigator main window to update the information in the **Remote Replication** window, or view the detailed status information in the **View Pair Properties (Remote)** window.

Resynchronizing pairs

While a TrueCopy pair is split, the primary system does not perform update copy operations to the S-VOL. Resynchronizing the pair updates the S-VOL with differential data accumulated since the split, so that its data is again identical with the P-VOL's data. Update copy operations begin again to the S-VOL.

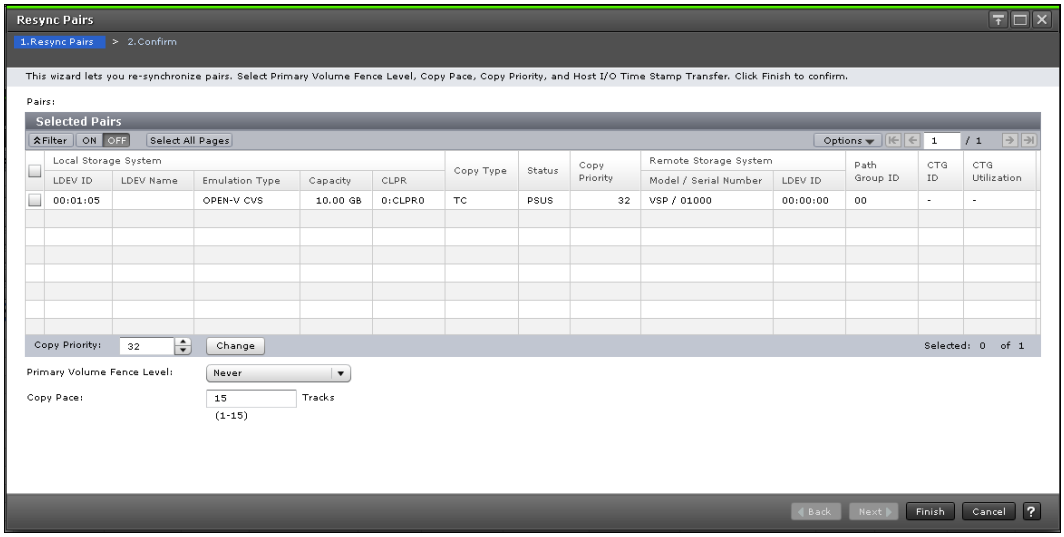
When resynchronizing, TrueCopy pairs can be migrated to global-active device. See the *Global-Active Device User Guide.*

Before you begin

- Required role: Storage Administrator (Remote Backup Management)
- Required status: Both volumes must be suspended (PSUS or PSUE).
- This operation is performed from the primary system only.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab, and then select the pair to be resynchronized.
4. In the **TC Pairs** tab, click **Resync Pairs**.
5. In the **Resync Pairs** window, ensure that the pair to be resynchronized appears in the **Selected Pairs** table.



6. For **Primary Volume Fence Level**, specify whether the primary system rejects write operations to the P-VOL when the pair is split due to an error.
   - **Status**: The P-VOL cannot be written to only if the primary system is not able to change S-VOL status to Suspend.
   - **Never**: The P-VOL can always be written to.
   - **Data**: The P-VOL cannot be written to when the update copy fails.

   For more information, see Allowing I/O to the P-VOL after a split: Fence Level options on page 61.
7. For **Copy Pace**, specify the number of tracks to be copied per remote I/O during the operation. The default is 15 (fast copy pace). This option affects performance as follows:
   - For OPEN-V, to change the copy pace, enter a number from 1 to 4.
   - The speed of 1 is a slow copy pace, and is used to reduce impact on host I/O.
   - The speeds of 2 and 3 are a medium copy pace.
   - The speed of 4 is a fast copy pace, and the host I/O performance might be degraded.
   - (VSP G1000, G1500, and VSP F1500) Other than OPEN-V, to change the copy pace value, enter a number from 1 to 15.
     - The speeds of 1 to 5 are a slow copy pace, and are used to reduce impact on host I/O.
     - The speeds of 6 to 10 are a medium copy pace.
     - The speeds of 11 to 15 are a fast copy pace, and the host I/O performance might be degraded.
8. For **Copy Priority**, enter the priority, or scheduling order, for the resync operation. You can set priority from 1 to 256. The default is 32. For more on priority, see the descriptions in Initial copy priority option and scheduling order on page 66.

9. Click **Finish**.
10. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
11. Click **Apply** to save your settings.

    After the pair is resynchronized, make sure that the TrueCopy pair is displayed correctly (in the PAIR status) in the **Remote Replication** window.

    To check the pair resynchronization operation status, click the update button at the upper right corner of the Device Manager - Storage Navigator main window to update the information in the **Remote Replication** window, or view the detailed status information in the **View Pair Properties** window.

Deleting pairs

A TrueCopy pair can be deleted. Doing this deletes the TC relationship, though not the volumes or their data.

- When it is no longer necessary to maintain a remote copy of the P-VOL, delete a pair from the primary system only. All update operations are stopped and pair status for both the P-VOL and S-VOL changes to unpaired.

  When a pair is deleted, the primary system continues to accept write I/O to the former P-VOL but does not keep track of the updates.
- Delete a pair from the secondary system only for disaster recovery purposes. When you do this, the secondary system changes the S-VOL pair status to unpaired, the primary system detects that the S-VOL status is unpaired and then changes the P-VOL status to PSUS (Delete pair to RCU).

  To restart a pair that was deleted from the secondary system, you must delete the pair from the primary system and then create the pair from the primary system.

Note: When you delete a pair from the secondary system, make sure that the S-VOL and P-VOL are identical, including the volume labels. Take all necessary steps to prevent system problems due to duplicate volumes.

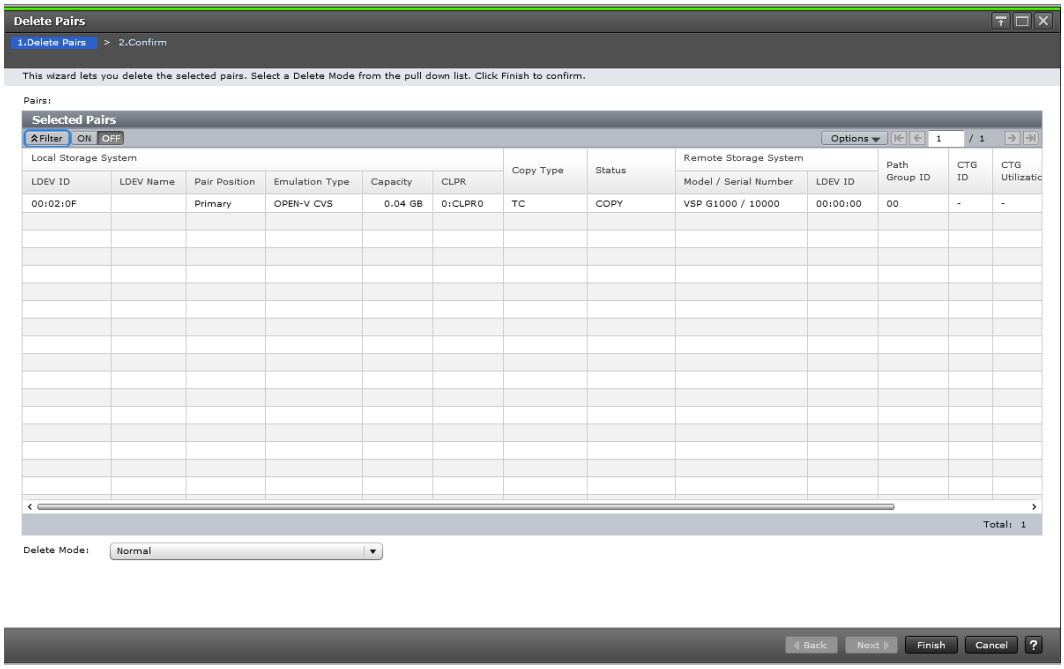
Before you begin

- Required role: Storage Administrator (Remote Backup Management)

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab, and then select the pair or pairs to be deleted.

4. In the **Delete Pairs** window, ensure that the pairs to be deleted appear in the **Selected Pairs** table.



5. For **Delete Mode**, specify one of the following:
   - **Normal**: Deletes the pair only if the primary system can change both P-VOL and S-VOL to unpaired volumes.
   - **Force**: Forcibly deletes pairs even when the primary system cannot communicate with the secondary system.
     Releases the host waiting for the I/O completion signal from the local storage system which cannot communicate with the remote storage system, and then allows host operations to continue.
6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings.

   After the pair is deleted, make sure that the TrueCopy pair is not displayed in the **Remote Replication** window.

   To check the pair deletion operation status, click the update button at the upper right corner of the Device Manager - Storage Navigator main window to update the information in the **Remote Replication** window, or view the detailed status information in the **View Pair Properties (Remote)** window.

7

Monitoring and maintaining the TC system

This chapter provides information and instructions for monitoring and maintaining a TrueCopy system.

Monitoring pair status and license capacity

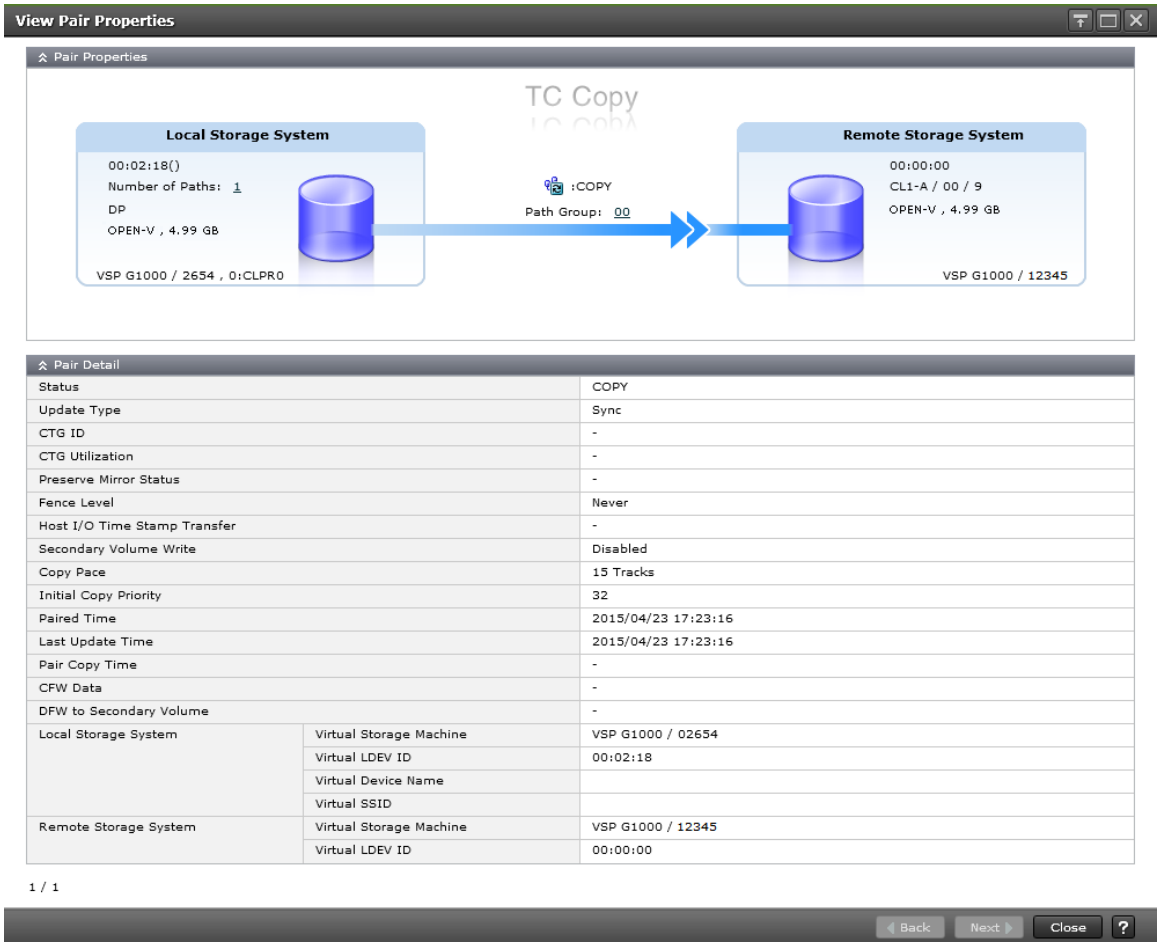
You should monitor the TrueCopy system frequently to keep track of and maintain the copy pairs.

- When you want to perform a pair operation, first check the pair's status. Each operation requires a specific status or set of statuses.
- Pair status changes when an operation is performed. Check status to see that pairs are operating correctly and that data is updated from P-VOLs to S-VOLs in PAIR status, or that differential data management is performed in Split status.

Monitoring using the GUI is done manually. Monitoring should be repeated frequently. Email notifications of problems can be set up using the GUI.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab, and then locate the pair volume with the status you want to review.
4. In the **TC Pairs** tab, click **More Actions > View Pair Properties** and review **Status**.



For more information, see Pair status definitions on page 126.

Next steps
To monitor license capacity, see the Summary area in the **Replication** window.

How pair status changes

The primary system changes and maintains the status of the P-VOL and is responsible for keeping the P-VOL and its S-VOL synchronized. The secondary system maintains the status of the S-VOL.

- The primary system can change the status of the P-VOL and S-VOL.
- The secondary system can change the status of the S-VOL but not the P-VOL. When an operation is performed from the secondary system, the primary system detects a status change in the S-VOL and then changes P-VOL status accordingly.
- The status indicates the state of the volume or pair:
  - When a pair is started, the secondary system changes the status of the P-VOL and S-VOL to COPY. When the initial copy operation is complete, the primary system changes the status of both volumes to PAIR.

- When you split a pair, the system changes the status of the P-VOL and S-VOL to Suspend (VSP G1000, G1500, and VSP F1500) or PSUS (VSP Gx00 models and VSP Fx00 models).
- When a pair is suspended due to an error condition, the primary/secondary system changes the P-VOL and S-VOL status to Suspend (VSP G1000, G1500, and VSP F1500) or PSUE (VSP Gx00 models and VSP Fx00 models).
- When a pair is deleted from the primary system, that system changes the status of the P-VOL and S-VOL to unpaired.
- When a pair is deleted from the secondary system, that system changes the S-VOL status to unpaired, and the secondary system detects the pair release and changes the P-VOL status to Suspend (VSP G1000, G1500, and VSP F1500) or PSUS (VSP Gx00 models and VSP Fx00 models).

Pair status definitions

Both Device Manager - Storage Navigator and CCI pair status names appear in the Status column, except when the names are the same. When they are the same, the CCI status does not appear.

The following table shows both types of status names and their descriptions. In some cases, a particular status has no exact parallel status in the other interface. This is noted.

When checking the pair status, click **Refresh** to display the latest information. The P-VOL access and S-VOL access columns in the following table indicate whether the volumes accept read/write.

HDvM - SN status	CCI status	Description	P-VOL access	S-VOL access
Unpaired in HDvM - SN	SMPL	This volume is not currently assigned to a TrueCopy pair.	Read/Write	Read/Write
 COPY*	COPY	The initial copy operation for this pair is in progress. This pair is not yet synchronized.	Read/Write	Read Only
 PAIR	PAIR	• The pair is synchronized • Updates from the host to the P-VOL are duplicated in the S-VOL.	Read/Write	Read Only
 PSUS (pair suspended-split) (See also Split types on page 128.)	SSUS, PSUS	• The pair was split by a user or deleted from the secondary system. • The pair is not synchronized.	Read/Write	Read only if Secondary Volume Write option is disabled.

HDvM - SN status	CCI status	Description	P-VOL access	S-VOL access
		• When you split the pair from the primary system, that system changes the status of the P-VOL and S-VOL to this status. • In this status, updates to the S-VOL stop. The storage system keeps track of updates to the P-VOL in order to update the S-VOL when the pair is resynchronized. CCI also shows the P-VOL in this status. • When you split the pair from the secondary system, that system changes the status of the S-VOL to this status. The primary system detects this and changes the P-VOL to this status. CCI shows the S-VOL status as SSUS. • When you release the pair from the secondary system, that system changes the S-VOL status to SMPL . The primary system detects this and changes the P-VOL to this status. The pair must be released from the primary system in order to change P-VOL status to SMPL. • CCI PSUS status indicates that although the paired status is retained, the user split the pair. This status is only for the P-VOL. While the pair is split, the storage system keeps track of updates to the P-VOL in the differential bitmaps.		Read/Write if Secondary Volume Write option is enabled.
 PSUE (pair suspended-error)	PSUE	• The primary or secondary system splits the pair due to an error.	Read/Write. Read only if Primary Volume	Read Only

HDvM - SN status	CCI status	Description	P-VOL access	S-VOL access
(See also Split types on page 128.)		• If the primary system cannot keep the pair synchronized for any reason, it changes the status of the P-VOL and S-VOL (if possible) to this status. • The pair is not synchronized. • CCI PSUE indicates that although the paired status is retained, updates to the S-VOL is sopped due to an error status. CCI PSUE is PSUS (SSUS) caused by an internal error. • (VSP Gx00 models and VSP Fx00 models) A user deleted the pair from the secondary system. • (VSP Gx00 models and VSP Fx00 models) An error occurred in the secondary system or the secondary volume, or during an update copy of TrueCopy. • (VSP Gx00 models and VSP Fx00 models) Communication with the secondary system was disabled.	Fence Level is Data.	
-	SSWS	• CCI SSWS status indicates that the pair status is retained. The P-VOL and the S-VOL of the pair is switched and then they are resynchronized (horctakeover).		
* When the pair status is COPY, neither cache nor shared memory can be added to or removed from the storage system. When either of these tasks is to be performed, first suspend (VSP G1000 and G1500, and VSP F1500 or split VSP Gx00 models and VSP Fx00 models any pairs in COPY status, and then resynchronize when the cache or shared memory operation is completed.				

Split types

This topic discusses pairs that are split by user operation (PSUS), and pairs that are suspended by the system because of failure (PSUE).

- You can split a pair when the initial copy operation is complete.

    - You must split a pair to access a volume which has the Secondary Volume Write option enabled.
    - To synchronize data of the primary and secondary sites after the split, complete the update copy operation before splitting a pair.
- Pairs are split by the primary system only, for any of the following reasons:
    - You released the pair from the secondary system.
    - An error condition related to the secondary system, the S-VOL, or an update-copy operation.
    - The primary system cannot communicate with the secondary system.

Split types appear in the Status field on the View Pair Properties window. The following table describes the split types.

Split type	Volume applies to	Description
Primary Volume by Operator	P-VOL	The user split the pair from the primary system specifying Disable for Primary Volume Write. The S-VOL split type is by MCU.
Secondary Volume by Operator	P-VOL S-VOL	The user split the pair from the primary or secondary system specifying Depends on Primary Volume Fence Level for Primary Volume Write.
by MCU	S-VOL	The secondary system received a request from the primary system to split the pair. The P-VOL split type is Primary Volume by Operator or Secondary Volume by Operator.
Release pair to RCU	P-VOL	The primary system detected that the S-VOL status changed to SMPL because you released the pair from the secondary system. The pair cannot be resynchronized because the S-VOL does not have the PSUE/PSUS status.
by RCU	P-VOL S-VOL	The primary system detected an error condition at the secondary system (RCU), that caused the primary system to split the pair. The S-VOL split type is Secondary Volume Failure.
Secondary Volume Failure	P-VOL S-VOL	The primary system detected an error during communication with the secondary system, or an error during update copy. In this case, the S-VOL split type is usually Secondary Volume Failure. This split type is also used when the number of paths falls below the minimum number of paths setting on the Add Remote Connection window.
MCU IMPL	P-VOL S-VOL	The primary system could not find valid control information in its nonvolatile memory during IMPL. This condition occurs only if the primary system is without power for more than 48 hours (that is, power failure and fully discharged backup batteries).
Initial Copy Failed	P-VOL S-VOL	The pair was split before the initial copy operation was complete. The data on the S-VOL is not identical to the data on the P-VOL.

System behavior

Note the following behaviors for split pairs:

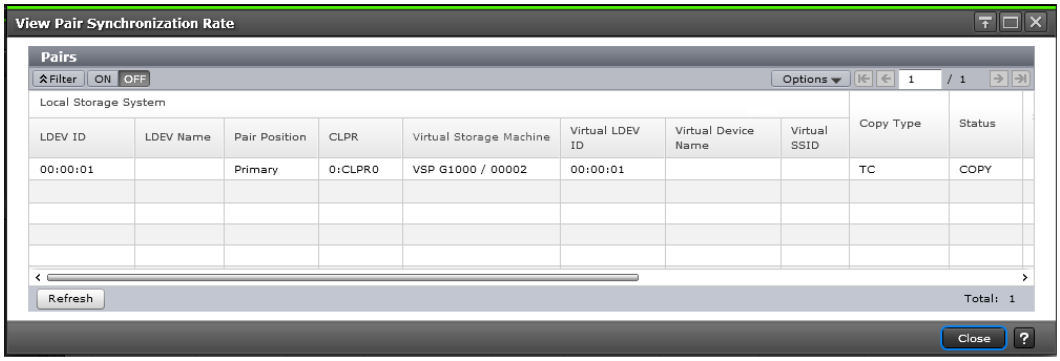
- The primary system stops performing update operations to the S-VOL. It may or may not continue accepting write I/Os to the P-VOL depending on the P-VOL fence level setting.
- If an update fails, the primary system reports a unit check and notifies the host that Write fails. This ensures that both the host system and application program regard the write operation to the P-VOL as failed.
- If the primary system accepts subsequent write I/Os for a split P-VOL, the system records the updated data in the P-VOL tracks as differential data. When a split pair is resynchronized, the primary system copies the out of sync P-VOL tracks to the S-VOL as differential data.

Monitoring TC pair synchronization rate

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

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab, and then select the pair whose rate you want to display.
4. In the **TC Pairs** tab, click **More Actions > View Pair Synchronization Rate**. Click **Refresh** to display the latest synchronization rate.

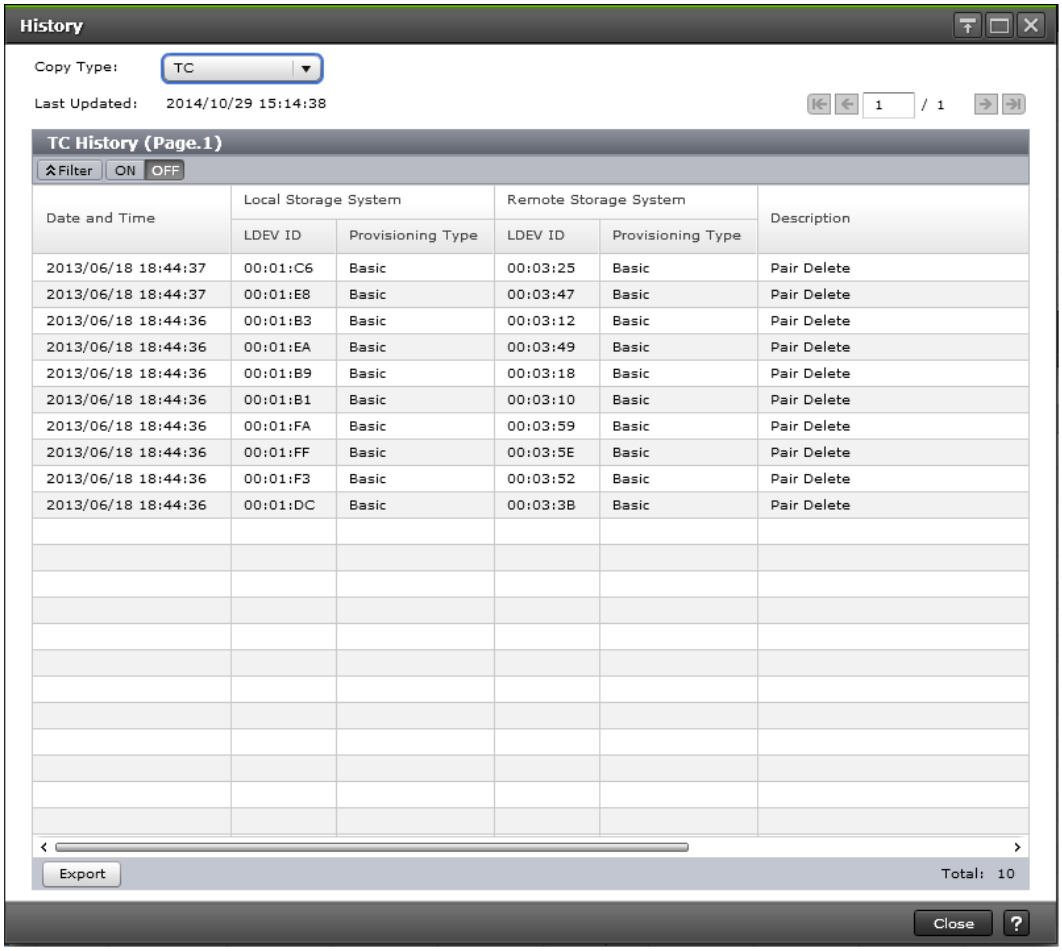


Monitoring TC operations history

You can review a pair's history of operations, including the operation's description, date and time it took place, primary and secondary system information, and other details.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication**.
3. In the **Replication** window, click **View History > Remote Replication**.
4. In the **History** window, for **Copy Type**, select **TC**. The **Description** column displays operations, which are explained below.



Result

Note the following when viewing histories:

- Operation rows might not appear in descending, chronological order.
- The most recent operations are displayed up to a maximum of 524,288 (8,192 for VSP Gx00 models and VSP Fx00 models) operations. Information older than seven days is not shown.
- "LDEV ID" indicates the physical LDEV ID, even when you use CCI and use pair volumes in a virtual storage machine.

- If a failed split occurred with two or more LDEVs at the same time, the number of pairs showing Pair Suspend (Failure) might not match the actual number of pairs in which the failure occurred.
- If you use 1,000 or more pairs concurrently, some operation history might not be recorded.

Operations listed in the History window

The following table describes the operations listed in the History window.

Operation Displayed	Description
Pair Add Start	Creation of the pair started.
Pair Add Complete	Creation of the pair completed.
Pair Delete	The pair was deleted.
Pair Suspend (Operation)	The pair was split.
Pair Suspend (Failure)	The pair was split (suspended) because of a failure.
Pair Resync. start	Resynchronization of the pair was started.
Pair Resync. Complete	Resynchronization of the pair was completed.

Changing P-VOL fence level

You can change the P-VOL's fence level, which specifies when to reject write operations to the P-VOL under certain failure circumstances.

For more information on fence levels, see Allowing I/O to the P-VOL after a split: Fence Level options on page 61.

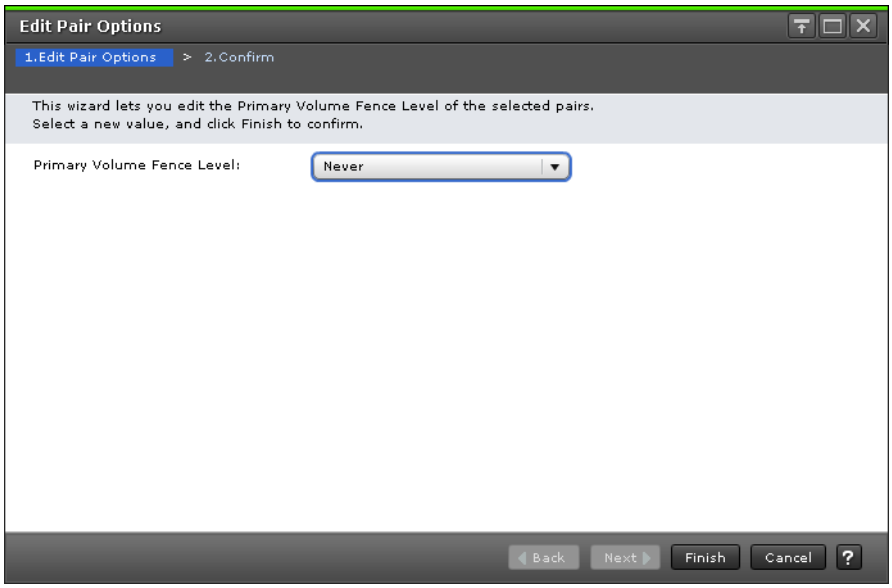
Before you begin

- Required status: Both volumes must be COPY or PAIR.
- The **Edit Pair Options** window is used for the following procedure. If you select multiple pairs, the values do not display but are blank. When you change a value, the change applies to all selected pairs

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.
3. In the **Remote Replication** window, click the **TC Pairs** tab then select the pair whose options are to be changed.
4. In the **TC Pairs** tab, click **More Actions > Edit Pair Options**.
5. In the **Edit Pair Options** window, for **Primary Volume Fence Level** box, select the fence level for the pairs.
   - **Never**: The P-VOL can always be written to.
   - **Data**: The P-VOL cannot be written to.

- **Status**: The P-VOL cannot be written to only if the primary system is not able to change S-VOL status to PSUE.



6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings in the system.

Forcibly deleting pairs

You forcibly delete a pair for the following reasons:

- A currently unpaired volume that was previously in a pair is unusable because previous pair information is still in the volume.
- The pair cannot be connected to the remote storage system because of a communication error. In this case, delete the pair forcibly in both local and the remote storage systems.

Caution: The following data is discarded:

- Data which is not sent to the secondary storage system when a pair in the primary storage system is deleted forcibly
- Data which is not restored when a pair is deleted forcibly in the secondary storage system

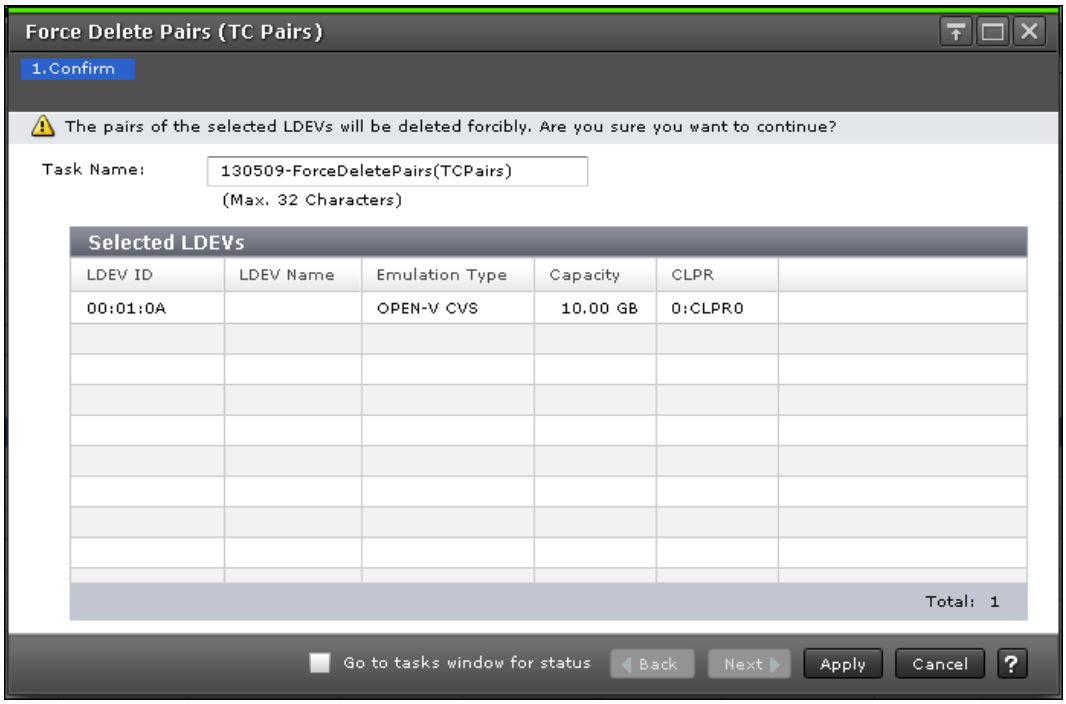
In addition, if a pair is deleted forcibly when a journal contains a pair in the PAIR/COPY status, host I/Os to the pair might time out.

Before you begin

- The volume must be unpaired.
- Required role: Storage Administrator (System Resource Management)

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Logical Devices**.
3. Click the **LDEVs** tab, and then select the pair to be forcibly deleted.
4. In the **LDEVs** tab, click **More Actions > Force Delete Pairs (TC Pairs)**.
5. In the **Force Delete Pairs (TC Pairs)** window, ensure that the volume is in the **Selected LDEVs** table.



6. In **Task Name**, enter the task name.
7. Click **Apply**.

Saving pair information to a text file

You can save pair status and other information to a tab-delimited TSV file.

Procedure

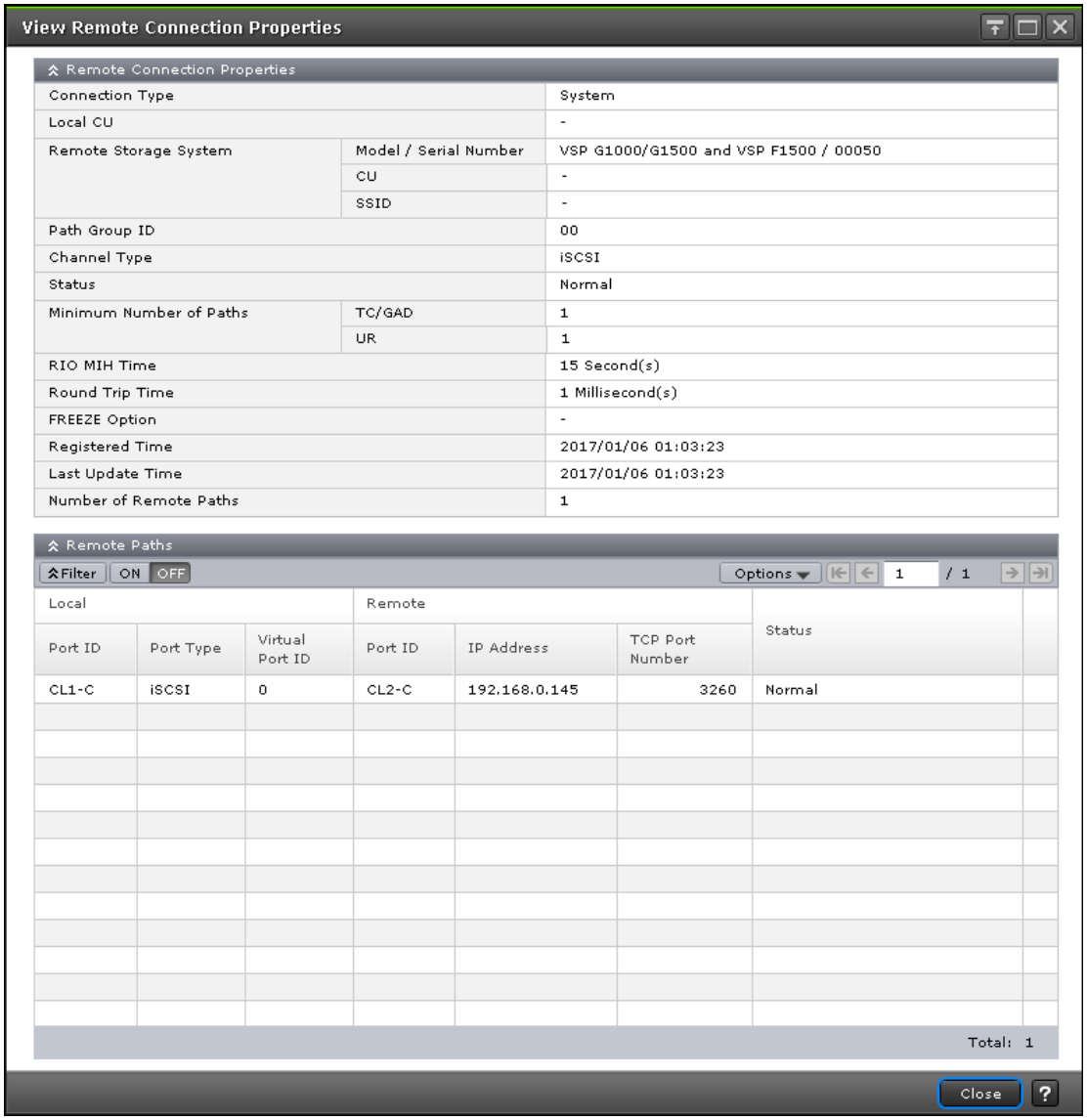
1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Replication**.

3. In the **Remote Replication** window, click **More Actions > Export**.
4. If necessary, follow instructions in online Help.

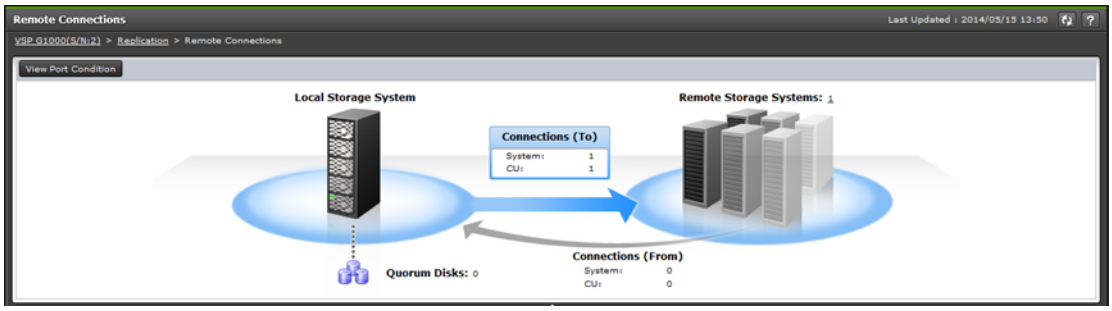
Monitoring and maintaining remote connections and paths

Procedure

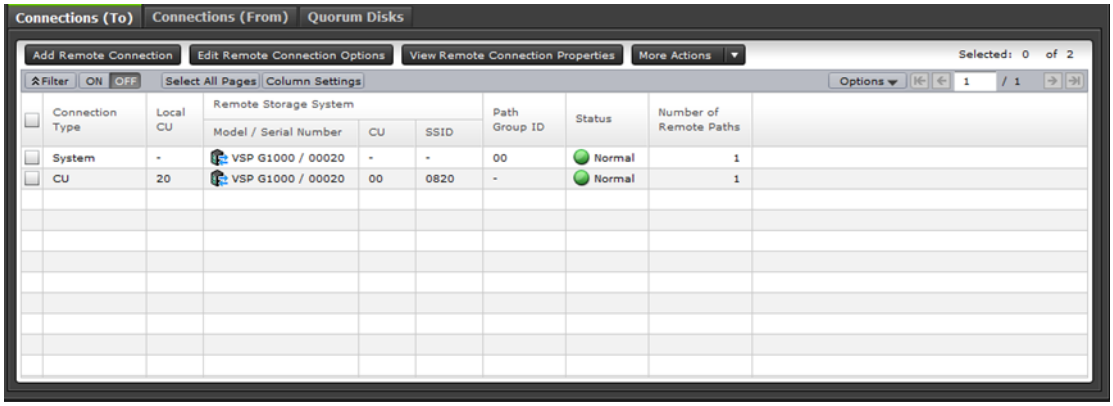
1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. View connection properties and path information by clicking **View Remote Connection Properties** in the **Remote Connections** window.



4. To check path and port information, from the Storage Systems tree, right- click the target storage system to select **Remote Connections**. Then click **Connections (To)** tab.
   Check connections under **View Port Condition**.



Check **Status** and other details in the **Connections (To)** tab.



Remote path status definitions

The following table provides remote path status descriptions.

Status	Definition
Normal	This path has been successfully established and can be used for TrueCopy remote copy activities.
Initialization Failed	The link initialization procedure with the secondary system has failed, because the physical path connection between either the primary and secondary system, or between the primary system and the host, was missing.
Communication Timeout	A timeout error has occurred between the primary and secondary system.

Status	Definition
Path Rejected	The remote path link function has been rejected by the secondary system. All remote path resources in the secondary system might be used for other connections.
Serial Number Mismatch	The serial number of the control unit that is connected to this remote path does not match the serial number specified by the Add Remote Connection window.
Invalid Port Mode	The specified port does not have the initiator attribute.
RCU Port Number Mismatch	There are three possible causes: • The specified port in the secondary system is physically disconnected from the primary system. • The port is not configured as an RCU target port. • The specified port number is not available.
RCU Port Type Mismatch	The microcode on the remote side does not support the fibre remote copy function, or the specified port type is not RCU target.
Communication Failed	A timeout error has occurred on the path between the primary and secondary system.
Logical Blockade	This remote path was blockaded because a path error or a link error occurred continuously.
Program Error	This remote path was blockaded because a program error occurred.
In Progress	This remote path is in progress of changing the attribute of port.

Configuring additional remote paths

You can configure additional remote paths as needed. A maximum of eight remote paths are supported.

Before you begin

- Review the path-related prerequisites in Adding remote connections on page 104.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. In the **Remote Connections** window, click the **Connections (To)** tab.
4. In the **Connections (To)** tab, select the remote connection where the remote path is to be added.
5. In the **Connections (To)** tab, click **More Actions > Add Remote Paths**.
6. In the **Add Remote Paths** window, add a new remote path by selecting ports for the primary (left side) and secondary systems. You can make multiple selections. To add paths, click **Add Path**.
7. In **Select Type**, select the port type.
8. Select the port to use for the local storage system and the remote storage system. If you selected iSCSI for the port type, enter the IP

address and the TCP port number for the port of the remote storage system. To add two or more paths, click **Add Path**.

9. Click **Finish**.
10. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
11. Click **Apply** to save your settings in the system.

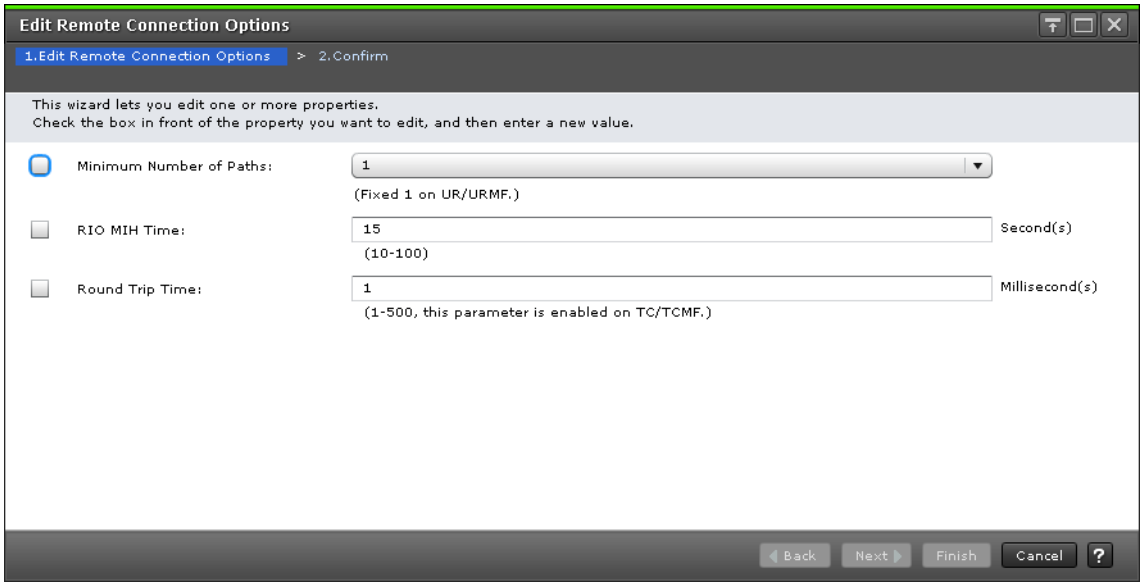
Changing remote connection options

You can change the following remote connection options that affect how copy operations are performed:

- Number of minimum paths for a pair. You can find detailed information in Minimum number of remote paths option on page 47
- RIO MIH Time, which is the interval for data transfer to complete.
- Round trip time, which is the time limit for copying data to the S-VOL. For more information, see Round trip time option on page 44 for more information.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. Click the **Connections (To)** tab, and then select the remote connection whose options you want to change.
4. In the **Connections (To)** tab, click **Edit Remote Connection Options**.
5. In the **Edit Remote Connection Options** window, for **Minimum Number of Paths**, select the minimum number of paths between the secondary and primary system.



6. For **RIO MIH Time**, enter an interval in seconds that, if exceeded, causes the data-transfer operation to be reported as failed by the system. The range is 10-100 seconds, and the default is 15.
7. For **Round Trip Time**, enter a time limit for data copy from P-VOL to S-VOL in ms. The range is 1-500 ms, and the default is 1.
8. Click **Finish**.
9. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
10. Click **Apply** to save your settings in the system.

Deleting remote paths

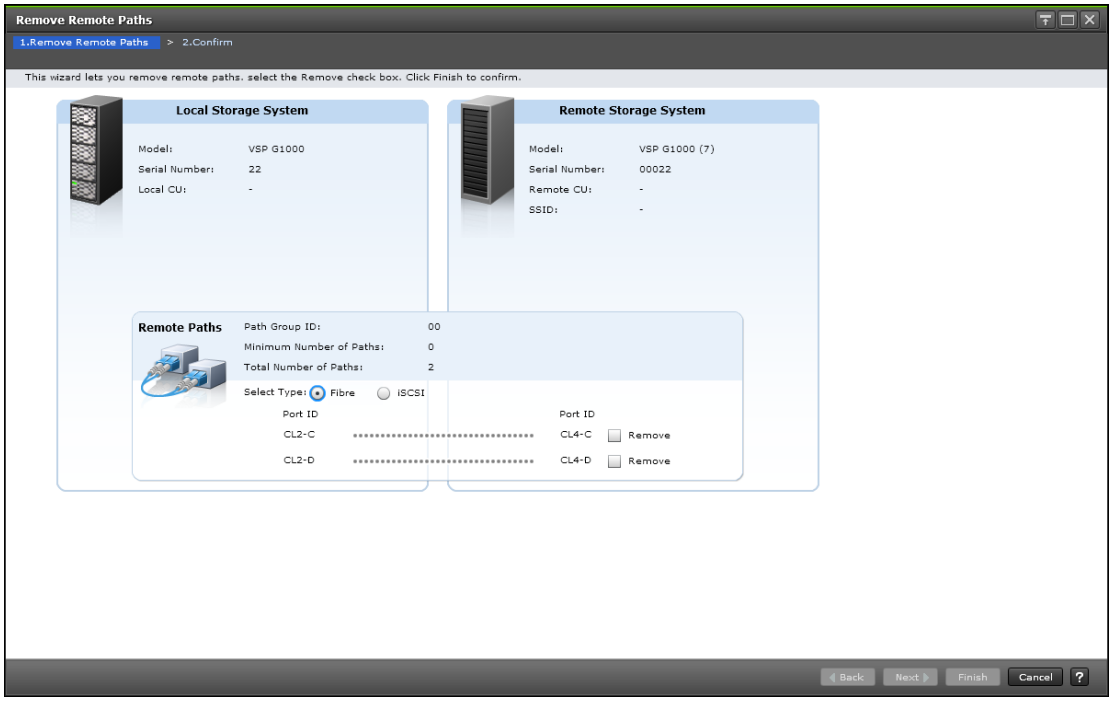
You can delete a remote path between a primary system and secondary system.

Before you begin

- Delete remote paths from the primary system.
- Make sure that the remaining number of paths is equal to or greater than the minimum number of paths setting on the Add Remote Connection window, otherwise the delete path operation will fail.

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. In the **Remote Connections** window, click the **Connections (To)** tab.
4. In the **Connections (To)** tab, select the remote connection with the path to be deleted.
5. Click **More Actions > Remove Remote Paths**.
6. In the **Remove Remote Paths** window, select the type of path to be removed (**Fibre** or **iSCSI**), and click **Remove** for each remote path to be removed. Note that remote paths become unselectable when the minimum number of paths is reached.



7. Click **Finish**.
8. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
9. Click **Apply** to save your settings in the system.

Deleting remote connections

You can delete the remote connection from the local storage system to a remote storage system.

When you delete a remote connection, the local storage system deletes all remote paths to the selected remote storage systems.

Deleting the TC relationship with a specific remote system does not affect TC operations between other local systems and the remote system.

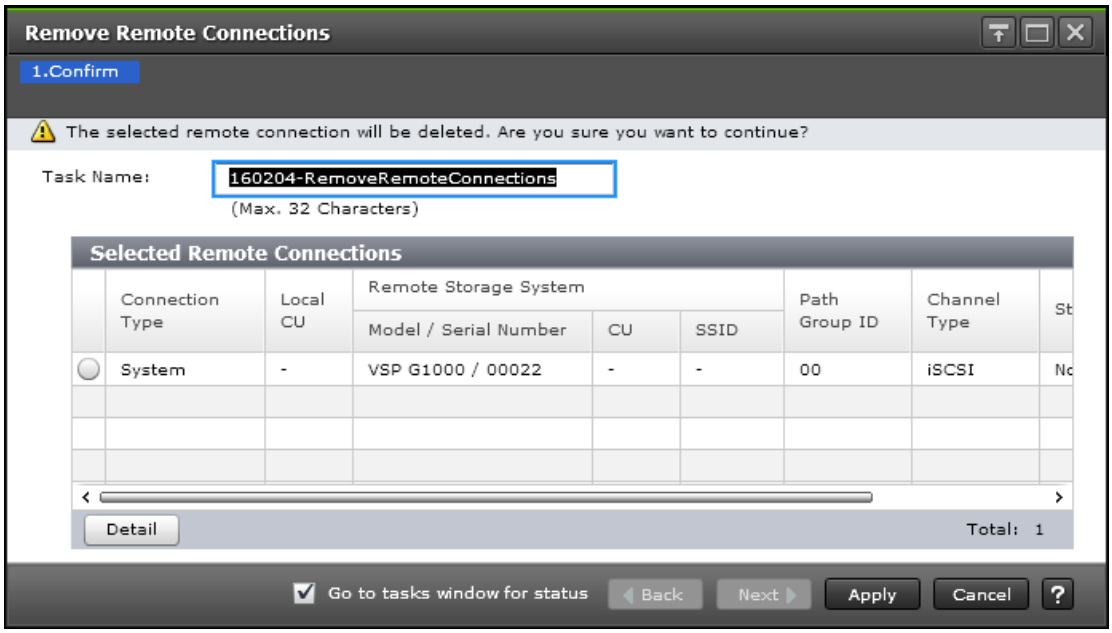
After a remote system is deleted, you can reconfigure the remote path to then connect another remote system to the local system. You can also delete the remote connection and reconfigure the local system ports (initiator ports to ordinary target ports for fibre) to provide additional host channels for the local system.

Before you begin

- All TC pairs must be deleted before removing the connection.
- When the remote connection is deleted, all remote paths are deleted.
- Required role: Storage Administrator (Remote Backup Management)

Procedure

1. Click **Storage Systems**, and then expand the Storage Systems tree.
2. In the Storage Systems tree, click **Replication > Remote Connections**.
3. In the **Remote Connections** window, click the **Connections (To)** tab.
4. In the **Connections (To)** tab, select the remote connection to be deleted.
5. Click **More Actions > Remove Remote Connections**.
6. In the **Remove Remote Connections** window, from the **Selected Remote Connections** table, select the connection to be removed.



(You can review information about the connection by clicking **Detail**.)

7. Click **Apply**.

Managing power-off for systems and network devices

Though you are responsible for controlling power-off activities, it is advisable to check with customer support.

The following topics provide information for planned outages when TrueCopy is present.

General information regarding powering off

Review the following system behaviors regarding powering off:

- TC pairs are not affected when power is removed from a primary system while operations are in progress.
- When power is restored on the primary system, the system communicates with the secondary systems to confirm S-VOL pair status(es). Make sure that TC communications are fully restored (all paths have normal status) before beginning I/O operations to the P-VOL.
  If the primary system accepts an I/O for a P-VOL when the path status is not normal, the primary system will split the pair. P-VOL status will change to PSUE (by RCU) or Suspend (by RCU) but the primary system cannot change the pair status of the S-VOL.
- If power is removed from a secondary system or from a data path component while TC operations are in progress, the primary system detects the communication failure, splits all affected pairs, and generates SIMs reporting the failures. The primary system changes the P-VOL status to PSUE (by RCU) or Suspend (by RCU) but cannot change the status of the S-VOLs.
- If a primary or secondary system is powered off and the backup batteries are fully discharged while pairs are split, differential data is retained to SSD. In this unlikely case, primary system copies differential data to secondary system when the pairs are resynchronized.

Planned outage of the primary system

A planned outage of the primary system does not affect TrueCopy.

Planned outage of the secondary system or remote path

You must split the pairs in a secondary system prior to a planned outage of the system or to a data path component (for example, switch, channel extender).

Procedure

1. Identify the P-VOLs that are paired with S-VOL in the secondary system that is to be powered off.
   For data path outage, identify all P-VOLs in the primary system that use the path or component to be powered off. You need to know the primary system, CU, and IDs (port, host group or iSCSI target, and LUN) for each of the P-VOLs.
   a. When powering off storage systems at the secondary site, identify all P-VOLs paired with the S-VOLs of storage systems to be powered off.
   b. When powering off remote copy connections, identify all P-VOLs of storage systems at the primary site that use paths, switches, or channel extenders to be powered off.
2. Connect to each primary system that contains affected P-VOLs, and split all affected pairs.
   Confirm the changed pair status in the **Remote Replication** window or the **View Pair Properties** window.

3. Perform the planned outage of the secondary system or remote copy connections.
4. When the secondary system is fully powered on and ready, resynchronize the affected pairs at each primary system. Confirm the pair status changes.

Planned outage of both primary and secondary systems

When you plan an outage of a TrueCopy primary and secondary systems at the same time, the primary system must be powered off first, and then powered on last.

Procedure

1. Perform the planned outage of the primary system first. Because a planned outage does not affect pairs, nothing out of the ordinary must be done regarding the TC system or operations. Do not power on the primary system at this time.
2. If a secondary system to be powered off is connected to a primary system that is not powered off, split the pairs before powering off the secondary system. Confirm that the pair status changes.
3. Perform the planned outage of the secondary systems as described in Planned outage of the secondary system or remote path on page 142.
4. Power on the secondary systems. Make sure that secondary systems and remote connections are fully operational and ready to resynchronize operations before powering on the primary system.
5. Power on the primary system, and make sure the primary storage system and remote connections are operational and ready to resynchronize operations. If you split any pairs in step 2, you can also resynchronize those pairs now.

8

Data migration

This chapter discusses using TrueCopy to migrate data from one storage system to another.

Migration overview

TrueCopy can be used to move data from one volume to another. Data is typically migrated for the following reasons:

- To copy data to a new volume
- To temporarily move data from an LU to accommodate other activities (for example, to make repairs)
- To relocate LUs in order to balance workloads and distribute I/O activity evenly within or across storage systems

You do not need to use host migration software for data migration when using TrueCopy. Also, TrueCopy data migration does not affect the host.

In a data migration, the entire contents of a volume are copied to the secondary volume (P-VOL to S-VOL). The volumes are identical when the copy operation completes. The volumes are then usually released from the TrueCopy pair.

If you need to migrate data from other vendors' storage system, contact customer support.

Migrating data

Procedure

1. Make sure that the data path is installed, and TrueCopy configuration procedures are completed. See TC configuration on page 101 for details.
2. Verify the target volume (S-VOL) is offline from all attached hosts. The source volume (P-VOL) can remain online.
3. (VSP G1000, G1500, and VSP F1500) Connect to the storage system that contains the volume to be migrated, and then start Device Manager - Storage Navigator.

   Set a data path, change the port attribute to Initiator, and then register the target storage system.

   (VSP Gx00 models and VSP Fx00 models) Add a remote connection in a storage system that contains the volume to be migrated, and then register storage systems in the secondary site. See Creating pairs on page 113 as needed.
4. In the Create Pairs window, create a TrueCopy pair.
5. When pair status changes to PAIR, the operation is completed. You can monitor the progress of the operation from the **Remote Replication** window.

6. If you are not using CCI commands and host software to complete the migration, continue the following procedure to stop using the P-VOLs and switch to the S-VOLs:
   a. Stop all host updates to the P-VOLs.
   b. When all update activity to the P-VOLs has stopped, connect to the primary system, select the correct CU, and release the TrueCopy pairs.
   c. If the P-VOL and S-VOL are attached to the same host, vary the P-VOL offline, and then vary the S-VOL online. Use this order because the P-VOL and S-VOL have the same volume labels and cannot be online to the same host at the same time.
   d. If you want to keep the volumes synchronized, establish the same TrueCopy pairs in the reverse direction using the None initial copy option. If the original P-VOLs will be temporarily unavailable for update copy operations, you can split the new pairs (pairsplit-r) so that the new primary system keeps track of changes.
   e. Start the applications with the S-VOLs. When the original P-VOLs become available, you can resynchronize the pairs.

Result

If the original P-VOL is temporarily unavailable for update copy operations, split the new pair so that the new primary system keeps track of changes.

Related tasks

- Creating pairs on page 113

9

Disaster recovery

This chapter discusses disaster recovery.

Disaster recovery overview

Preparing for disaster recovery involves the following major steps:

1. Identify the volumes and groups that contain important files and data for disaster recovery.
2. Create TrueCopy pairs, paying special attention to the options in P-VOL Fence Level Settings to ensure that the system responds the way you want in the event of a failure (see Allowing I/O to the P-VOL after a split: Fence Level options on page 61).
3. Install and configure host failover software between the primary and secondary sites.
4. Establish file and database recovery procedures. These procedures for recovering volumes due to control unit failure must already be in place.
5. Make sure that the host system at the primary site is configured to receive sense information from the primary storage system (for example, using SNMP). This must also be done at the secondary site if a host is connected to it.

Note: Procedures for disaster recovery involve releasing pairs. However, when using CCI you can perform disaster recovery without releasing pairs. To do this, when setting up TrueCopy, add remote paths between the secondary system and primary system. For VSP G1000, VSP G1500, and VSP F1500, connect the Initiator port in the secondary storage system and the RCU Target port in the primary storage system via a remote path in advance. Then add a remote connection from the secondary system CU to the primary system CU. Use the same path group ID as you used from the primary to secondary system connection.

Remote copy and disaster recovery procedures are complex. Consult customer support on sense-level settings and recovery procedures.

Sense information shared between sites

When the primary system splits a TrueCopy pair due to an error condition, the primary and secondary systems send sense information with unit check status to the appropriate hosts. This sense information is used during disaster recovery to determine the consistency of the S-VOL and must be transferred to the secondary site using the host failover software.

File and database recovery

File recovery procedures for disaster recovery should be the same as those used for recovering a data volume that becomes inaccessible due to control unit failure.

TrueCopy does not provide a procedure for detecting and retrieving lost updates. To detect and recreate lost updates, you must check other current information (for example, database log file) that was active at the primary system when the disaster occurred.

The detection and retrieval process can take some time. Your disaster recovery scenario should be designed so that detection and retrieval of lost updates is performed after the application has been started at the secondary site.

You should prepare for file and database recovery using files for file recovery (for example, database log files that have been verified as current).

Switching operations to the secondary site

If a disaster or failure occurs at the primary site, the first disaster recovery activity is to switch your operations to the secondary site. S-VOLs are recovered individually based on the pair status and P-VOL fence level information for each pair.

You can switch operations to the secondary site either by deleting pairs and then re-establishing them when recovery is completed, or by not deleting pairs. Both methods are presented below.

Switching operations to the secondary site by deleting pairs

Procedure

1. Record the pair status and fence level of each S-VOL.
2. Analyze the consistency of the S-VOLs, based on pair status and Primary Volume Fence Level setting in the **Create TC Pairs** window. See Checking S-VOL consistency with the P-VOL on page 152.
3. Perform file recovery as needed.
4. Split all pairs from the secondary system using one of the following commands:
   - BCM YKSUSPND
   - PPRC CSUSPEND
   - CCI pairsplit
5. Release all pairs using one of the following commands:
   - BCM YKRECOVER
   - PPRC CRECOVER
   - CCI pairsplit -S

   If you are not using these tools, connect to each secondary system with Device Manager - Storage Navigator to split and release the pairs.

Note: When the S-VOL is no longer paired, it cannot be distinguished it from a non-TrueCopy volume. Use the appropriate means to change the S-VOL volume labels.

6. Complete file recovery procedures.
7. Vary the S-VOLs online.
8. At the secondary site, start critical host operations, with the previous S-VOLs now the P-VOLs.

Switching operations to the secondary site by not deleting pairs

Procedure

1. Record the pair status and fence level of each S-VOL.
2. Analyze the consistency of the S-VOLs, based on pair status and the Primary Volume Fence Level setting in the **Create TC Pairs** window. See Checking S-VOL consistency with the P-VOL on page 152.
3. Perform file recovery as needed.
4. Run the CCI horctakeover or pairsplit -RS on the S-VOL.
5. Complete file recovery procedures.
6. Vary the S-VOLs online.
7. At the secondary site, start critical host operations, with the previous S-VOLs now the P-VOLs.

Checking S-VOL consistency with the P-VOL

An S-VOL's consistency refers to whether S-VOL data is identical to data in the P-VOL. This is dependent on your Fence Level setting, which determines whether data is copied to the P-VOL if an error occurs during an update to the S-VOL.

The following table shows S-VOL consistency information, based on Device Manager - Storage Navigator pair status and the P-VOL fence level setting.

S-VOL status			Split type	Fence level	Consistency of S-VOL
Device Manager - Storage Navigator	CCI	BCM			
Single volume	SMPL	SIMPLEX	--	Data, Status, Never	Not consistent. The S-VOL does not belong to a pair. Even if you have created a pair using this volume, if the pair status is still SMPL, you must regard its data as not consistent with the P-VOL.
COPY	COPY	PENDING	--	Data, Status, Never	Not consistent. The S-VOL is not synchronized because not all tracks have been copied from

S-VOL status			Split type	Fence level	Consistency of S-VOL
Device Manager - Storage Navigator	CCI	BCM			
					the P-VOL yet. This S-VOL must be initialized (or copied from the P-VOL at a later time).
PAIR	PAIR	DUPLEX	--	Data, Status	Consistent. The S-VOL is synchronized with its P-VOL.
				Never	Needs to be analyzed. The S-VOL requires further analysis to determine its level of consistency.
PSUE	PSUE	SUSPER(50)	Initial copy failed	Data, Status, Never	Not consistent. The S-VOL is not synchronized because not all tracks have been copied from the P-VOL yet. The S-VOL must be initialized (or copied from the P-VOL at a later time).
PSUS	PSUS	SUSPOP(04)	S-VOL by operator	Data, Status, Never	Suspect. The S-VOL is not synchronized with its P-VOL if any write I/Os were issued to the P-VOL after the pair was split. The pair must be released and restarted using Entire Volume for the Initial Copy Type option. If you are sure that no data on the P-VOL changed, you can use None for Initial Copy Type.
PSUS or PSUE	PSUE	SUSPOP/ SUSPER(all other types)	All other types	Data	Consistent. The S-VOL is synchronized with its P-VOL.
				Status, Never	Suspect. The S-VOL is not synchronized with its P-VOL if any write I/Os were issued to the P-VOL after the pair was split. Restore the consistency of the S-VOL and update it, if required. The time of suspension indicated on the Last Update Time field of the Detailed Information dialog box (MCU SVP time) will help to determine the last time the S-VOL was updated.

Legend:

Data: Data in the secondary volume

Status: Status of the secondary volume

For pairs with a P-VOL fence level setting of Never, further analysis is required to determine the S-VOL consistency. This can be determined by using sense information transferred by host failover, or by comparing the contents of the S-VOL with other files that are confirmed to be consistent (for example, database log files). The S-VOLs should be recovered using the files that are confirmed to be consistent.

Note: Actual data recovery must be done using recovery point data in the database operation log.

Transferring operations back to the primary site

When host operations are running at the secondary site, the primary site must be restored and operations transferred back.

Create a TrueCopy pair by specifying secondary site volume to primary volume and primary site volume to secondary volume.

Select the appropriate procedure below based on whether you deleted pairs to switch operations to the secondary site, or ran the CCI Run horctakeover or pairsplit -RS to the S-VOL command.

Transferring operations back to the primary site if pairs were deleted

Procedure

1. At the primary site, bring up the host. Make sure that TC components are operational.
2. At the primary system, release all pairs on the primary system.

   The Delete Pair by Force option must be used because the paired S-VOLs are in the SMPL state at the secondary site.
3. At the primary system, delete the TC association with the secondary systems (Remove Remote Connections).

   In Device Manager - Storage Navigator, connect to each primary system to make sure that all secondary systems are deleted.
4. At the primary and secondary systems, change path and port settings.
   - (VSP G1000, G1500, and VSP F1500) If you plan to use the same remote paths, change the existing initiator ports to RCU target ports at the primary system. At the secondary system, change the existing RCU target ports to initiator ports.
   - To use the same switches, change the operating mode to the opposite direction.
   - To use the same extenders, change the operating mode to the opposite direction. The boxes/nodes connected to the primary system must be set to channel-mode, and the boxes/nodes connected to the secondary systems must be set to device-mode.
5. (VSP G1000, G1500, and VSP F1500) At the secondary system, check that it is ready to create TrueCopy pair.

   (VSP Gx00 models and VSP Fx00 models) At the secondary site, set TrueCopy operations in the reverse direction.
6. (VSP G1000, G1500, and VSP F1500) At the secondary system, create TrueCopy pair and synchronize S-VOL with P-VOL.

   (VSP Gx00 models and VSP Fx00 models) At the secondary site, create a TC pair in the reverse direction, and synchronize the old P-VOL with the S-VOL.

   Make sure to use Entire Volume for the Initial Copy Type option. Confirm that the pairs are created and that status is PAIR.
7. At the secondary system, halt host operations and vary the P-VOL (old S-VOL) offline. This maintains synchronization of the pairs.
8. At the secondary system(VSP G1000, G1500, and VSP F1500) or the primary system, which is an old secondary system (VSP Gx00 models, VSP Fx00 models), split the pairs and destage held data from cache.

Confirm that the pairs are split and status is PSUS before proceeding. If an error occurs, resolve it before proceeding.

9. At the secondary system(VSP G1000, G1500, and VSP F1500) or the primary system, which is an old secondary system (VSP Gx00 models, VSP Fx00 models), release the pairs. You do not need to use the Force Delete Pairs (TC Pairs) option.
10. At the primary and secondary systems, change the path and port settings.
    - (VSP G1000, G1500, and VSP F1500) If you plan to use the same data paths, change the existing RCU target ports to initiator ports at the primary system. At the secondary system, change the existing initiator ports to RCU target ports.
    - To use the same switches, change the operating mode back to the original direction.
    - To use the same channel extenders, change the operating mode back to the original direction. The boxes/nodes connected to the primary system must be set to channel-mode, and the boxes/nodes connected to the secondary systems must be set to device-mode.
11. At the primary system, check that it is ready to create TrueCopy pairs.
12. At the primary system, create TrueCopy pairs(VSP G1000, G1500, and VSP F1500) or set TrueCopy pairs to the original direction (VSP Gx00 models, VSP Fx00 models). If all P-VOL and S-VOL are synchronized, you may use None for the Initial Copy Type option. If P-VOL and S-VOL are not fully synchronized, use Entire Volume for Initial Copy Type.
13. Vary the primary system and P-VOLs online, and start host operations.

Transferring operations back to the primary site if pairs were not deleted

Procedure

1. At the primary site, bring up the host. Make sure that TC components are operational.
2. Run the CCI pairresync -swaps command to the S-VOL. If the pair data flow is already set in the opposite direction and the pair is in PAIR or COPY status, the pairresync -swaps needs not to be run.
3. At the secondary system, halt host operations and vary the P-VOL (old S-VOL) offline. This maintains synchronization of the pairs.
4. Run the horctakeover command to the P-VOL.
5. Verify the primary system and P-VOLs online, and start host operations at the primary site.

10

Troubleshooting TrueCopy

This chapter provides TrueCopy troubleshooting information.

Error codes and messages

Error messages display on the Device Manager - Storage Navigator computer or the management client when error conditions occur during TrueCopy operations. The message describes the error and provides a part code and error code.

The error message might also include an SVP error code. If you need to contact customer support, report the error codes. See the *Hitachi Device Manager - Storage Navigator Messages* for a list of the error codes.

General troubleshooting

The following table provides a list of general error conditions and provides recommended action for each condition.

Error	Corrective action
The Device Manager - Storage Navigator computer or management client hangs, or TrueCopy operations do not function properly.	• Make sure that the problem is not being caused by the computer or Ethernet hardware or software, and restart the computer. Restarting the Device Manager - Storage Navigator computer or management client does not affect storage system operations. • Make sure that all TrueCopy requirements and restrictions are met (for example, same LU type). • Make sure that the primary and secondary systems and data paths are powered on and fully operational (NVS, cache). • Check all input values and parameters to make sure that you entered the correct information about the Device Manager - Storage Navigator computer (for example, remote storage system S/N and ID, path parameters, P-VOL and S-VOL IDs).
An initiator channel-enabled LED indicator (on the control panel) is off or flashing.	Contact customer support.
The pairs or paths to the remote system or to the secondary storage system are not displaying correctly.	Make sure that the correct CU is selected.
A TrueCopy error message is displayed on the Device Manager - Storage Navigator computer or management client.	Resolve the error, and then try the TrueCopy operation again.
The remote system or secondary storage system path status is not normal.	Check the path status (**View Remote Connection Properties** window), and see Remote path status problems on page 159.
Pair status is PSUE.	See Split pair problems on page 161.
The paircreate or pairresync operation resulted in a timeout error.	• Hardware failure: If the timeout error was caused by a hardware failure, a SIM is generated. If this occurs,

Error	Corrective action
	call service personnel, and then retry TrueCopy operations after the problem is fixed. • Heavy workload: If no SIM was generated, wait 5 or 6 minutes then check the pair's status. - If status changed correctly, the failed operation completed after the timeout message was issued. - If the pair status did not change as expected, heavy workload might have prevented the operation from being completed. Retry the operation when the system has a lighter workload. • A communication error may have occurred between the Device Manager - Storage Navigator computer or management client and SVP. See the *System Administrator Guide* for your storage system for information and instructions.
There is a pinned track on a TrueCopy volume.	See Pinned track recovery on page 173 for more information.
Monitoring data is not updated though the Monitoring Switch option is set to Enable.	Because the time setting of SVP is changed, the monitoring data might not be updated. Disable Monitoring Switch, and then enable again. For more information about Monitoring Switch, see the *Performance Guide* of your storage system.

Remote path status problems

The following table provides a list of remote path status problems.

Path status	Description	Corrective action
Normal	This remote path has been successfully established and can be used for TrueCopy copy activities.	None required.
Initialization Failed	The link initialization procedure to the remote storage system failed because the physical path connection was missing between the local and remote storage system or between the local storage system and the switch.	• Make sure that the local and remote storage systems or the local storage system and the switch are physically and correctly connected. • Make sure that you entered the correct remote storage system S/N, model name, and local and remote storage system port numbers. • Make sure that topologies (Fabric, FC-AL, Point-to-point) for the local and remote storage system ports are configured correctly.
Communication Time Out	Communication between the local and remote storage systems timed out.	• Make sure the remote storage system is powered on and that NVS and cache are fully functional. • Make sure that network relay devices are properly configured and functional. This includes cables, connectors, switches, extender devices,

Path status	Description	Corrective action
		communication lines, and all other devices connected to the extenders.
Port Rejected	The local or remote storage system rejected the logical path link control function because all logical path resources in the local or remote storage system are used for other connections.	• Delete all remote paths not in use. • (VSP G1000, G1500, and VSP F1500) Make sure that all local and remote storage system ports are properly configured: ordinary RCU target ports for remote storage systems, initiator ports for local storage systems. If necessary, change to the correct port attribute. • Remove all remote storage systems currently not in use in the Remove Remote Connection window.
Serial Number Mismatch	The primary storage system's S/N does not match the specified S/N.	• Make sure that you entered the correct remote storage system S/N and model name, and local and remote storage system port numbers. • Make sure that topologies (Fabric, FC-AL, Point-to-point) for the local and remote storage system ports are configured correctly. • Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.
Invalid Port	The specified local storage system port is in the following status: • Not mounted. • (VSP G1000, G1500, and VSP F1500) The port attribute is not Initiator. • A remote path is already added.	• (VSP G1000, G1500, and VSP F1500) Make sure the correct port on the local storage system is installed or set to the initiator attribute. • Make sure that no two paths between local and remote storage system ports have the same settings. • Make sure that you entered the correct remote storage system S/N and model name, and local and remote storage system port numbers. • Make sure that topologies (Fabric, FC-AL, Point-to-point) for the local and remote storage system ports are configured correctly. • Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.
Pair-Port Number Mismatch	The specified port in the remote storage system is physically disconnected from the local storage system.	• Make sure that you specified the correct remote storage system port number. Correct the port number if necessary. • Make sure that the cables between the local and remote storage system ports and between the remote storage system and the switch are connected correctly. • Make sure that the topology settings (Fabric, FC-AL, point-to-point) of the local and remote storage system ports are correct.
Pair-Port Type Mismatch (VSP G1000, G1500, and VSP F1500)	The specified remote storage system port is not configured as an RCU target port.	Make sure that the remote storage system port is configured as an RCU target port.

Path status	Description	Corrective action
Communication Failed	The local storage system connected to the remote storage system successfully, but logical communication timeout occurred.	• Make sure that the remote storage system port and the relay equipment are configured correctly. • Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.
In Progress	Remote paths are being created or deleted. (VSP G1000, G1500, and VSP F1500) The port attribute is being changed.	Wait until processing is completed.
Path Blockade	Blockaded due to continual path or link failure.	See the following.
	The local storage system port does not work.	Repair the port on the local storage system, and then restore the path.*
	The remote storage system port does not work.	Repair the port on the remote storage system, and then restore the path.*
	The path relay equipment does not work.	Repair the path relay equipment, and then restore the remote path.*
	The connection cable is physically broken.	Replace the broken cable, and then restore the remote path.*
Program Error	A program error is detected.	Restore the remote path.*
* To restore a remote path, delete and then add the path again. It may be necessary to delete and then add the remote system again. To delete the remote system or path, see Deleting remote connections on page 140 or Deleting remote paths on page 139. To re-register, see Adding remote connections on page 104. If you cannot restore the path after performing these operations, contact customer support.		

Split pair problems

The following table provides a list of split pair problem types.

Pair status/ split type	Applies to	Description	Corrective action
PSUE/by RCU)	P-VOL	The primary system detected an error condition at the secondary system, which caused the primary system to split the pair. The S-VOL split type is S-VOL Failure.	Clear the error condition at the secondary system or S-VOL, and then resynchronize the pair from the primary system. If you need to access the S-VOL to clear the error conditions, release the pair from the secondary system. After you clear the

Pair status/ split type	Applies to	Description	Corrective action
			error conditions from S-VOL, re-create the pair.
PSUE/ Secondary Volume Failure	P-VOL	The primary system detected an error during communication with the secondary system, or detected an I/O error during update copy. In this case, the split type for the S-VOL is usually S-VOL Failure.	Check the path status in the **Remote Connections** window. If errors occurred on the path, clear the error conditions. • Clear any error conditions at the secondary system or S-VOL, and then resynchronize the pair from the primary system. • If you need to access the S-VOL to clear the error conditions, release the pair from the secondary system. After you clear the error conditions, recreate the pair.
PSUE/MCU IMPL	P-VOL, S-VOL	The primary system could not find valid control information in its nonvolatile memory during the IMPL procedure. This error occurs only if the system is without power for more than 48 hours (for example, power failure or fully discharged batteries).	Resynchronize the pair from the primary system. An entire initial copy operation will be performed in response to the pairresync request.
PSUE/Initial Copy Failed	P-VOL, S-VOL	The primary system split this pair during the initial copy operation. The data on the S-VOL is not identical to the data on the P-VOL.	Release the pair from the primary system. Clear all error conditions on the primary system, P-VOL, secondary system, and S-VOL. Resume the initial copy operation.

Troubleshooting using CCI

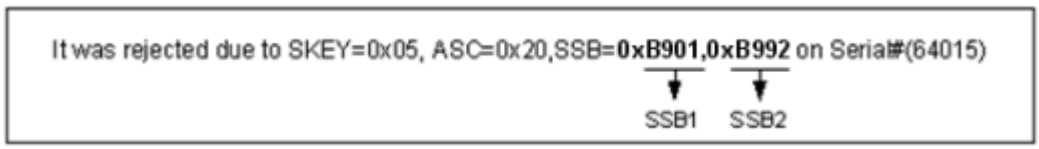
When an error occurs in pair operations using CCI, you can identify the cause of the error by referring to the CCI operation log file. This file is stored in the following directory by default:

```
/HORCM/log*/curlog/horcmlog_HOST/horcm.log
```

Where:

- * is the instance number.
- *HOST* is the host name.

Example:



Error codes appear on the right of the equal symbol (=).

Review CCI error codes in the following topics.

- SSB2 error codes when SSB1 = 2E31/B901/B90A/B90B/B912/D004 on page 163
- SSB2=B992 error codes when SSB1 = B901 or B90A on page 172

SSB2 error codes when SSB1 = 2E31/B901/B90A/B90B/B912/D004

Error code (SSB2)	Description
4A96	The pair cannot be created because CLPR to which the specified P-VOL belongs and CLPR for the registered consistency group are different.
4B02 (VSP G1000, G1500, and VSP F1500)	A pair cannot be resynchronized because the request was for a consistency group without the open or mainframe consistency attribute defined from Business Continuity Manager.
9100	The command cannot be executed because the user authentication is not performed.
B920	The pair cannot be created because the system identifier is not correct.
B923	(VSP Gx00 models and VSP Fx00 models) The consistency group paircreate or pairresync was rejected because supported and unsupported software is used in the DKC. (VSP G1000, G1500, and VSP F1500) The command was rejected because supported microcode and non-supported microcode co-exist in DKC after receiving consistency group definition direction which is configured from several storage systems for pair creation and pair resync request.
B927	You cannot run the following operations to a pair in a 2DC configuration: • Swap Suspend • Takeover
B928	The pair cannot be created because the mirror ID is invalid.
B929	The pair operation was rejected because the microcode or firmware is being replaced.
B92A	The pair cannot be created because the specified volume is a command device.
B934	The pair cannot be created because TC is not installed.
B935	S-VOL hide mode is not supported.
B936	The required shared memory for operating TrueCopy is not installed.
B93B	The specified volume is a P-VOL. The pair cannot be released because the P-VOL is specified as an S-VOL.
B941	The specified volume is an S-VOL. The pair cannot be released because the S-VOL is specified as a P-VOL.
B945	The command was rejected because the volume is unpaired.
B952	The specified LU is not defined. The DKC configuration might have been changed. Restart CCI.
B97B	The operation cannot run because pair status is either PSUS (by user) or PSUE (because of failure).
B97C	The command was rejected because the volume is unpaired.
B990	The pair cannot be created because the consistency group ID is greater than is allowed. If this error occurred when you did not specify the consistency group ID, contact customer support.

Error code (SSB2)	Description
B994	The Swap Resync operation cannot be performed because the S-VOL is not in PSUS or SSWS status. (Swap Resync resynchronizes differential data when the S-VOL is swapped for the P-VOL.)
B998	The pair cannot be created because the secondary system path setting is invalid.
B99B	The pair cannot be created because TC Asynchronous is not supported.
B9BD	The DKC LDEV configuration might have been changed while starting CCI. Restart CCI.
B9C0	The resource of the command device has run out. In LUN Manager, set the command device to OFF, then to ON.
C162	The pair cannot be resynchronized because the pair was not in the PSUS or PSUE status.
C16B	The pair cannot be created because the S-VOL is not available.
C184	A request for a pairsplit -S operation was rejected because the status change of the S-VOL failed.
C189	A request for a pairsplit -S operation was rejected because the pair status was invalid.
C18A	A request for a pairsplit -S operation was rejected because the status of the volume is being changed or the group contains a pair of which status is being changed.
C194	The pair cannot be split because the S-VOL pair status was in transition.
C195	A request for a pairsplit -r operation was rejected because the pair status was already PSUS or PSUE.
C198	The group includes no pair that can be split.
C199	A request for a pairsplit -r operation was rejected because the status of the volume is being changed or the group contains a pair of which status is being changed.
C1BE	The pair's status cannot be changed during the power-on processing of the DKC.
C1D6	The command was rejected because it was issued to a non-TC pair volume.
C211	The command was rejected because the specified volume is a P-VOL. If the error occurs when the volume is unpaired, select the volume in Device Manager - Storage Navigator, release the pair using the Force Delete Pairs (TC Pairs) window, and then run the command again.
C212	The command was rejected because the specified volume is an S-VOL. If the error occurs when the volume is unpaired, select the volume in Device Manager - Storage Navigator, release the pair using the Force Delete Pairs (TC Pairs) window, and then run the command again.
C214	The command was rejected because the secondary system is not registered, or the registered secondary system information is invalid.
C215	The command was rejected because an internal logical error has occurred.
C218	The command was rejected because the pair status is invalid.
C21A	The command was rejected because the P-VOL status is other than PSUS or PSUE.
C21C	The command was rejected because the secondary system is not registered, or the registered secondary system information is invalid.
C22A	The command was rejected because the pair was deleted on a volume other than P-VOL.
C22C	The command was rejected because the volume is unpaired.
C22D	The command was rejected because the specified volume is the volume other than the P-VOL.
C22E	The command was rejected because the pairsplit command specifying -P option (write protection of P-VOL) was issued to a volume whose status is not PAIR.
C233	The command was rejected because the S-VOL status is unpaired.
C234/C235/ C236/C237	The command was rejected because an internal logical error has occurred.

Error code (SSB2)	Description
C238	The command was rejected because the specified volume is the volume other than the P-VOL.
C239	The command was rejected because the pair was resynchronized on a volume whose status is other than PSUS or PSUE.
C23A	The command was rejected because an internal logical error has occurred.
C23B	The command was rejected because the volume is unpaired.
C23C	The command was rejected because the volume status is other than PAIR or COPY.
C23D	The command was rejected because the command for TC asynchronous was issued to the TC volume.
C267	The pair cannot be created because the command was issued to the command device.
C271	The command was rejected because the specified consistency group ID is invalid.
C28B	The command was rejected because the horctakeover command was issued to a volume whose status is not SSWS.
C28C	The command was rejected because the secondary system is not registered, or the registered secondary system information is invalid.
C28D	There is no volume to which the horctakeover command can run.
C28E	The command was rejected because an internal logical error has occurred.
C297	The command was rejected because the specified volume is used as an S-VOL.
C2A0	The pair cannot be created because the capacity that is used by software products other than TC exceeds license capacity.
C2A1	The command was rejected because an internal logical error has occurred.
C2A3	The pair cannot be created because the used capacity exceeds the license capacity.
C2B3	The command was rejected because DP-VOL capacity is being changed.
C2B4	The command was rejected because an internal logical error has occurred.
C2B5	The pair cannot be created because the TC P-VOL is being initialized by ShadowImage.
C2B6	The command was rejected because releasing pages in DP-VOL is in progress.
C300	A copy pair associated with UR cannot be created because the Disaster Recovery Extended program product is not installed on the primary system.
C301	A copy pair associated with UR cannot be created because the Disaster Recovery Extended program product is not installed on the secondary system.
C304	The pair cannot be created because the S-VOL is a DP-VOL.
C305	The pair cannot be created because the capacity that is used by TC in the secondary system exceeds license capacity. Check license capacity, including for related software products.
C30D	The volume in the secondary system or another volume that belongs to the same group is changing to SMPL, PSUS, or PSUE status. Retry the operation after approximately 5 minutes.
C312	The P-VOL is not in unpaired status.
C313	The P-VOL is not in PSUS or PSUE.
C314	The P-VOL is not in unpaired status.
C315	The P-VOL includes PIN data.
C316	The P-VOL is in the process of drive copy for failure assistance.
C317	The P-VOL is in the process of drive copy for an SVP request.
C318	The P-VOL is terminating the copy task.

Error code (SSB2)	Description
C319	The P-VOL is in the process of correction copy.
C31A	The P-VOL is in the process of correction access.
C31B	A request for creating or resynchronizing TC pairs was received, but the command was rejected because the physical volume with the specified P-VOL is blocked.
C31C	The P-VOL is blocked and cannot be accessed.
C31D	The P-VOL is being formatted.
C31E	The P-VOL is read only.
C320	The number of remote paths between primary and secondary systems is 0 (not specified).
C321	The number of remote paths between primary and secondary systems is smaller than the minimum required.
C322	The DKC type of the primary system does not support TC.
C324	The secondary system's sequence number is invalid.
C327	The pair cannot be created because the P-VOL is not available for remote copy.
C328	The track formats of the P-VOL and the S-VOL do not match.
C32A	The S-VOL is protected by Data Retention Utility.
C32B	The P-VOL is protected by Data Retention Utility.
C32C	The S-VOL is protected by Data Retention Utility.
C32D	The S-VOL is protected by Data Retention Utility.
C32E	A request for a paircreate operation was rejected because the specified secondary system is an unsupported product.
C32F	The number of P-VOL cylinders in the TC volume is not equal to or smaller than the number of S-VOL cylinders.
C330	The pair cannot be created or resynchronized because of one of the following: • P-VOL and S-VOL capacities are not the same. • (VSP G1000, G1500, and VSP F1500) The S-VOL is in a LUSE configuration.
C332	S-VOL cache is disabled.
C333 (VSP G1000, G1500, and VSP F1500)	S-VOL DFW is disabled.
C335	The S-VOL is the TC asynchronous P-VOL.
C336	The S-VOL includes PIN data.
C337	The S-VOL is in reserve status.
C338	Copy pair cannot be created because of the either of the following reasons: • The S-VOL is requesting intervention, protected, or cannot be used. • The S-VOL is configured as the S-VOL or reserved volume of ShadowImage, reserved volume of Volume Migration, or the volume of UR pair.
C339	The S-VOL is not available.
C33A	A request for a paircreate operation was rejected because the secondary system is not supported by TC.
C33B	The corresponding volume cannot be specified as an S-VOL because the volume is used as another pair's S-VOL.
C33C	A request for a paircreate operation was rejected because the specified S-VOL was not mounted.

Error code (SSB2)	Description
C33E	The pair cannot be created because the S-VOL is not installed or is blocked (DEV NOT READY status).
C33F	The corresponding volume cannot be specified as an S-VOL because the volume is already specified as a TC pair volume.
C35C	The P-VOL is not accessible.
C370	There are fewer paths than the required minimum number because a path failure occurred or an invalid path was specified.
C371	The process that is performed after the copying process of Volume Migration in the S-VOL is in progress. Try again in a few minutes.
C372	The process that is performed after the copying process of Volume Migration in the P-VOL is in progress. Try again in a few minutes.
C373	A request for a paircreate operation was rejected because the specified S-VOL is a ShadowImage for Mainframe reserved volume.
C379	The minimum number of paths that need to be set is not met because a path failure occurred or an invalid path was specified.
C37A	An internal error occurred.
C37B	The S-VOL is not available.
C37E	The S-VOL cache is disabled.
C37F (VSP G1000, G1500, and VSP F1500)	The S-VOL DFW is disabled.
C380	The primary system cache is in transition to blockage on one side.
C381	The primary system cache is in the process of being restored.
C382	The primary system cache is either in transition to blockage on one side or in the process of being restored on one side.
C388	The pair cannot be created because the emulation type is not available for the specified volume.
C38B	The secondary system is already used by TC.
C38D	The S-VOL is not available.
C38E	The S-VOL is a device which is not supported by TC.
C390	The S-VOL status is not PSUS or PSUE.
C391	The S-VOL cannot be copied.
C392	The volume cannot be used as an S-VOL because it is in reserve status, is already being used by TC, or is being used by UR.
C393	The S-VOL includes PIN data.
C395	The pair cannot be created or resynchronized because the specified S-VOL is blocked, physical volume with the S-VOL is blocked, correction access is in progress, or other reasons.
C398	The pair cannot be created because the emulation type is not available for the specified volume.
C39B	An internal error occurred.
C39E	The pair cannot be created because the capacity of the P-VOL exceeded the maximum volume capacity allowed to create a TC pair.
C39F	The pair cannot be created because the capacity of the S-VOL exceeded the maximum volume capacity allowed to create a TC pair.

Error code (SSB2)	Description
C3A0	The P-VOL is a device not supported by TC.
C3A8	The device type combination between the P-VOL and S-VOL is invalid.
C3AA	The secondary system's cache is blocked on one side.
C3AB	The secondary system's cache is blocked on one side.
C3AC	TC is not supported for this controller emulation type of the secondary system.
C3AD	The secondary system capacity exceeds the license capacity.
C3AE	TC is not installed on the secondary system.
C3AF	The DKC type of the secondary system is not supported by TC.
C3B1	The number of paths is smaller than the required minimum number of paths.
C3B3	An internal error occurred.
C3B5	The configuration combination of P-VOL and S-VOL is invalid
C3B6	The TC P-VOL is an SI pair volume.
C3B7	The TC S-VOL is an SI pair volume.
C3B8	An internal error occurred.
C3B9	The pair cannot be created for one of the following reasons: • LUN is not defined for the S-VOL. • (VSP G1000, G1500, and VSP F1500) The S-VOL is a mainframe volume. • (VSP G1000, G1500, and VSP F1500) The S-VOL is an intermediate volume. • (VSP G1000, G1500, and VSP F1500) The emulation type is not supported for the S-VOL.
C3BC	TC is not installed on the secondary system.
C3BE	The following volumes cannot be specified as a TC P-VOL: • SI S-VOL not in PSUS status • SI P-VOL in the process of reverse copy
C3BF	An SI S-VOL, SI reserved volume, or SI P-VOL in the process of reverse copy cannot be specified as a TC S-VOL.
C3C7	A request for a paircreate operation was rejected because the specified volume was already part of a TC or UR pair (including journal volumes).
C3CA	The S-VOL is reserved, or a secondary system, S-VOL, or the path between primary system and secondary system is in the busy status.
C3CD	The TC S-VOL is an SI pair volume.
C3D2	The DKC type of the secondary system is not supported by TC.
C3D4	A pair cannot be created because the P-VOL is being used by Volume Migration.
C3D6	The specified S-VOL is unavailable because the connecting port cannot recognize it.
C3D7	The pair status of secondary system's S-VOL is invalid.
C3D8	The pair cannot be created because the volume specified for the S-VOL is a system volume.
C3D9	The pair cannot be created if the TC S-VOL corresponds to any of the following: • The volume is a DP-VOL, and paired using a reserved volume of an SI, Thin Image, or (VSP G1000, G1500, and VSP F1500) Copy-on-Write Snapshot pair, or Volume Migration. • The volume is a DP-VOL and its capacity is being expanded, or pages are being released. • The capacity of the volume is different from the capacity of the P-VOL

Error code (SSB2)	Description
	• The volume is being initialized by SI
C3DB	S-VOL pair status is not PSUS or PSUE.
C4DE	The pair cannot be created because the remote path between the primary and secondary storage systems is not valid.
C4FC	The required amount of shared memory for the operation is not installed in the secondary system.
CB12	TC, TCz, and UR, URz cannot be mixed in the consistency group.
CB19	The secondary system consistency group cannot be deleted because reversing the P-VOL and S-VOL using the **`horctakeover`** command failed.
CB1A	Deletion of the secondary system consistency group was abnormally terminated because reversing the P-VOL and S-VOL using the **`horctakeover`** command failed.
CB1D	No dummy volume can be created in the S-VOL.
CB1F	The secondary system does not support TC.
CB20	In referring to the function bit, the system information reference function was abnormally terminated.
CB21	In a Pairresync operation, all difference setting was abnormally terminated.
CB23	An internal error occurred.
CB5D	The command was rejected because after receiving pair creation request, since it is connected to old model, specified P-VOL became out of support.
CB60	TC is not installed in the secondary system.
CB66	The TC pair cannot be created or resynchronized because the differential bitmap area is not available due to one of the following reasons: • Free area for shared memory in the secondary system is insufficient. • Free area for Dynamic Provisioning pool specified as the S-VOL is insufficient.
CB67	An additional shared memory is not installed in the secondary system.
CB68	The pair cannot be created or resynchronized because the free area for shared memory in the primary system is insufficient and the differential bitmap area cannot be reserved.
CB69	The pair cannot be created because the number of pairs exceeds the maximum number that can be created in a single consistency group.
CB6E	The paircreate operation cannot run because the P-VOL is a volume in a storage system from another company.
CB6F	The paircreate operation cannot run because the S-VOL is a volume in a storage system from another company.
CB71	The paircreate operation cannot run because the P-VOL is a migration volume in a storage system from another company.
CB73	The paircreate operation cannot run because the S-VOL is a migration volume in a storage system from another company.
CB75	The device is not recognized correctly.
CB76	The paircreate operation cannot run because the paths are specified per storage system.
CB77	The used capacity of the Data Retention Utility software product on the secondary system exceeds the license capacity.
CB78	The paircreate operation cannot run because the specified S-VOL is defined as the command device.

Error code (SSB2)	Description
CB7E	A request for a paircreate operation was rejected because the specified S-VOL belongs to a different CLPR than the registered consistency group's CLPR.
CB9E	A request for a paircreate operation was rejected in the secondary system due to one of the following reasons: • (VSP G1000, G1500, and VSP F1500)The function for defining the same consistency group for open and mainframe systems is not supported. • The function for defining a consistency group that contains multiple pairs of storage systems is not supported. • The function for defining a consistency group for open systems is not supported.
CBD7	The storage system is in internal processing. Try the operation again.
CBD8	A pair cannot be created because the specified P-VOL is one of the following: • A journal volume used for UR. • A UR secondary volume that is not suspended.
CBDA	The paircreate operation cannot run because the used capacity of Data Retention Utility on the secondary system exceeds the license capacity.
CBDC	A request for creating a TC pair was received in the TC-UR combination status. However, the command was rejected because the mirror ID of UR was 0.
CBDD	In configuring a TC-UR multi-target configuration, a request for a TC paircreate operation was rejected because the UR pair was in the process of copying.
CBDE	The paircreate operation cannot run because the P-VOL is used by Thin Image.
CBDF	The paircreate operation cannot run because the S-VOL is used by Thin Image or (VSP G1000, G1500, and VSP F1500) Copy-on-Write Snapshot.
CBE0	The paircreate operation cannot run because the P-VOL is a Thin Image virtual volume.
CBE1	The paircreate operation cannot run because the S-VOL is a Thin Image or (VSP G1000, G1500, and VSP F1500) Copy-on-Write Snapshot virtual volume.
CBE2	The paircreate operation cannot run because the P-VOL is a Dynamic Provisioning or Thin Image pool-VOL.
CBE3	The paircreate operation cannot run because the S-VOL is a Dynamic Provisioning, Thin Image, or (VSP G1000, G1500, and VSP F1500) Copy-on-Write Snapshot pool-VOL.
CBE7	65,280 pairs or more cannot be created in one storage system.
CBEB	The pair cannot be created because the specified P-VOL is being shredded by Volume Shredder.
CBEC	The pair cannot be created because the specified S-VOL is being shredded by Volume Shredder.
CBED	The paircreate operation cannot run because of one of the following reasons: • The specified S-VOL is the volume for a UR S-VOL. • The specified S-VOL is the volume for a UR journal volume. • An attempt was made to create the 2DC or 3DC configuration using the specified S-VOL, but a storage system that does not support 2DC or 3DC is included in the configuration.
CBEE	The request for a paircreate operation was rejected because the specified P-VOL is already paired for either of the following purposes: • P-VOL for the differential data resync in UR. • P-VOL for the primary site in the 3DC multi-target configuration with three UR sites.
CBF3	The pair was not created because the specified P-VOL is either of the following: • An external volume mapped for moving data online • An external volume of which data direct mapping attribute is enabled

Error code (SSB2)	Description
CBF4 (VSP G1000, G1500, and VSP F1500)	The pair cannot be created because the S-VOL is used as the external volume mapped for online data migration.
CBF7	An attempt was made to create the 2DC or 3DC configuration using the specified P-VOL, but the paircreate operation cannot run because a storage system that does not support the 2DC or 3DC configuration is included.
CBF8	The pair cannot be created due to either of the following reasons: • The microcode or firmware version of the primary or secondary system does not support the connection to a remote storage system. • The primary or secondary system is a model that does not support the connection to a remote storage system.
CBFC	The pair cannot be created because the consistency group ID is not within the supported range.
CBFF	The pair cannot be created because the remote path between the primary and secondary systems is not valid.
FD01	The pair cannot be created because no virtual LDEV ID is specified for the volume specified as the S-VOL.
FD02	The pair cannot be created because no virtual LDEV ID is specified for the volume specified as the P-VOL.
FD03	The pair cannot be created because the specified virtual information does not match the virtual information registered in the secondary storage system.
FD04	The specified secondary storage system does not support global storage virtualization.
FD05	The specified primary storage system does not support global storage virtualization.
FD06 (VSP G1000, G1500, and VSP F1500)	The pair cannot be created because the volume specified as the P-VOL is used as an external volume for nondisruptive migration and also used as a volume for a Volume Migration pair.
FD07	The pair cannot be created because volume specified as P-VOL is used by GAD pair.
FD08	The pair cannot be created because volume specified as S-VOL is used by GAD pair.
FD09	The pair cannot be created because volume specified as P-VOL is a GAD reserve volume.
FD0A	The pair cannot be created because volume specified as S-VOL is a GAD reserve volume.
FD0B	The internal process to secure tier memory difference has timed out for the specified P-VOL. This might happen if there is a large load on the HDD, cache memory, and MP blade or unit. Try to identify the specific problem using performance monitoring tools. If that is not possible, wait for about 5 minutes and retry the operation. If the retry fails, contact customer support.
FD0C	The pair cannot be created or resynchronized because the differential bitmap area cannot be reserved due to one of the following reasons: • Free area for shared memory in the primary system is insufficient. • Free area for Dynamic Provisioning pool specified as the P-VOL is insufficient.
FD0E	Internal processing is being processed in the specified S-VOL. Try again after a while.
FD0F	The pair was not created because the data direct mapping attribute of the specified P-VOL is enabled, and the function of R-DKC for mapping external volumes larger than 4 TB is not supported.
FD10	The pair cannot be created. The T10 PI attribute setting of the primary volume and that of the secondary volume are different.

Error code (SSB2)	Description
FD12 (VSP Gx00 models and VSP Fx00 models)	The pair was not created because the specified S-VOL operates as the system LU of NAS.

SSB2=B992 error codes when SSB1 = B901 or B90A

Error Code (SSB1)	Error Code (SSB2)	Description
B901	B992	Pair cannot be created because DKC type does not support TC Asynchronous.
B90A	B992	Consistency group information cannot be retrieved because TC or UR is not installed.

SSB2 error codes when SSB1 = B90B

Error Code (SSB1)	Error Code (SSB2)	Description
B90B	B9E0	The command was rejected because the function for deleting pairs forcibly is not supported.

SSB2 error codes when SSB1 = B912

Error Code (SSB1)	Error Code (SSB2)	Description
B912	B96D	The command was rejected because the volume status is SMPL.

SSB2 error codes when SSB1 = B980 (VSP Gx00 models and VSP Fx00 models)

Error Code (SSB1)	Error Code (SSB2)	Description
B980	B901	The command was rejected because the specified port is for NAS Platform (system LU).
B980	B903	The command was rejected because the selected resource belongs to NAS_Platform_System_RSG.

Service information messages (SIMs)

The storage system generates a service information message (SIM) to notify users of a possible service requirement. The SVP reports all SIMs related to TrueCopy operations.

SIMs are classified according to the following severities: service, moderate, serious, or acute.

All SIMs are recorded on the SVP or storage system and displayed in the Alert tab of the **Device Manager - Storage Navigator Storage System** window.

For more information, see the *System Administrator Guide*.

During TrueCopy operations, the primary and secondary system generate a service SIM when P-VOL or S-VOL pair status changes for any reason, including normal status transitions (for example, COPY to PAIR).

- SIMs generated by the primary system include the P-VOL device ID (byte 13).
- SIMs generated by the secondary system include the S-VOL device ID (byte 13).

If SNMP is installed and operational on the storage system, each SIM results in an SNMP trap being sent to the appropriate hosts.

For further information about SNMP operations and SIMs, see the *System Administrator Guide or Hitachi SNMP Agent User Guide,* or contact customer support.

Pinned track recovery

Use this procedure to ensure the pair's data integrity while recovering the pinned track.

Procedure

1. Connect to the primary system of the pair containing a volume with the pinned track.
2. Release the pair that contains the volume with the pinned track.
3. Perform your usual procedure for recovering data from a pinned track. See the pinned track recovery procedures for your OS, or contact customer support in recovering the pinned track.
4. Recreate the pair from **Create TC Pairs** Window. Make sure to use Entire Volume in the **Initial Copy Type** option.

Calling customer support

If you need to contact customer support, please provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure.
- The content of any error messages displayed on the host systems.
- The content of any error messages displayed by Device Manager - Storage Navigator.
- The Device Manager - Storage Navigator configuration information (use the Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by Device Manager - Storage Navigator.

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

A

TC CLI reference

This appendix provides commands and options for command line user interfaces and the Device Manager - Storage Navigator gui. Commands and options for configuring, operating, monitoring, and maintaining TrueCopy pairs, and for working with consistency groups, are provided for HDvM - SN, CCI, BCM, and PPRC.

Configuration commands and options

The following table shows the commands and options for configuring TC.

For information about CCI commands, see the *Command Control Interface Command Reference*.

Operation	Option	Available in HDvM - SN?	CCI command and options
Edit Ports (VSP G1000, G1500, and VSP F1500)	Port Attribute	Yes	raidcom modify port -port_attribute *port attribute*
Add Remote Connection	Connection Type (VSP G1000, G1500, and VSP F1500)	Yes	none
	Remote Storage System	Yes	raidcom add rcu -rcu *serial# mcu# rcu# id*
	Remote Paths	Yes	raidcom add rcu -cu_free *serial# id pid*
	RIO MIH Time	Yes	raidcom modify rcu -rcu_option *mpth rto rtt*[fzd|fze]
Edit Remote Replica Options	Copy Type	Yes	none
	Maximum Initial Copy Activities	Yes	none
	Blocked Path Monitoring	Yes	none

Pair operation commands and options

The following table shows the commands and options for performing TC pair operations.

Operation	Option	Available in HDvM - SN?	CCI command and options
Create Pairs	Copy Type	Yes	paircreate none
	LU Selection	Yes	paircreate none
	CTG ID	Yes	paircreate -f[g] *fence* [CTG ID]
	Initial Copy Type	Yes	paircreate

Operation	Option	Available in HDvM - SN?	CCI command and options
			[-nocopy | -nocsus]
	Initial Copy Priority	Yes	paircreate none
	None (VSP G1000, G1500, and VSP F1500)	Yes	paircreate -nomsg
Split Pairs	Secondary Volume Write	Yes	pairsplit -rw
Resync Pairs (VSP G1000, G1500, and VSP F1500)	none	Yes	pairresync -nomsg
Resync Pairs (VSP Gx00 models and VSP Fx00 models)	none	Yes	pairresync none
Delete Pairs	none	Yes	pairsplit -S

Monitoring commands and options

The following table shows the commands and options for viewing TC pair information.

Operation	Options	Available in HDvM - SN?	CCI command and options
View Pair Properties	none	Yes	pairdisplay -m *mode*
View Pair Synchronization Rate	none	Yes	pairdisplay -m *mode*
View Remote Connection Properties	none	Yes	pairdisplay -m *mode*

Maintenance commands and options

The following table shows the commands and options for maintaining TC pairs.

Note: Maintenance commands and options are not available from CCI.

Operation	Options	Available in HDvM - SN?
Edit Pair Options	none	Yes
Edit Remote Connection Options	RIO MIH Time	Yes
Add Remote Paths	none	Yes
Remove Remote Paths	none	Yes
Remove Remote Connections	none	Yes

Consistency group commands and options

The following table shows the commands and options for setting up and managing consistency groups for TC.

Note: Consistency group commands and options are not available from HDvM - SN.

Operation	CCI command name
Reserve CTGs	paircreate -f[g] *fence*[CTG ID]
Add pair to the CTG	paircreate -f[g] *fence*[CTG ID]
Split pairs in CTG (no reservation time)	pairsplit -S*
Resync pairs in CTG	pairresync -f[g] *fence*[CTG ID]
Delete pairs in CTG	pairsplit -S
* If you want to split multiple pairs simultaneously, the pairs must be part of the same consistency group.	

B

TC GUI reference

This appendix describes Device Manager - Storage Navigator windows and fields used for TrueCopy. The following key topics are covered:

Important: Procedures in this manual are tailored to the Device Manager - Storage Navigator (HDvM - SN) GUI. When using this GUI, "Local Storage System" is displayed for the system you have accessed on the HDvM - SN server.

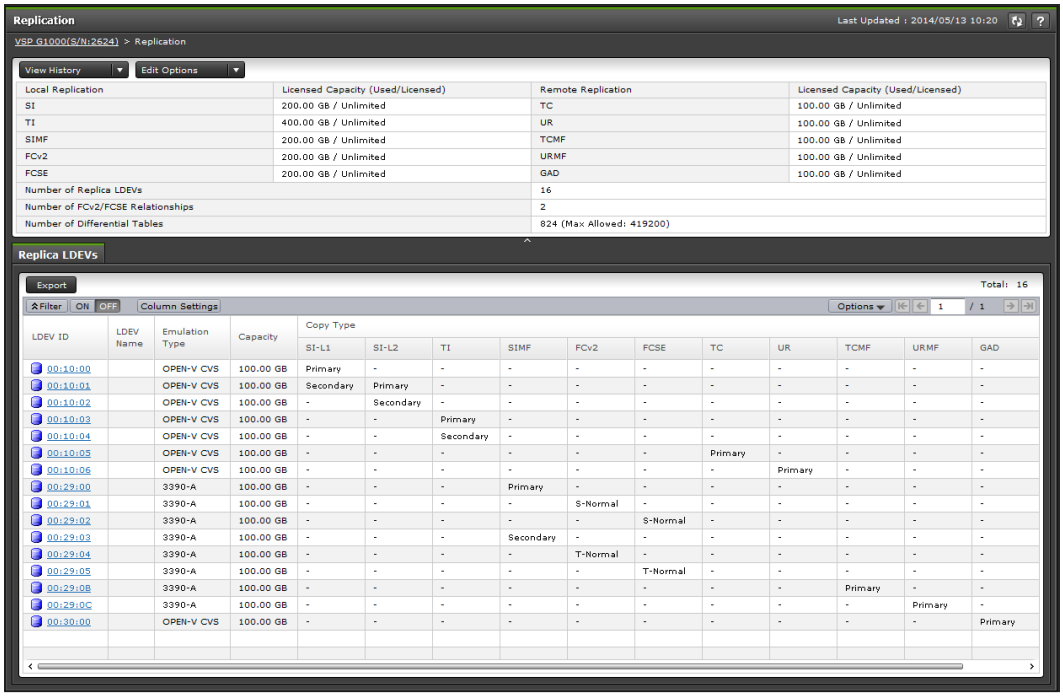
Therefore, if you access the secondary site's HDvM - SN server, the GUI displays information for the pair's secondary (remote) system under "Local Storage System", and the GUI identifies the storage system connected to the accessed storage system as the "Remote Storage System".

In this manual, the term "primary storage system" and "primary system" refer to the storage system in which the primary volume (P-VOL) is located, and the terms "secondary storage system" and "secondary system" refer to the storage system in which the secondary volume (S-VOL) is located, unless otherwise noted.

- Remove Remote Paths wizard
- Edit Remote Replica Options wizard
- Create Pairs wizard
- Split Pairs wizard
- Resync Pairs wizard
- Delete Pairs wizard
- Force Delete Pairs (TC Pairs) window
- Edit Pair Options wizard
- View Pair Properties (Remote) window
- View Pair Synchronization Rate window
- History window
- Edit Ports window
- Complete SIMs (TC) window (VSP G1000, G1500, and VSP F1500)

Replication window

Use this window to view information about pairs and pair volumes.



In this topic, you can view the following tables.

- Summary section
- Replica LDEVs tab

Summary section

Item	Description
Licensed Capacity (Used/ Licensed)	Used capacity and licensed capacity for each local and remote replication program product.
Number of Replica LDEVs	Number of LDEVs used in replication.
Number of FCv2/FCSE relationships (VSP G1000, G1500, and VSP F1500)	Number of Compatible FlashCopy® V2 and Compatible FlashCopy® SE relationships.
Number of differential tables	The number and the maximum number of differential tables that are already used in local replication. The number of differential tables that are already used in remote replication is not included.

Item	Description
	Differential tables will not be used for the following operations. Therefore, number of differential tables will not change when you execute the following operations. • SI pair operations for a DP-VOL that exceeds 4 TB. • TI pair operations. • (VSP G1000, G1500, and VSP F1500) SIz pair operations for a DP-VOL that exceeds 262,668 cylinders. • (VSP G1000, G1500, and VSP F1500) Compatible FlashCopy® V2 or Compatible FlashCopy® SE relationship operations.
View History - Local Replication	Opens the **History** window for local replication.
View History - Remote Replication	Opens the **History** window for remote replication.
Edit Options - Local Replication	Opens the **Edit Local Replica Options** window.
Edit Options - Remote Replication	Opens the **Edit Remote Replica Options** window.
Edit Options - SCP Time (VSP G1000, G1500, and VSP F1500)	Opens the **Edit SCP Time** window.

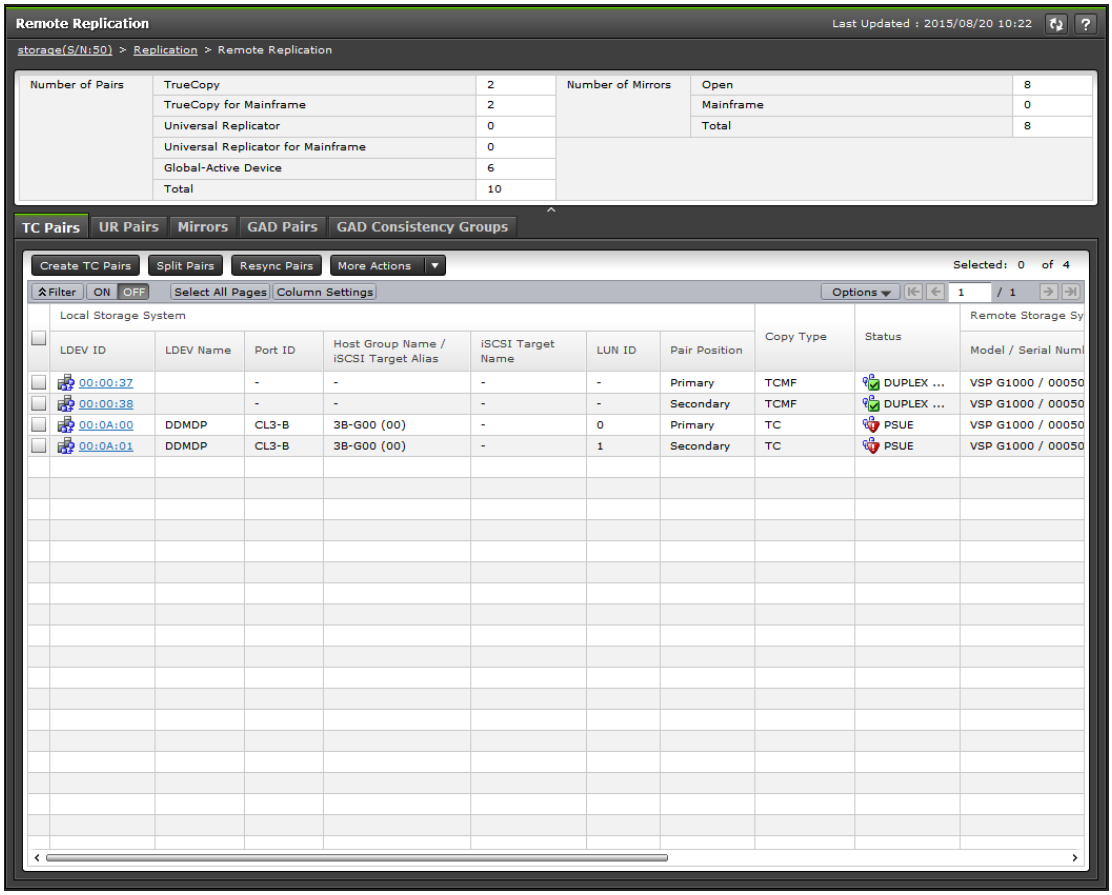
Replica LDEVs tab

Item	Description
LDEV ID	LDEV identifier. Clicking the link opens the **LDEV Properties** window.
LDEV Name	LDEV name.
Emulation Type (VSP G1000, G1500, and VSP F1500)	LDEV's emulation type.
Capacity	LDEV's capacity.
Copy Type	Copy and volume type of the pair. • SI-L1: ShadowImage L1 pair • SI-L2: ShadowImage L2 pair • (VSP G1000, G1500, and VSP F1500) SIMF: ShadowImage for Mainframe pair • TI: Thin Image • (VSP G1000, G1500, and VSP F1500) FCv2: Compatible FlashCopy® V2 relationship • (VSP G1000, G1500, and VSP F1500) FCSE: Compatible FlashCopy® SE relationship • TC: TrueCopy pair • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe pair • UR: Universal Replicator pair • (VSP G1000, G1500, and VSP F1500) URMF: Universal Replicator for Mainframe pair • GAD: global-active device pair Volume types (SI, TI, SIMF, TC, UR, TCMF, URMF, GAD) • Primary: Primary volume

Item	Description
	• Secondary: Secondary volume Volume types (FCv2, FCSE) S indicates the source volume and T indicates the target volume: • S-Normal: Normal source volume • T-Normal: Normal target volume • ST-Normal: Normal volumes set for both the source and target volumes • S-Failed, S-Full, S-Full & Failed: Abnormal source volume • T-Failed, T-Full, T-Full & Failed: Abnormal target volume • ST-Failed, ST-Full, ST-Full & Failed: Abnormal volume set for both the source and target volumes. A hyphen (-) is displayed if no pair is set.
Virtual Storage Machine*	Information about the LDEV's virtual storage machine and about the LDEV. • Model type/Serial number: Model type and serial number. • LDEV ID: Virtual LDEV identifier of the volume. • Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates that no values are specified. • SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Export	Opens the window for exporting the table information.
* This item does not appear in the window by default. To display this item, change the Column Settings option for the table.	

Remote Replication window

Use this window to view information about remote replication pairs and mirrors UR / URz only.



Summary section

Item	Description
Number of Pairs	Number of pairs for each remote replication product and the total of all pairs.
Number of Mirrors	(VSP G1000, G1500, and VSP F1500) Open: Number of mirrors for open systems Mainframe: Number of mirrors for mainframe systems Total: Total number of mirrors

TC Pairs tab

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.

Item	Description
Local Storage System	Information about volumes in the accessed storage system.

Item	Description
	• LDEV ID: LDEV identifier. Click to open the **LDEV Properties** window. • LDEV Name: LDEV name. • Port ID: Port identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • iSCSI Target Name: Volume's iSCSI target name. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • LUN ID: LUN identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • Pair Position: Whether the volume is a primary or secondary volume. • Provisioning Type[1]: Provisioning type of the volume. • (VSP G1000, G1500, and VSP F1500) Emulation Type[1]: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute[1]: Volume's LDEV attribute. • Capacity[1]: Capacity of the volume. • CLPR[1]: CLPR ID of the volume. • Encryption[1]: Encryption information ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume or migration volume, a hyphen (-) is displayed. For DP-VOL's, the pool to which the LDEV belongs is an external volume or blocked. • Capacity Saving[1]: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used. ○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume. ○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled. A hyphen (-) is displayed if the emulation type is other than OPEN-V. • Virtual storage machine[1]: Virtual storage machine's model type and serial number. • Virtual LDEV ID[1]: Virtual LDEV identifier of the volume.

Item	Description
	• Virtual Device Name[1]: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates no values are specified. • Virtual SSID[1]: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Copy Type (VSP G1000, G1500, and VSP F1500)	• TC: TrueCopy • TCMF: TrueCopy for Mainframe
Status	Pair status. In Storage Navigator, the pair status is displayed as pair-status-in-Storage-Navigator/pair-status-in-CCI-or-Business-Continuity-Manager. If the pair status in Device Manager - Storage Navigator and the pair status in CCI or Business Continuity Manager are the same, the pair status in CCI or Business Continuity Manager is not displayed.
Remote Storage System	Information about volumes in the storage system connected to the accessed system. • Model / Serial Number: Remote system's model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: Remote system's SSID number. TCz only. • LDEV ID: LDEV identifier. • Port ID: Port identifier when specifying an LDEV ID at pair creation. Note that this field does not change if the remote system path settings are changed. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • LUN ID: LUN identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs. • Virtual storage machine[1]: Virtual storage machine's model type and serial number. • Virtual LDEV ID[1]: Virtual LDEV identifier of the volume.
Path Group ID	Path group identifier.
Update Type[1]	One of the following: • Sync: It is a TC or TCMF pair which is not assigned to consistency group. • Sync (Specified CTG): It is a TC or TCMF pair created by specifying consistency group.
CTG ID[1]	Pair's consistency group identifier.
CTG Utilization[1]	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.

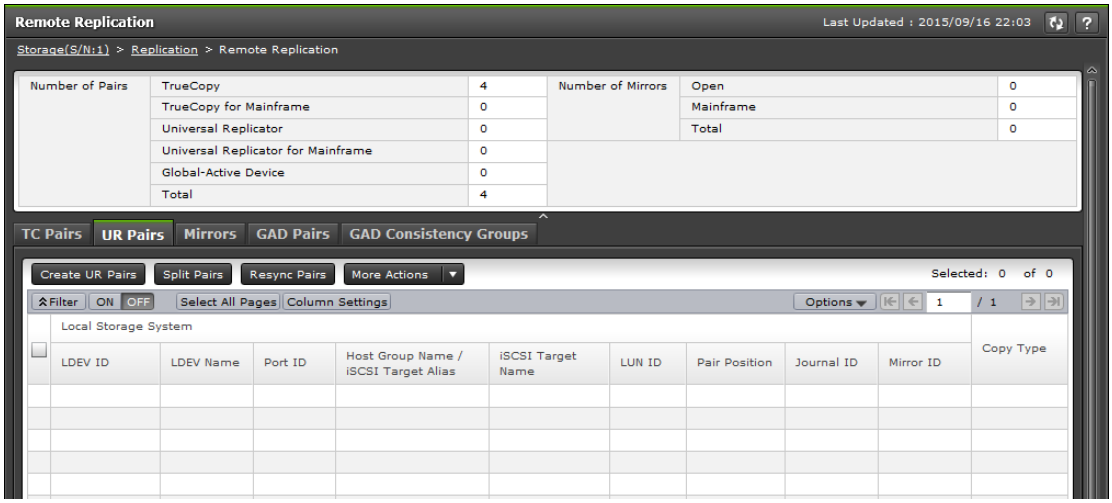
Item	Description
Preserve Mirror Status[1] (VSP G1000, G1500, and VSP F1500)	• - (hyphen): Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.
Fence Level[1]	Specified P-VOL fence level.
Host I/O Time Stamp Transfer[1] (VSP G1000, G1500, and VSP F1500)	Whether the host time stamp is transferred to an S-VOL.
Create TC Pairs	Opens the Create TC Pairs window.
Split Pairs	Opens the **Split Pairs** window.
Resync Pairs	Opens the **Resync Pairs** window.
View Pair Synchronization Rate[2]	Opens the **View Pair Synchronization Rate** window when the pair's primary system is accessed.
View Pair Properties[2]	Opens the **View Pair Properties** window.
View Remote Connection Properties[2]	Opens the **View Remote Connection Properties** window.
Edit Pair Options[2]	Opens the **Edit Pair Options** window.
Delete Pairs[2]	Opens the **Delete Pairs** window.
Export[2]	Opens the window for exporting the table information.

Notes:

1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.
2. This item is displayed when you select More Actions.

UR Pairs tab

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.



Item	Description
Local Storage System	Information about volumes in the accessed storage system. • LDEV ID: LDEV identifier. Clicking the link opens the **LDEV Properties** window. • LDEV Name: LDEV name. • Port ID: Port identifier. UR only. A hyphen (-) is displayed for URz pairs. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. UR only. A hyphen (-) is displayed for URz pairs. • iSCSI Target Name: iSCSI target name. UR only. A hyphen (-) is displayed for URz pairs. • LUN ID: LUN identifier. UR only. A hyphen (-) is displayed for URz pairs. • Pair Position: Whether the volume is a primary or secondary volume. • Journal ID: Journal identifier. • Mirror ID: Mirror identifier. • Provisioning Type[1]: Provisioning type of the volume. • (VSP G1000, G1500, and VSP F1500) Emulation Type[1]: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute[1]: Volume's LDEV attribute. • Capacity[1]: Capacity of the volume. • CLPR[1]: CLPR ID of the volume. • Encryption[1]: Encryption information ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume or migration volume, a hyphen (-) is displayed. For Dynamic Provisioning or Dynamic Provisioning for Mainframe virtual volumes, the pool to which the LDEV belongs is an external volume or blocked. • Journal Encryption[1]: Journal's encryption status. ○ Enabled: The journal contains encrypted volumes. ○ Disabled: The journal contains unencrypted volumes. ○ Mixed: The pool to which the journal volume belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume

Item	Description
	Note: Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked. • Capacity Saving[1]: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used. ○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume. ○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled. A hyphen (-) is displayed if the emulation type is other than OPEN-V. • Virtual storage machine[1]: Virtual storage machine's model type and serial number. • Virtual LDEV ID[1]: Virtual LDEV identifier of the volume. When the virtual LDEV ID is not assigned, this item is blank. • Virtual Device Name[1]: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates no values are specified. • Virtual SSID[1]: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Copy Type (VSP G1000, G1500, and VSP F1500)	• UR: Universal Replicator • URMF: Universal Replicator for Mainframe
Status	Pair status.
Remote Storage System	Information about volumes in the system connected to the system you accessed. • Model / Serial Number: Remote system's model and serial number. • LDEV ID: LDEV identifier. • Port ID: Port identifier. UR only. A hyphen (-) is displayed for URz pairs. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed. UR only. A hyphen (-) is displayed for URz pairs. • LUN ID: LUN identifier. UR only. A hyphen (-) is displayed for URz pairs. • Journal ID: Journal's identifier. • Virtual storage machine[1]: Virtual storage machine's model type and serial number. • Virtual LDEV ID[1]: Virtual LDEV identifier of the volume.
Path Group ID	Path group identifier.
CTG ID[1]	Consistency group identifier.

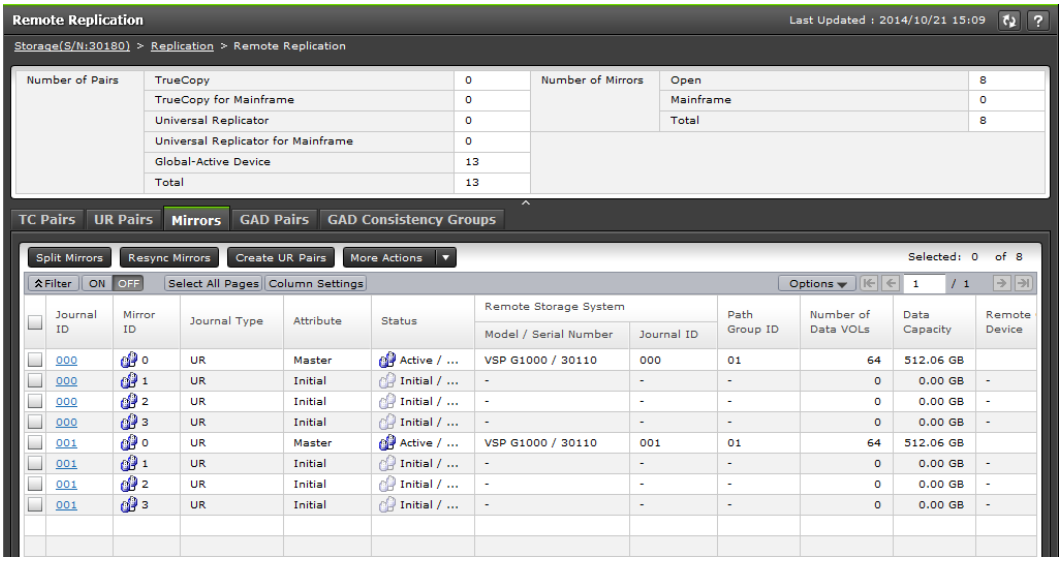
Item	Description
Error Level[1]	The error level.
Create UR Pairs	Opens the Create UR Pairs window.
Split Pairs	Opens the **Split Pairs** window.
Resync Pairs	Opens the **Resync Pairs** window.
View Pair Synchronization Rate[2]	Opens the **View Pair Synchronization Rate** window when the pair's primary system is accessed.
View Pair Properties[2]	Opens the **View Pair Properties** window.
View Remote Connection Properties[2]	Opens the **View Remote Connection Properties** window. Displays only if Pair Position is Primary.
Edit Pair Options[2]	Opens the **Edit Pair Options** window.
Delete Pairs[2]	Opens the **Delete Pairs** window.
Split Mirrors[2]	Opens the **Split Mirrors** window.
Resync Mirrors[2]	Opens the **Resync Mirrors** window.
Delete Mirrors[2]	Opens the **Delete Mirrors** window.
Export[2]	Opens the window for exporting the table information.

Notes:

1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.
2. This item is displayed when you select More Actions.

Mirrors tab

UR / URz only. Only the mirrors to which all volumes are allocated for each user are displayed.



Item	Description
Journal ID	Journal identifier. Clicking opens the **Journal Volumes** window.
Mirror ID	Mirror identifier.
Journal Type (VSP G1000, G1500, and VSP F1500)	The journal's copy type and journal type option are displayed. If the journal type is standard, only the copy type is displayed.
Attribute	Whether the journal is Master, Restore, or Initial-registered but with no pair volumes assigned to it.
Status	Mirror status. For mirror descriptions, see *Hitachi Universal Replicator User Guide*.
Remote Storage System	• Model / Serial Number: Remote system model and serial number. • Journal ID: Remote system journal identifier
Path Group ID	Path group identifier.
Number of Data VOLs	Number of volumes associated with the mirror.
Data Capacity	Total capacity of all the associated volumes.
Remote Command Device	LDEV ID of the remote command device if it is assigned to the mirror. • The column is blank if the remote command device is not assigned to the mirror. • A hyphen (-) indicates the remote command device cannot be assigned to the mirror.
CTG ID[1]	Displays the consistency group ID.
CTG Utilization[1]	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
EXCTG Setting[1] (VSP G1000, G1500, and VSP F1500)	Displays the EXCTG ID and Super DKC (device name and serial number) if the journal belongs to the EXCTG. A hyphen (-) is displayed when no journal is registered in the EXCTG.
Path Watch Time[1]	Displays the path watch time.
Path Watch Time Transfer[1]	Specifies whether to forward the Path Watch Time value of the master journal to the secondary mirror. If the Path Watch Time value is forwarded from the master journal to the secondary mirror, both the primary and secondary mirrors will have the same Path Watch Time value. • Yes: The Path Watch Time value will be forwarded to the secondary mirror. • No: The Path Watch Time value will not be forwarded to the secondary mirror.
Copy Pace[1]	Indicates the speed of initial copy of a volume. Slower, Medium, or Faster is displayed. A hyphen is displayed if the journal is a restore journal.
Transfer Speed[1]	Specifies the transfer speed (in Mbps (megabits per second)). Specify one of the following: 256, 100, 10, or 3.

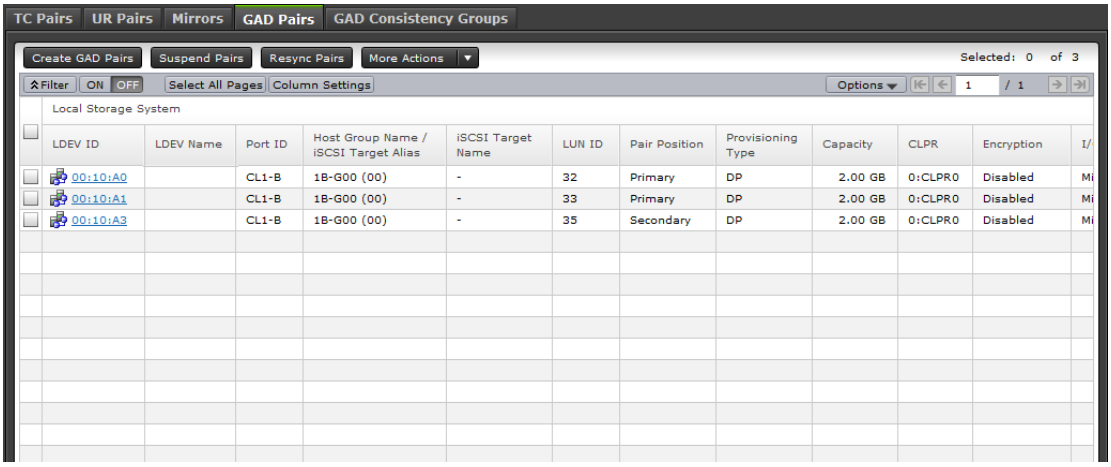
Item	Description
Delta Resync Failure[1]	Indicates the processing that must be performed if delta resync cannot be performed. • Entire Copy: Copies all data in the primary volume to the secondary volume if delta resync cannot be performed. • No Copy: Does not perform any processing if delta resync cannot be performed. Does not update the secondary volume.
Split Mirrors	Opens the **Split Mirrors** window.
Resync Mirrors	Opens the **Resync Mirrors** window.
Create UR Pairs	Opens the Create UR Pairs window.
Edit Mirror Options[2]	Opens the **Edit Mirror Options** window.
View Remote Connection Properties[2]	Opens the **View Remote Connection Properties** window when the value for Attribute is "Master".
Delete Mirrors[2]	Opens the **Delete Mirrors** window.
Assign Remote Command Devices[2]	Opens the **Assign Remote Command Devices** window.
Release Remote Command Devices[2]	Opens the **Release Remote Command Devices** window.
Export[2]	Opens the window for exporting the table information.

Notes:

1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.
2. This item is displayed when you select More Actions.

GAD Pairs tab

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.



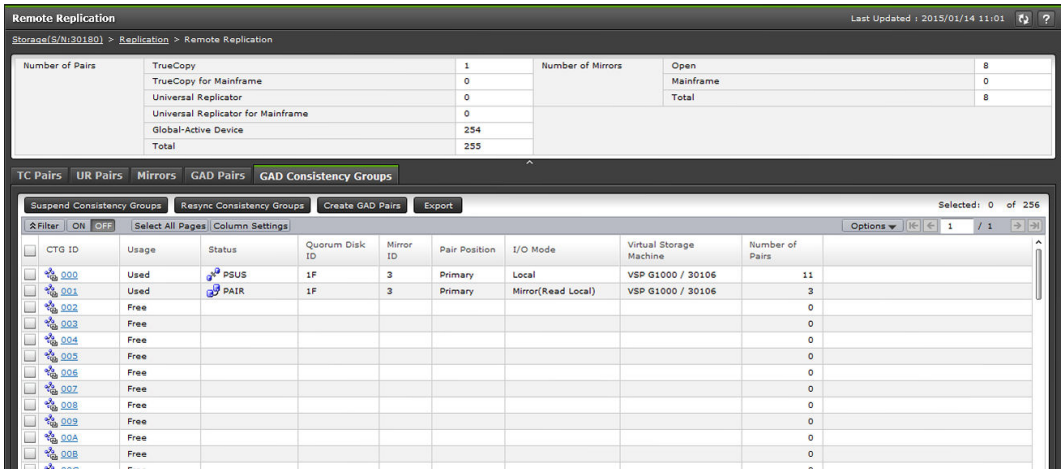
Item	Description
Local Storage System	Information about volumes in the Local Storage System. • LDEV ID: LDEV identifier. Click to open the **LDEV Properties** window. • LDEV Name: LDEV name. • Port ID: Port identifier. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. • iSCSI Target Name: iSCSI target name of the volume. • LUN ID: LUN identifier. • Pair Position: Whether the volume is a primary or secondary volume. • (VSP Gx00 models and VSP Fx00 models) Attribute[1]: Volume's LDEV attribute. • Provisioning Type[1]: Provisioning type of the volume. • Capacity[1]: Capacity of the volume. • CLPR[1]: CLPR ID of the volume. • Encryption[1]: Encryption information. ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which the LDEV belongs is an external volume or blocked. • I/O Mode: I/O Mode of the volume. • ALUA Mode: Information about the ALUA mode. • Capacity Saving[1]: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used. ○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume. ○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled.
Status	Pair status.
Failure Factor[1]	Failure Factor. To check the failure factors, see the Failure Factors on page 195 for more details.
Remote Storage System	Information about volumes in the Remote Storage System. • Model / Serial Number: Remote system's model and serial number. • LDEV ID: LDEV identifier.

Item	Description
	• Port ID: Port ID when specifying an LDEV ID at pair creation. Note that this field does not change if the remote system path settings are changed. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target ID when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed. • LUN ID: LUN identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed.
Path Group ID	Path group identifier.
Mirror ID	Mirror identifier.
Quorum Disk ID	Quorum Disk identifier.
CTG ID	Consistency group identifier.
Pair Operating Mode When Quorum Disk Blocked	Displays the pair operating mode when the quorum disk is blocked. • Pair Retained (both Primary and Secondary Accessible): The server can access both the P-VOL and the S-VOL. • Pair Retained (Primary Accessible and Secondary Inaccessible): The server can access the P-VOL. The data written to the P-VOL is written to the S-VOL. • Pair Suspension: The server can access the P-VOL. The data written to the P-VOL is not written to the S-VOL.
Virtual Storage Machine	Information about the LDEV's virtual storage machine. • Model type/Serial number: Model type and serial number. • LDEV ID: Virtual LDEV identifier of the volume. • Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute. ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates no values are specified. • SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Create GAD Pairs	Opens the Create GAD Pairs window.
Suspend Pairs	Opens the **Suspend Pairs** window.
Resync Pairs	Opens the **Resync Pairs** window.
View Pair Synchronization Rate[2]	Opens the **View Pair Synchronization Rate** window when the pair's primary system is accessed.
View Pair Properties[2]	Opens the **View Pair Properties** window.
View Remote Connection Properties[2]	Opens the **View Remote Connection Properties** window.
Delete Pairs[2]	Opens the **Delete Pairs** window.
Export[2]	Opens the window for exporting the table information.

Notes:

1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.
2. This item is displayed when you select More Actions.

GAD Consistency Groups tab



Item	Description
CTG ID	Consistency group identifier.
Usage	Displays whether a consistency group is used. • Used • Free
Status	Consistency group status. See the *Global-Active Device User Guide* for status descriptions.
Quorum Disk ID	Quorum Disk identifier.
Mirror ID	Mirror identifier.
Pair Position	Displays whether the GAD pair volume registered to the consistency group is a primary or secondary volume.
I/O Mode	Displays the I/O mode of the GAD pair that is registered to the consistency group.
Virtual Storage Machine	Displays the model type/serial number of the virtual storage machine.
Number of Pairs	Number of pairs registered to the consistency group.
Suspend Consistency Groups	Opens the **Suspend Consistency Groups** window.
Resync Consistency Groups	Opens the **Resync Consistency Groups** window.
Create GAD Pairs	Opens the Create GAD Pairs window.
Export	Opens the window for exporting the table information.

Failure Factors

The following table shows failure factors displayed in the Failure Factor column and their meanings.

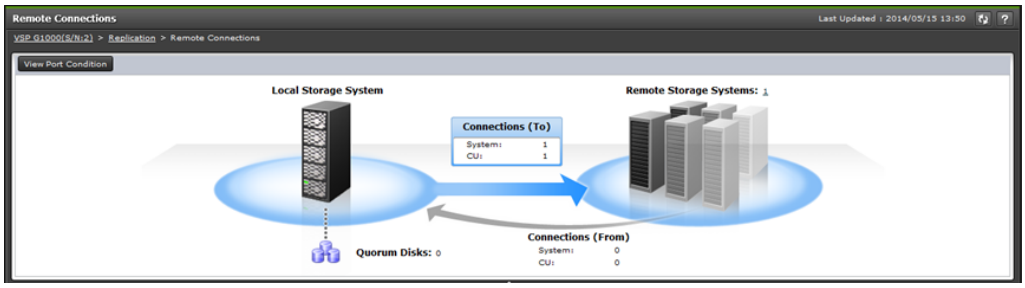
Failure Factor	Meanings
Local Volume Failure	A failure is detected on a volume in the local storage system.
Remote Path Failure	A failure is detected on the remote path.
Quorum Disk Failure	A failure is detected on the quorum disk.
Internal Error	An internal error is detected.
Not Failure	No failure is detected. The pair is suspended when the local storage system is turned on.
Remote Volume Failure	A failure is detected on a volume in the remote storage system.
Remote Side Unidentified Failure	A failure due to an unidentified factor is detected on a volume in the remote storage system.
blank cell	No failure is detected.

Remote Connections window

Use this window to view information about remote connections and paths, and add additional remote connections and paths.

In this topic you can review the following tables:

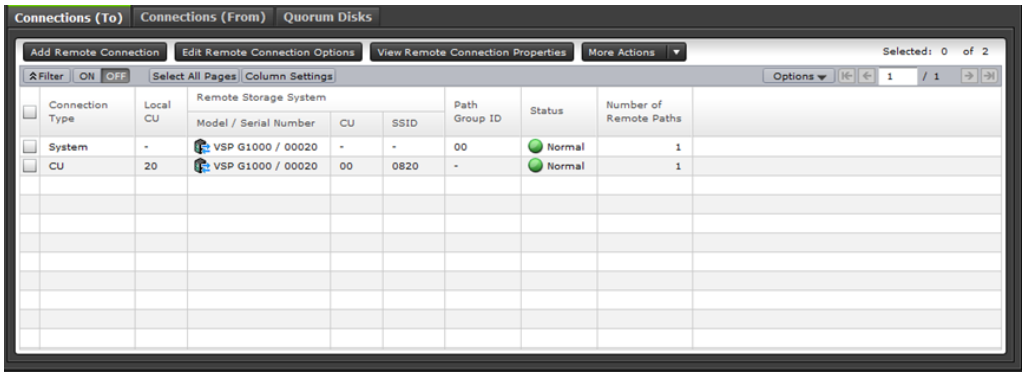
Remote connections window



Item	Description
View Port Condition	Opens the **View Port Condition** window.
Connections (To)	• System: Number of system-to-system connections from local to remote system. • (VSP G1000, G1500, and VSP F1500) CU: Number of CU-to-CU connections from local to remote system.

Item	Description
Remote Storage System	Number of remote systems connected to the local system.
Connections (From)	• System: Number of system-to-system connections from remote to local system. • (VSP G1000, G1500, and VSP F1500) CU: Number of CU-to-CU connections from remote to local system. Only the number of remote connections used for TC/TCz pairs is displayed as the number of connections.
Quorum Disks	The number of quorum disks.
View Port Location	Opens the **View Port Location** window.

Connections (To) tab



Use this tab to view information about the remote system.

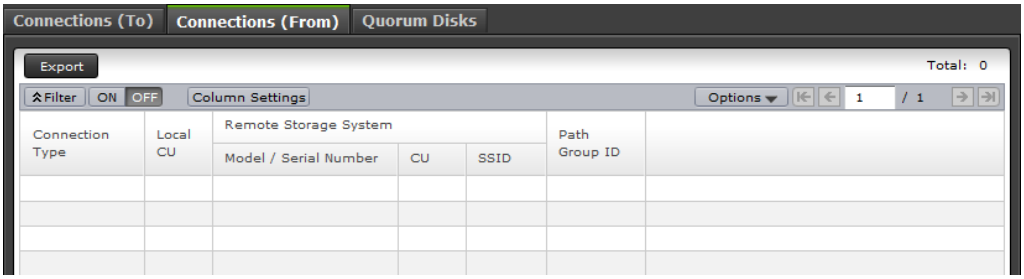
Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection (local to remote). • CU: CU-to-CU connections (local to remote).
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: Remote Storage System's CU number. • (VSP G1000, G1500, and VSP F1500) SSID: Remote Storage System's SSID number.
Path Group ID	Path group identifier.
Status	Remote connection status. • Normal: All remote paths are normal. • Failed: All remote paths are abnormal. • Warning: Some remote paths are abnormal.

Item	Description
Number of Remote Paths	Number of remote paths.
Minimum Number of Paths[1]	The specified minimum number of paths.
RIO MIH Time (sec.)[1]	The specified RIO MIH time in seconds.
Roundtrip Time (msec.)[1]	The specified roundtrip time in milliseconds.
FREEZE Option[1] (VSP G1000, G1500, and VSP F1500)	The specified the FREEZE option.
Add Remote Connection	Opens the **Add Remote Connection** window.
Edit Remote Connection Options	Opens the **Edit Remote Connection Options** window.
View Remote Connection Properties	Opens the **View Remote Connection Properties** window.
Add Remote Paths[2]	Opens the **Add Remote Paths** window.
Remove Remote Paths[2]	Opens the **Remove Remote Paths** window.
Add SSIDs[2] (VSP G1000, G1500, and VSP F1500)	Opens the **Add SSIDs** window.
Delete SSIDs[2] (VSP G1000, G1500, and VSP F1500)	Opens the **Delete SSIDs** window.
Remove Remote Connections[2]	Opens the **Remove Remote Connections** window.
Export[2]	Opens the window for exporting the table information.

Notes:
1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.
2. This item is displayed when More Actions is clicked.

Connections (From) tab

Use this tab to view information about the remote storage system. This information is displayed only when remote connections are used for TC and TCz pairs.

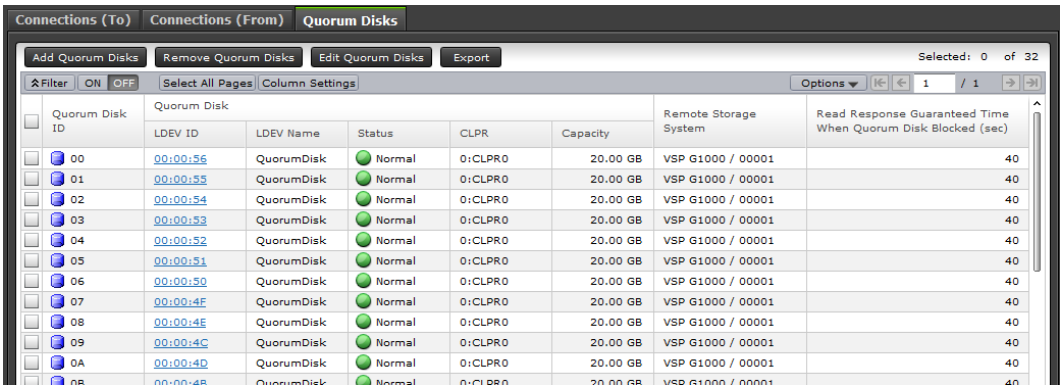


Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection from remote to local. • CU: CU-to-CU connections from remote to local.

Item	Description
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number.
Path Group ID	Path group identifier.
Export	Opens the window for exporting the table information.

Quorum Disks tab

Use this tab to view information about quorum disks allocated to users.



Item	Description
Quorum Disk ID	Quorum disk identifier.
Quorum Disk	Below is some information about quorum disks. • LDEV ID: Virtual LDEV identifier of the volume. Click to open the **LDEV Properties** window. • LDEV Name: LDEV Name of the volume.

Item	Description
	• Status: Displays the status of the volume: ○ Normal: Volume is in normal status. ○ Blocked: Volume is blocked. Access cannot be made from the host. ○ Warning: Volume has a problem. ○ Formatting: Volume is being formatted. ○ Preparing Quick Format: Preparation for quick formatting is in progress. ○ Quick Formatting: Volume is under quick formatting. ○ Correction Access: Access attribute is being corrected. ○ Copying: Volume data is being copied. ○ Read Only: Volume is in Read Only status. Data cannot be written. ○ Shredding: Volume is being shredded. ○ - : Volume is in a status other than the above. • CLPR: CLPR ID of the volume. • Capacity: Capacity of the volume.
Remote Storage System	Model/Serial number of Remote Storage System.
Read Response Guaranteed Time When Quorum Disk Blocked (sec)	Displays the time elapses until the S-VOL pair status changes to PSUE (Block), if a remote path disconnection is detected after a quorum disk is blocked.
Add Quorum Disk	Opens the window to add quorum disks.
Remove Quorum Disk	Opens the window to remove quorum disks.
Edit Quorum Disks	Opens the window to edit quorum disks.
Export	Opens the window to export the table information.

Add Remote Connection wizard

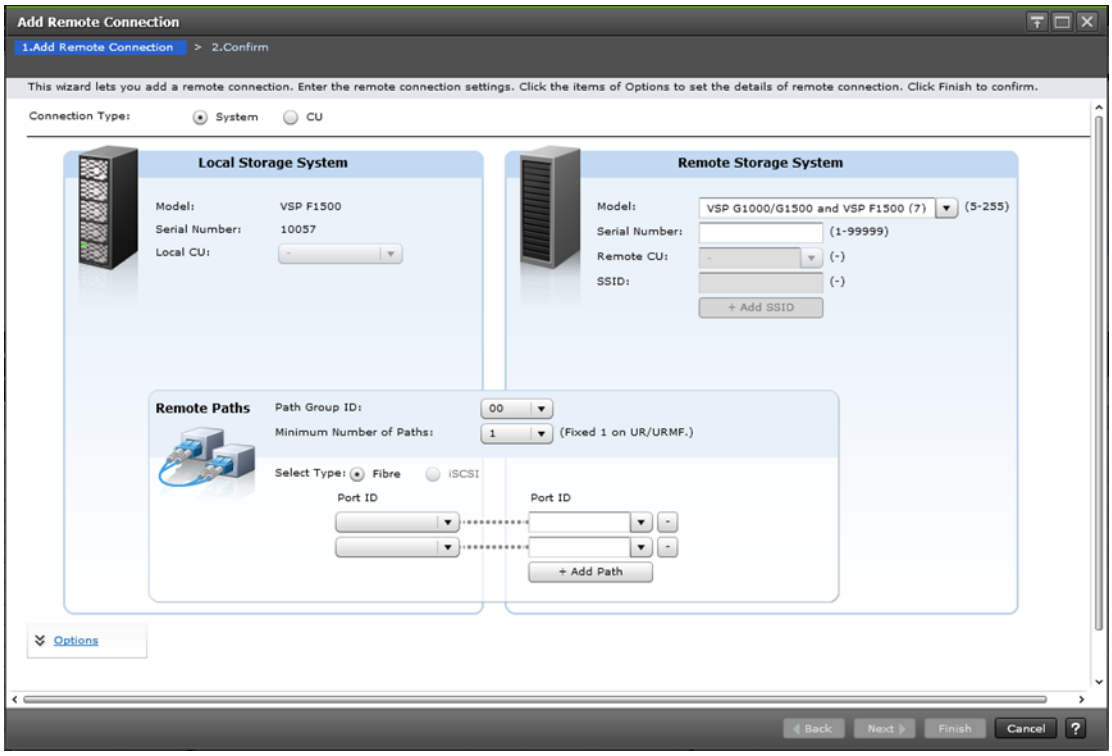
Use this wizard to set up storage systems for replication.

Add Remote Connection window

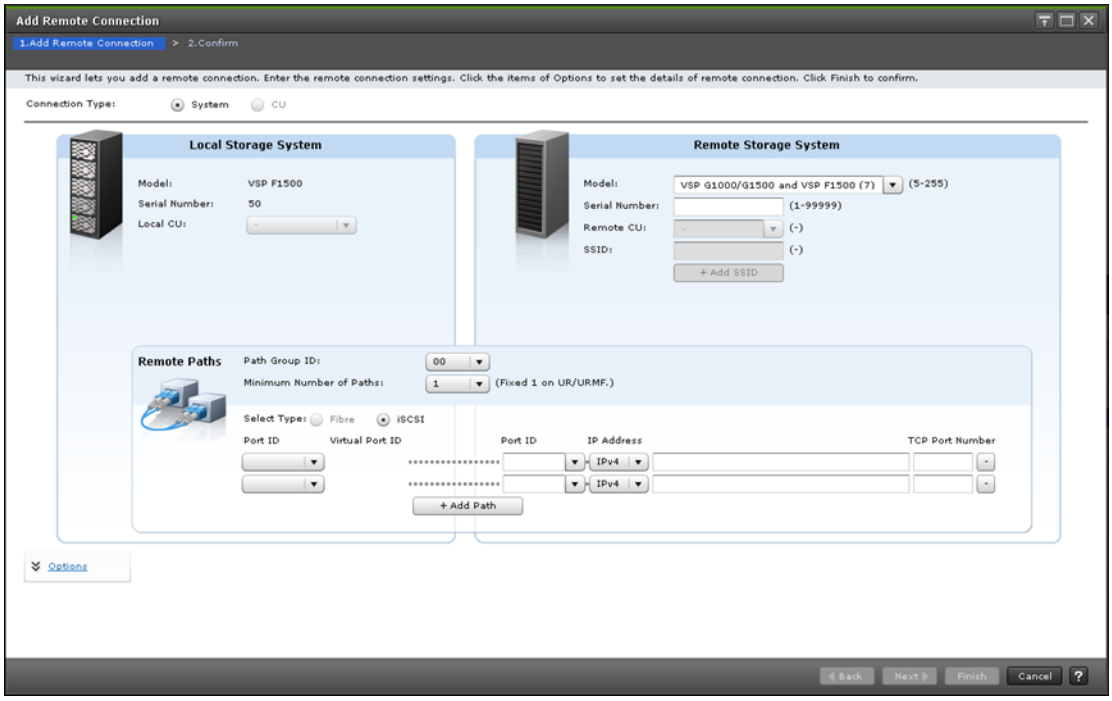
Use this window to connect storage systems for remote replication.

For complete UR or URz information, see the section on configuring primary and secondary systems in the *Hitachi Universal Replicator User Guide* or *Hitachi Universal Replicator for Mainframe User Guide*.

When Select Type is Fibre:



When Select Type is iSCSI:



Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. TC/UR/URz/GAD. • CU: CU-to-CU connections. TCz only. By default, System is selected.

Local Storage System

Item	Description
Model	Local model.
Serial Number	Local serial number.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number (00 to FE), displayed when Connection Type is CU. A hyphen (-) is displayed when Connection Type is System.

Remote Storage System

Item	Description
Model	Remote system's model. • VSP G1000 and G1500, and VSP F1500 (7) • VSP (6) • USP V/USP VM (5) • HUS VM (19) • VSP Gx00 models and VSP Fx00 models (18) Specify the same value for VSP Gx00 models and VSP Fx00 models. HUS VM (19) and VSP Gx00 models and VSP Fx00 models (18) can be selected only when System is selected for Connection Type. If a value other than the above is specified, it is regarded as a storage system that will be supported in the future. In this case, in the **Remote Connections** window, the specified value will be enclosed by parentheses, such as (255), is displayed.
Serial Number	Last five or six digits of the remote system serial number, as follows: • VSP G1000 and G1500, and VSP F1500: 1 to 99999 (5 digits) • VSP or USP V/VM: 1 to 99999 (5 digits) • HUS VM: 200001 to 265535 (6 digits) (TC/UR only) • VSP Gx00 models and VSP Fx00 models: 400001 to 499999 (6 digits) • Future storage systems: 0 to 99999 (VSP Gx00 models and VSP Fx00 models) **Note:** When using virtual storage machine volumes, specify the serial number of the storage system. Do not specify the serial number of the virtual storage machine.
Remote CU (VSP G1000, G1500, and VSP F1500)	Remote system CU number, displayed when Connection Type is CU.

Item	Description
SSID (VSP G1000, G1500, and VSP F1500)	Remote system SSID in hexadecimal (0004 to FFFE). Can be selected when Connection Type is CU. If there are two or more SSID numbers, clicking the minus (-) button deletes the SSID text box.
Add SSIDs (VSP G1000, G1500, and VSP F1500)	Clicking adds the SSID to the remote system. The maximum is four. This button is not displayed if four SSID numbers are already added.

Remote Paths

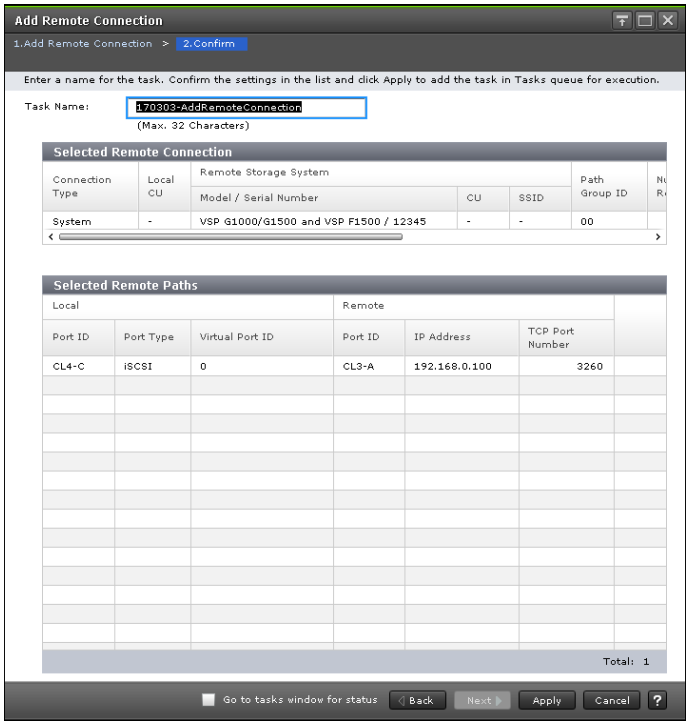
Item	Description
Path Group ID	Path group identifier (00 to FF). Up to 64 path group IDs can be registered per storage system. Path group IDs can be selected when Connection Type is System.
Minimum Number of Paths	Minimum number of remote paths. • TC and TCz: The range is from 1 to 8, and the default is 1. • UR and URz: The minimum number is set to 1, regardless of the number entered.
Select Type	Select the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
Port ID (for local storage systems)	Select the port identifier of the local storage system.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Select the port identifier of a remote storage system. A hyphen (-) is displayed if the number of valid paths is greater than the minimum number of paths. Clicking the hyphen deletes the text box of the port for the local and remote storage systems.
IP address	Select the IP type (IPv4 or IPv6) for the port of the remote storage system to enter the IP address. Displayed only when iSCSI is selected as the port type.
TCP Port Number	Enter the TCP port number of the remote storage system. Displayed only when iSCSI is selected as the port type.
Add Paths	Opens a dialog box for creating additional paths (maximum of eight).

Options

Item	Description
RIO MIH Time	Time limit between 10 and 100 seconds for the data-transfer operation to complete (15 is the default).
Roundtrip Time (msec.)	TC, TCz and GAD only.

Item	Description
	Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).
FREEZE Option (Mainframe systems)	Enables or disables support for the CGROUP (FREEZE/RUN) PPRC TSO command. Can be selected when Connection Type is CU.

Add Remote Connection confirmation window



In this topic, you can view the following tables.

- Selected Remote Connection table on page 204
- Selected Remote Paths table on page 205

Selected Remote Connection table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	System or CU.
Local CU (VSP G1000, G1500, and VSP F1500)	TCz only. Specified local system CU number, displayed when Connection Type is CU.

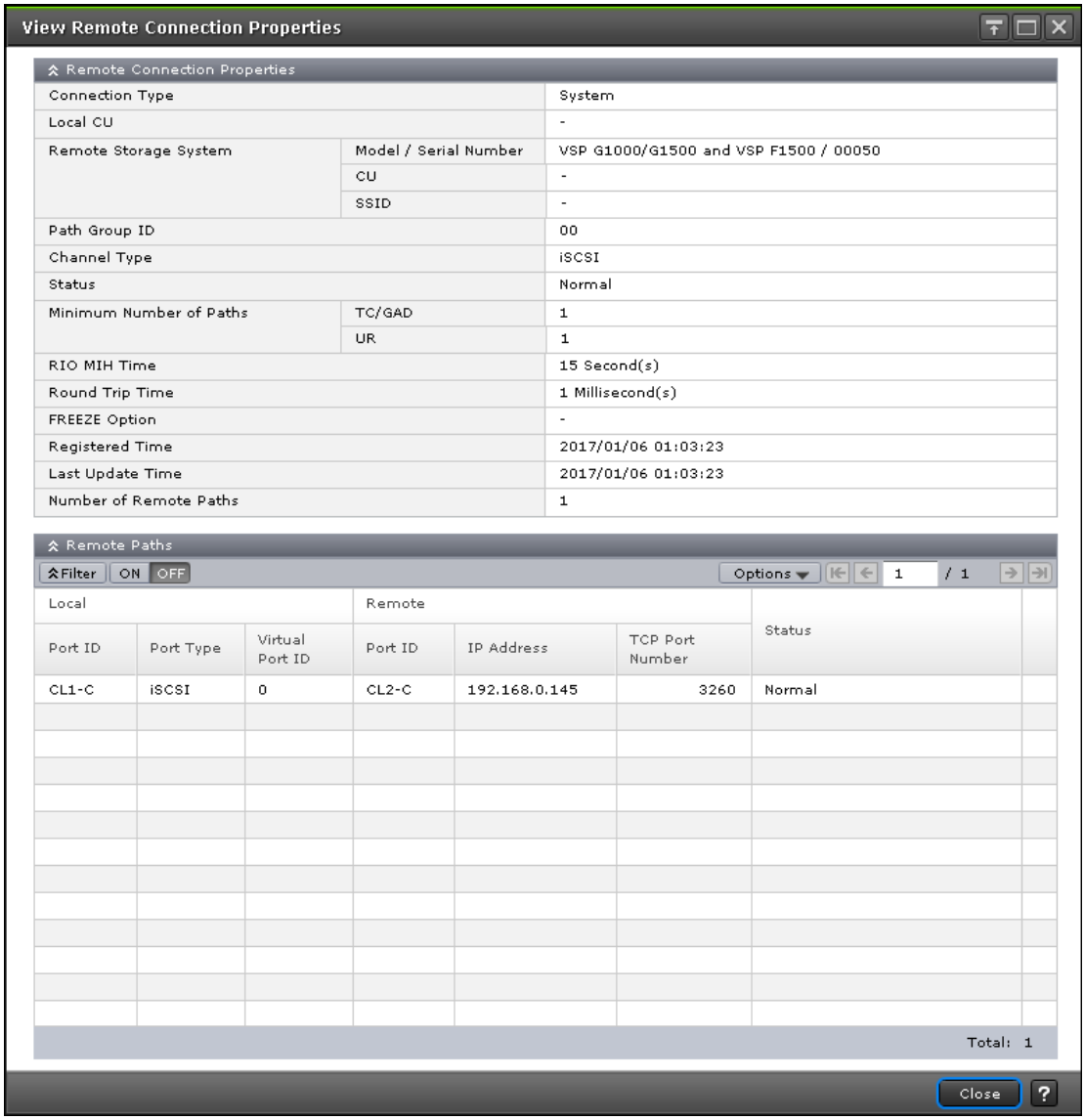
Item	Description
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID.
Path Group ID	Specified path group identifier.
Number of Remote Paths	Specified number of remote paths.
Minimum Number of Paths	Specified minimum number of remote paths.
RIO MIH Time (sec.)	Specified RIO MIH time.
Roundtrip Time (msec.)	Specified roundtrip time.
FREEZE Option (VSP G1000, G1500, and VSP F1500)	Specified FREEZE option.

Selected Remote Paths table

Item	Description
Local	Information about ports on the local storage system. • Port ID: Port identifier • Port Type: Port type can be Fibre, iSCSI, or (VSP G1000, G1500, and VSP F1500)FCoE • Virtual Port ID: Virtual port ID. Displayed when the port type is iSCSI.
Remote	Information about ports on the remote storage system. • Port ID: Port identifier • IP Address (displayed only when the port type is iSCSI) • TCP Port Number (displayed only when the port type is iSCSI)

View Remote Connection Properties window

Use this window to view information about remote connections and paths.



In this topic, you can view the following tables.

- Remote Connection Properties table on page 206
- Remote Paths table on page 207

Remote Connection Properties table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. • CU: CU-to-CU connections.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.

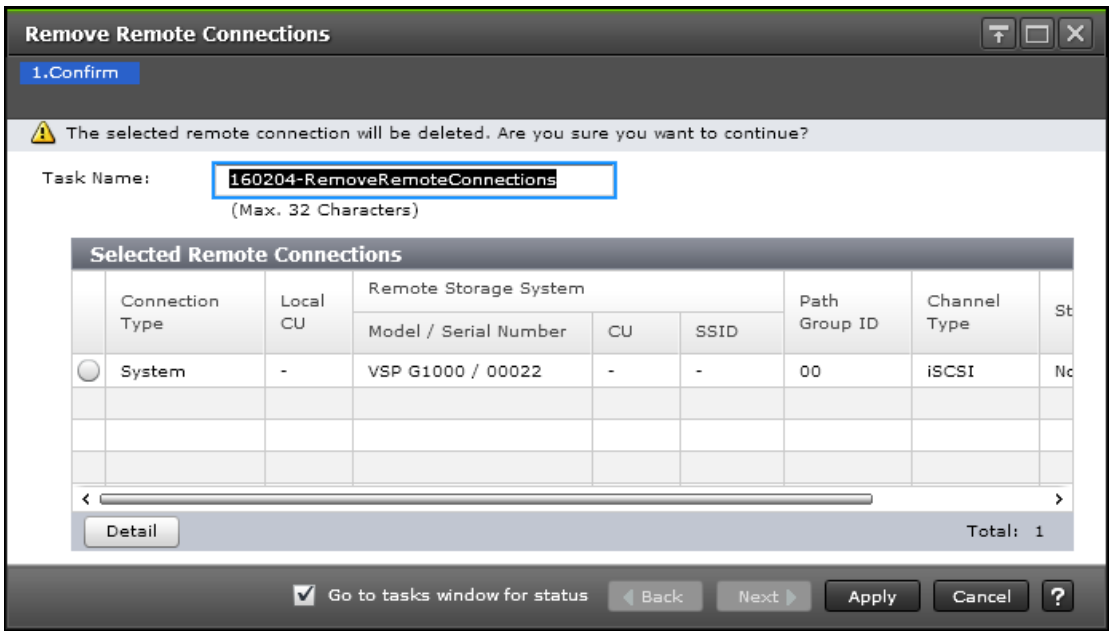
Item	Description
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID.
Path Group ID	Path group identifier.
Channel Type	Displays the channel type or type of data path. • Fibre: Local port type of all remote paths in the remote connection is Fibre. • (VSP G1000, G1500, and VSP F1500) FCoE: Local port type of all remote paths in the remote connection is FCoE. • iSCSI: Local port type of all remote paths in the remote connection is iSCSI. • Mixed: Local port type of at least two remote paths in the remote connection is not the same.
Status	Remote connection status. • Normal: All remote path within remote connection are fine. • Failed: All remote path within remote connection has problem. • Warning: Some remote path within remote connection has problem.
Minimum Number of Paths	The specified minimum number of remote paths.
RIO MIH Time	The specified RIO MIH time in seconds.
Roundtrip Time	The specified roundtrip time in milliseconds.
FREEZE Option (VSP G1000, G1500, and VSP F1500)	Whether the FREEZE option is enabled or disabled.
Registered Time	Date and time the connection was established.
Last Update Date	Date and time of the last update.
Number of Remote Paths	Number of paths specified in the remote connection.

Remote Paths table

Item	Description
Local	Information about ports on local storage systems. • Port ID: Port identifier • Port Type: Port type (Fibre, iSCSI, or (VSP G1000, G1500, and VSP F1500) FCoE) • Virtual Port ID: Virtual port ID. Displayed when the port type is iSCSI.
Remote	Information about ports on remote storage systems. • Port ID: Port identifier • IP Address: IP address of the port. Displayed when the port type is iSCSI. • TCP Port Number: TCP port number of the port. Displayed when the port type is iSCSI.
Status	Remote path status.

Remove Remote Connections window

Use this window to remove remote connections.



Selected Remote Connections table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. • CU: CU-to-CU connections.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only.
Path Group ID	TC only. Path group identifier.
Channel Type	Channel type for remote connections. • Fibre: Port type of all remote paths in the remote connection is Fibre. • (VSP G1000, G1500, and VSP F1500) FCoE: Port type of all remote paths in the remote connection is FCoE.

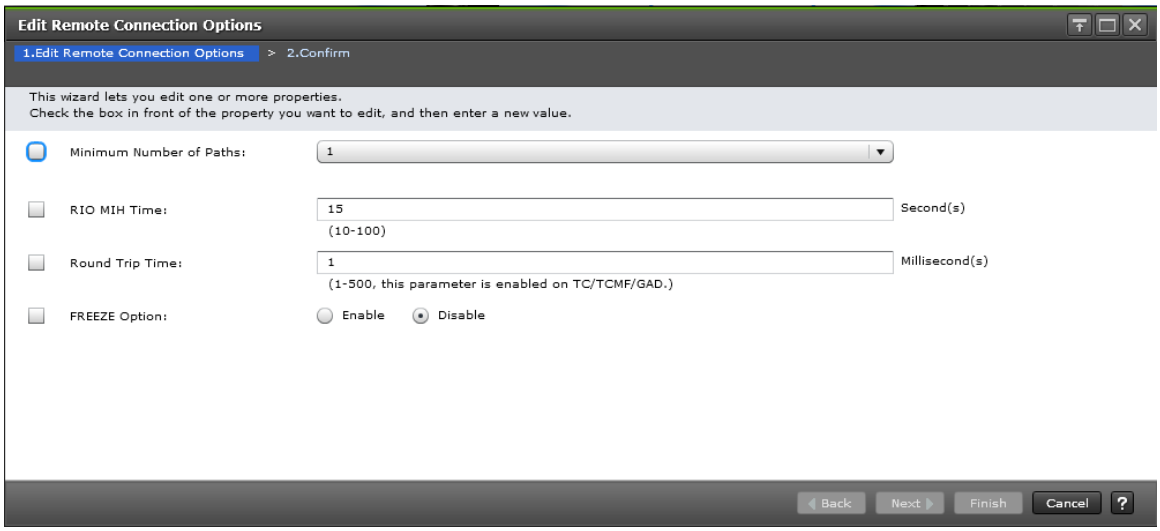
Item	Description
	• iSCSI: Port type of all remote paths in the remote connection is iSCSI. • Mixed: Port type of all remote paths in the remote connection is not the same (at least two are different).
Status	Path status.
Number of Remote Paths	Number of remote paths including those being added.
Detail	Opens the **View Remote Connection Properties** window.

Edit Remote Connection Options wizard

Use this wizard to edit remote connection options.

Edit Remote Connection Options window

Use this window to edit remote connection options, such as minimum paths and round trip time.

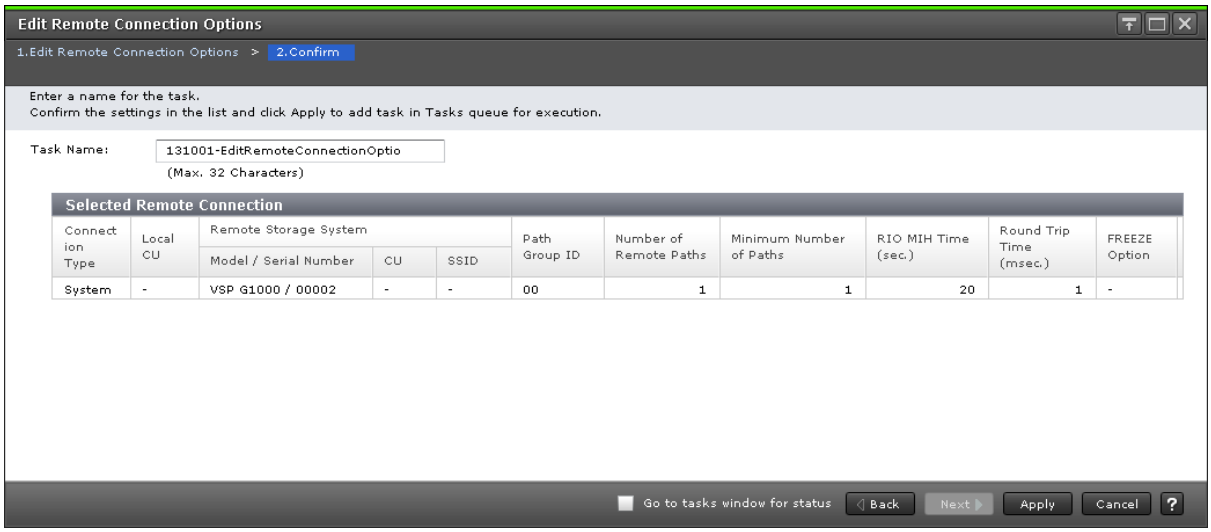


Selected Remote Connection table

Item	Description
Minimum Number of Paths	Minimum number of remote paths. • TC and TCz: The range is from 1 to 8, and the default is 1. • UR and URz: The minimum number is set to 1, regardless of the number entered.
RIO MIH Time	Time limit between 10 and 100 seconds (default = 15) for the data-transfer operation to complete.

Item	Description
Round Trip Time	TC, TCz, and GAD only. Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).
FREEZE Option (VSP G1000, G1500, and VSP F1500)	TCz only. Enables or disables support for the CGROUP (FREEZE/RUN) PPRC TSO command. Displayed only when Connection Type is CU.

Edit Remote Connection Options confirmation window



Selected Remote Connection table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. • CU: CU-to-CU connections.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: Remote Storage System's CU number. • (VSP G1000, G1500, and VSP F1500) SSID: Remote Storage System's SSID number. TCz only.
Path Group ID	Path group identifier.

Item	Description
Number of Remote Paths	Number of remote paths including those being added.
Minimum Number of Paths	Minimum number of remote paths. • TC and TCz: The range is from 1 to 8, and the default is 1. • UR and URz: The minimum number is set to 1, regardless of the number entered.
RIO MIH Time	Time limit between 10 and 100 seconds (default = 15) for the data-transfer operation to complete.
Round Trip Time (msec.)	TC, TCz, and GAD only. Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).
FREEZE Option (VSP G1000, G1500, and VSP F1500)	TCz only. Enables or disables support for the CGROUP (FREEZE/RUN) PPRC TSO command.

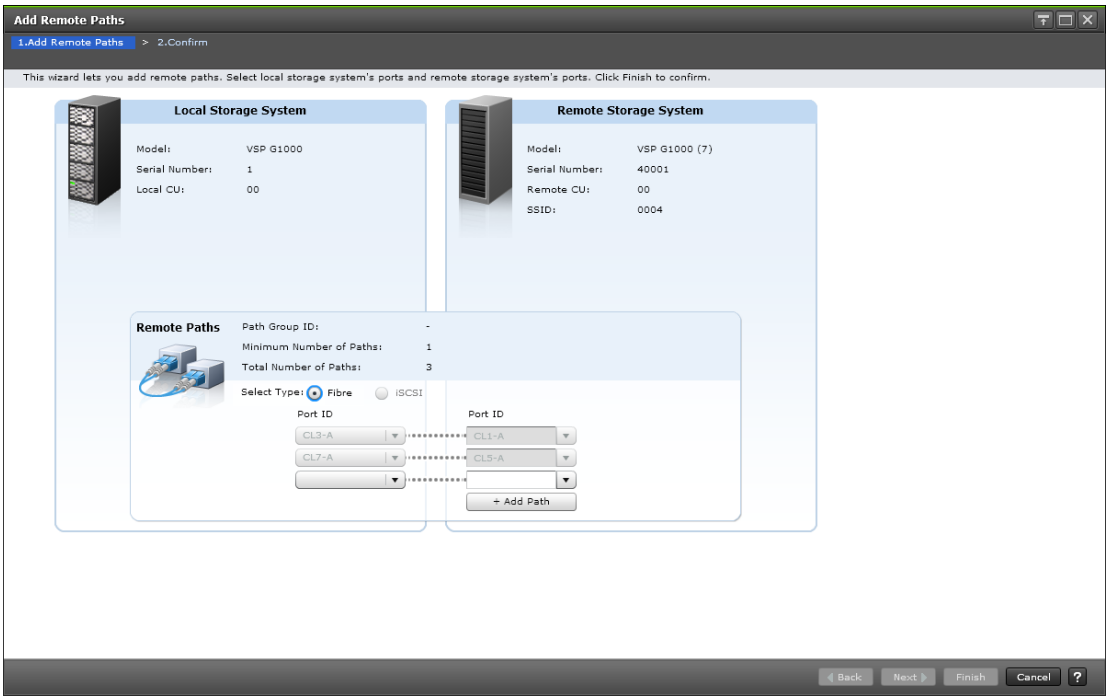
Add Remote Paths wizard

Use this wizard to add remote paths to a remote connection.

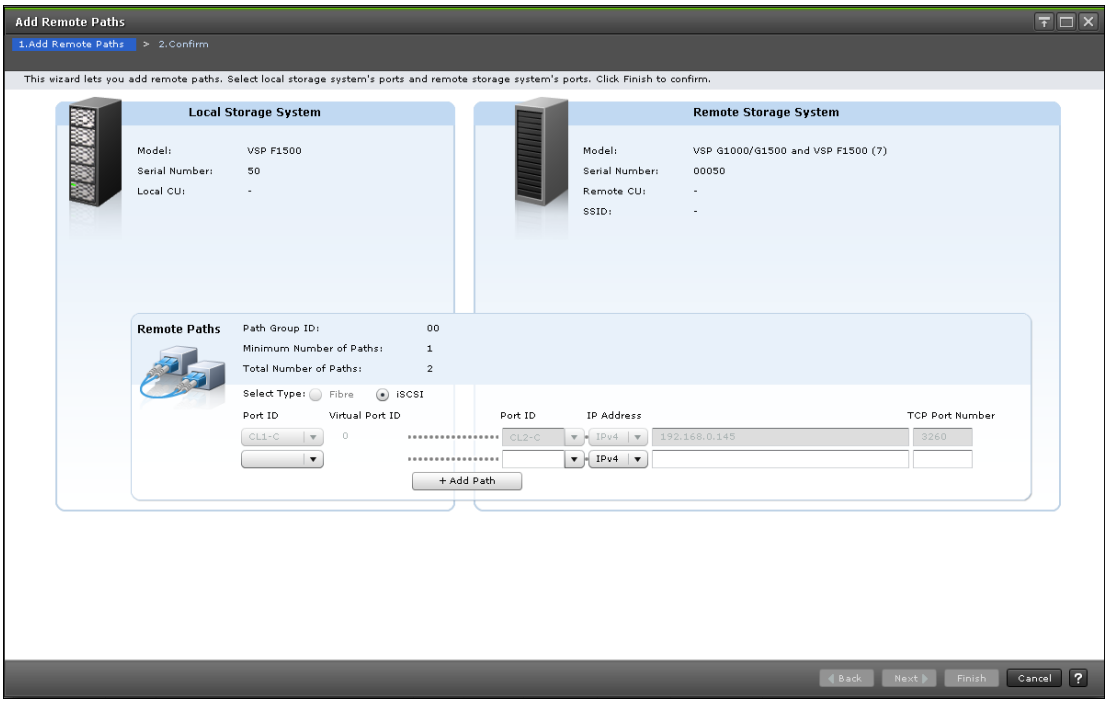
Add Remote Paths window

Use this window to add remote paths to a remote connection.

When Select Type is Fibre:



When Select Type is iSCSI:



Local Storage System

Item	Description
Model	Local system model.
Serial Number	Local system serial number.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number. A hyphen is displayed in case of system connection.

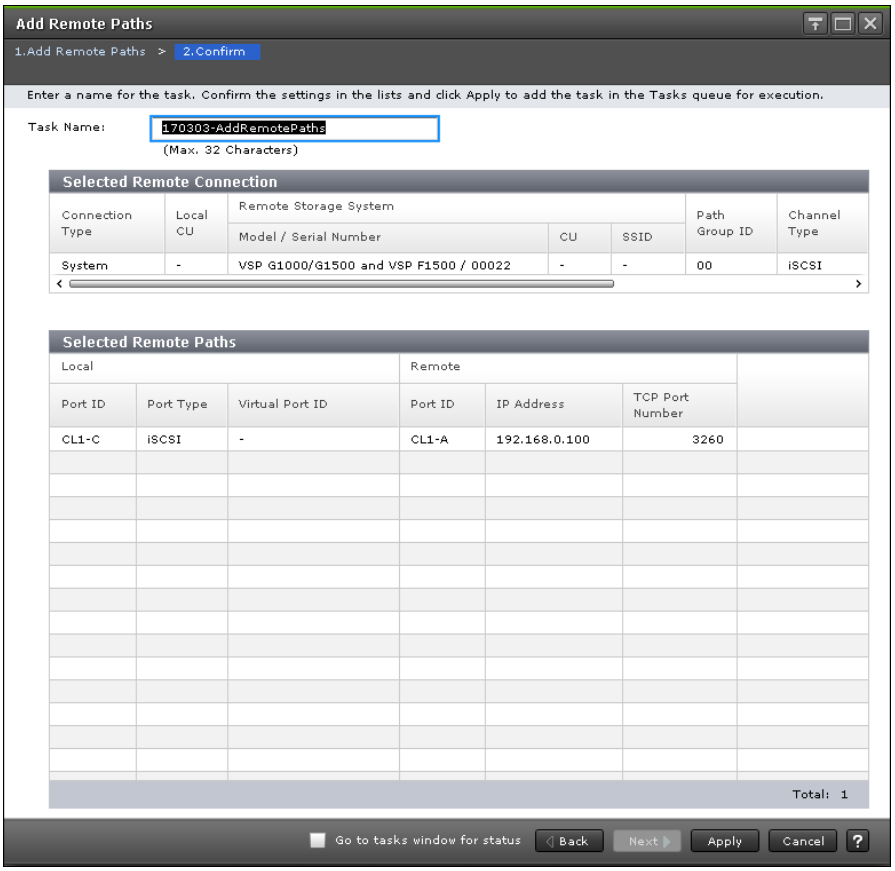
Remote Storage System

Item	Description
Model	Remote system model.
Serial Number	Remote system serial number.
Remote CU (VSP G1000, G1500, and VSP F1500)	Remote system CU number. A hyphen is displayed in case of system connection.
SSID (VSP G1000, G1500, and VSP F1500)	Remote system SSID. A hyphen is displayed in case of system connection.

Remote Paths

Item	Description
Path Group ID	Path group identifier. A hyphen is displayed for CU connection.
Minimum Number of Paths	Specified minimum number of remote paths.
Total Number of Paths	Total number of paths. Total of the number of paths registered for remote connections and the number of paths to be added (including blank lines).
Select Type	Select the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port (VSP G1000, G1500, and VSP F1500) For TCz and URz, Fibre is selected automatically because connections using iSCSI ports are not supported.
Port ID (for local storage systems)	Select the port identifier of the local storage system.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Select the port identifier of a remote storage system. A minus button is displayed if the number of valid paths is greater than the minimum number of paths. Clicking the minus button deletes the text box of the port for the local and remote storage systems.
IP address	Select the IP type (IPv4 or IPv6) for the port of the remote storage system to enter the IP address. Displayed only when iSCSI is selected as the port type.
TCP Port Number	Enter the TCP port number of the port on a remote storage system. Displayed only when iSCSI is selected as the port type.
Add Paths	Clicking adds more paths, up to eight.

Add Remote Paths confirmation window



In this topic, you can view the following tables.

- Selected Remote Connection table on page 214
- Selected Remote Paths table on page 215

Selected Remote Connection table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. • CU: CU-to-CU connections.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only.
Path Group ID	Path group identifier.
Channel Type	Channel type for remote connections.

Item	Description
	• Fibre: Port type of all remote paths in the remote connection is Fibre. • (VSP G1000, G1500, and VSP F1500) FCoE: Port type of all remote paths in the remote connection is FCoE. • iSCSI: Port type of all remote paths in the remote connection is iSCSI. • Mixed: Port type of at least two remote paths in the remote connection is not the same.
Number of Remote Paths	Number of remote paths including those being added.
Minimum Number of Paths	Specified minimum number of remote paths.

Selected Remote Paths table

Item	Description
Local	Information about ports on the local storage system. • Port ID: Port identifier • Port Type: Port type (Fibre, iSCSI, or (VSP G1000, G1500, and VSP F1500) FCoE) • Virtual Port ID: Virtual port ID. Displayed when iSCSI is selected for Port Type.
Remote	Information about ports on the remote storage system. • Port ID: Port identifier • IP Address: IP address of the port. Displayed when iSCSI is selected for Port Type. • TCP Port Number: TCP port number of the port. Displayed when iSCSI is selected for Port Type.

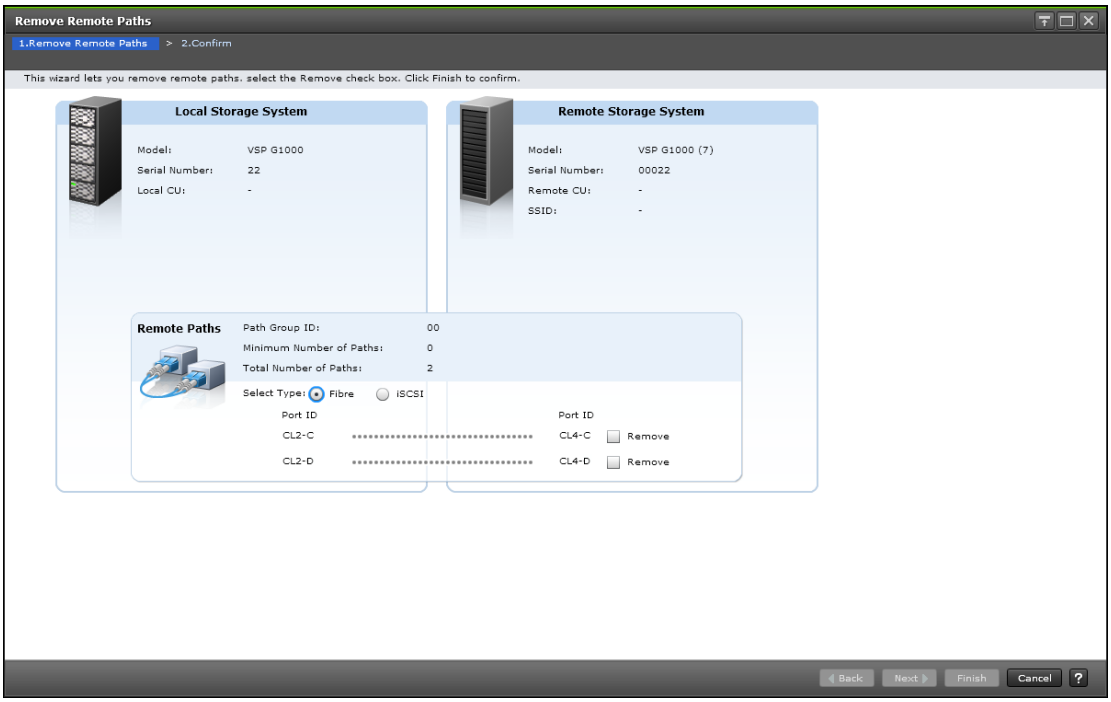
Remove Remote Paths wizard

Use this wizard to remove paths from a remote connection.

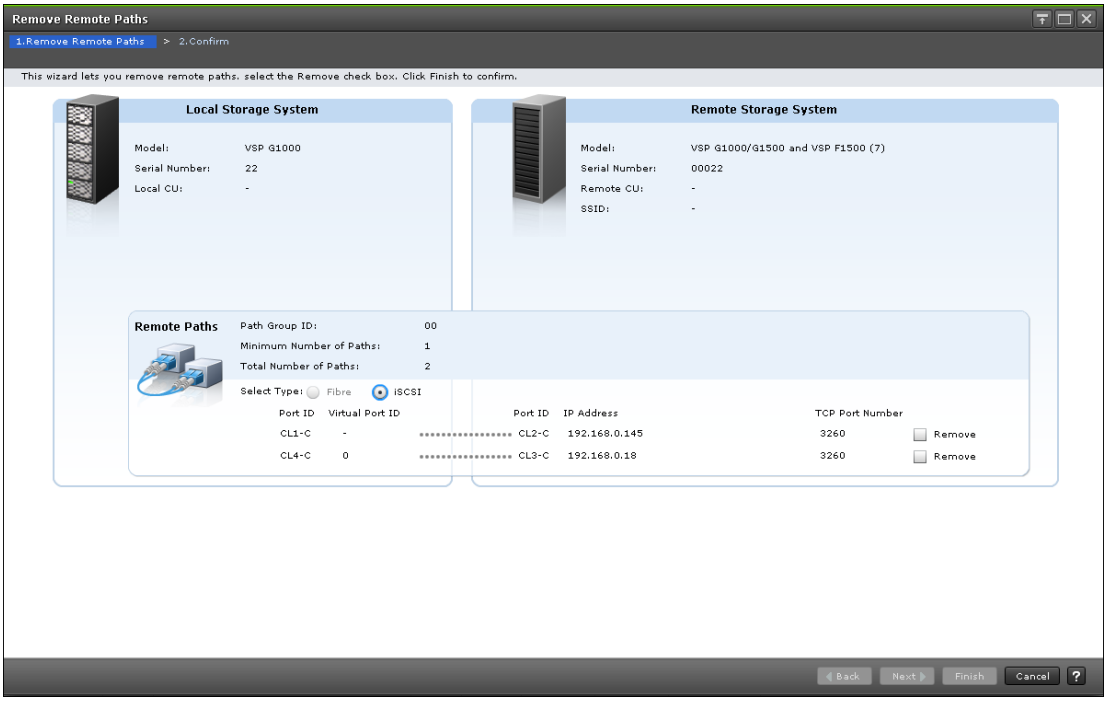
Remove Remote Paths window

Use this window to remove paths from a remote connection.

When Select Type is Fibre:



When Select Type is iSCSI:



Local Storage System

Item	Description
Model	Local system model.
Serial Number	Local system serial number.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number. A hyphen (-) is displayed in the case of system connection.

Remote Storage System

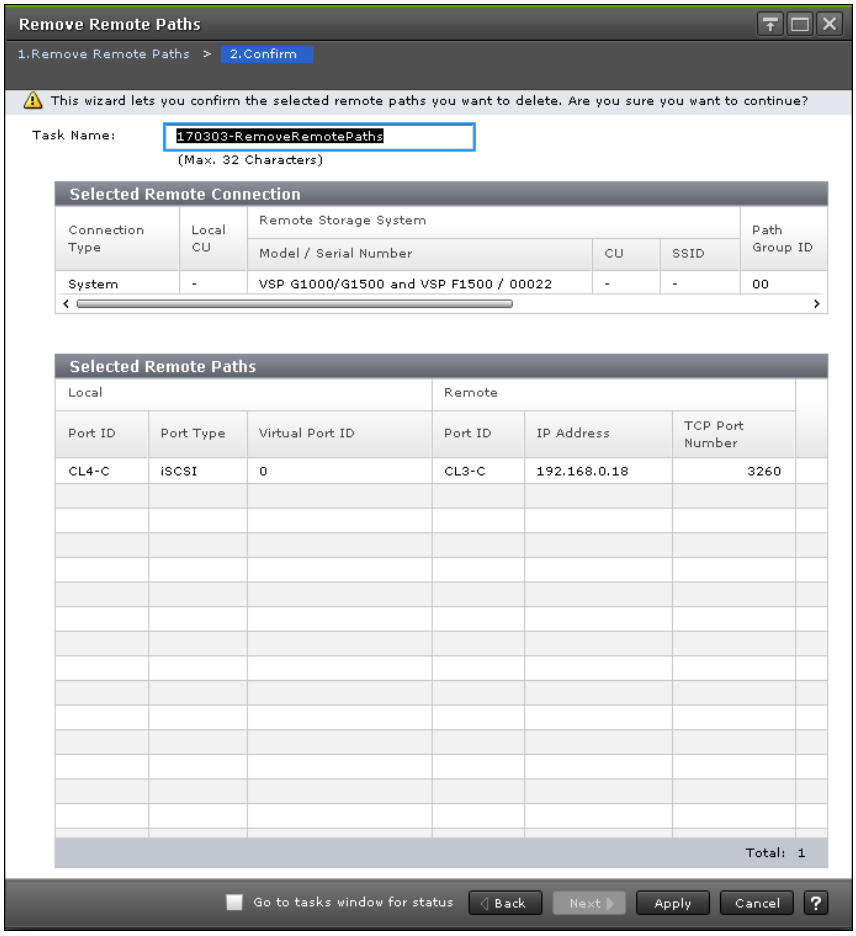
Item	Description
Model	Remote system model.
Serial Number	Remote system serial number.
Remote CU (VSP G1000, G1500, and VSP F1500)	Remote system CU number. A hyphen (-) is displayed for system connection.
SSID (VSP G1000, G1500, and VSP F1500)	Remote system SSID. A hyphen (-) is displayed for system connection.

Remote Paths

Item	Description
Path Group ID	Path group identifier. A hyphen is displayed for CU connection.
Minimum Number of Paths	Specified minimum number of remote paths.
Total Number of Paths	Total number of paths. Displays the total number of path registered to remote connection and path to be added (includes blank line).
Select Type	Select the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port (VSP G1000, G1500, and VSP F1500) For TCz and URz, Fibre is selected automatically because connections using iSCSI ports are not supported.
Port ID (for local storage systems)	Port identifier of the local storage system. Information of the added paths.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed only when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Port identifier of a remote storage system. Information of the added paths.
IP address	IP address of a port on a remote storage system. Displayed only when iSCSI is selected as the port type.
TCP Port Number	TCP port number of a port on a remote storage system. Displayed only when iSCSI is selected as the port type.

Item	Description
Remove	Check box for deleting the path from the remote connection.

Remove Remote Paths confirmation window



In this topic, you can view the following tables.

- Selected Remote Connection table on page 218
- Selected Remote Paths table on page 219

Selected Remote Connection table

Item	Description
Connection Type (VSP G1000, G1500, and VSP F1500)	• System: system-to-system connection. • CU: CU-to-CU connections.
Local CU (VSP G1000, G1500, and VSP F1500)	Local system CU number.

Item	Description
Remote Storage System	• (VSP Gx00 models and VSP Fx00 models) Model and serial number. • (VSP G1000, G1500, and VSP F1500) Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) CU: CU number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only.
Path Group ID	Path group identifier.
Channel Type	Channel type for remote connections. • Fibre: Port type of all remote paths in the remote connection is Fibre. • (VSP G1000, G1500, and VSP F1500) FCoE: Port type of all remote paths in the remote connection is FCoE. • iSCSI: Port type of all remote paths in the remote connection is iSCSI. • Mixed: Port type of all remote paths in the remote connection is not the same (at least two are different).
Number of Remote Paths	Number of remote paths including those being added.
Minimum Number of Paths	Specified minimum number of remote paths.

Selected Remote Paths table

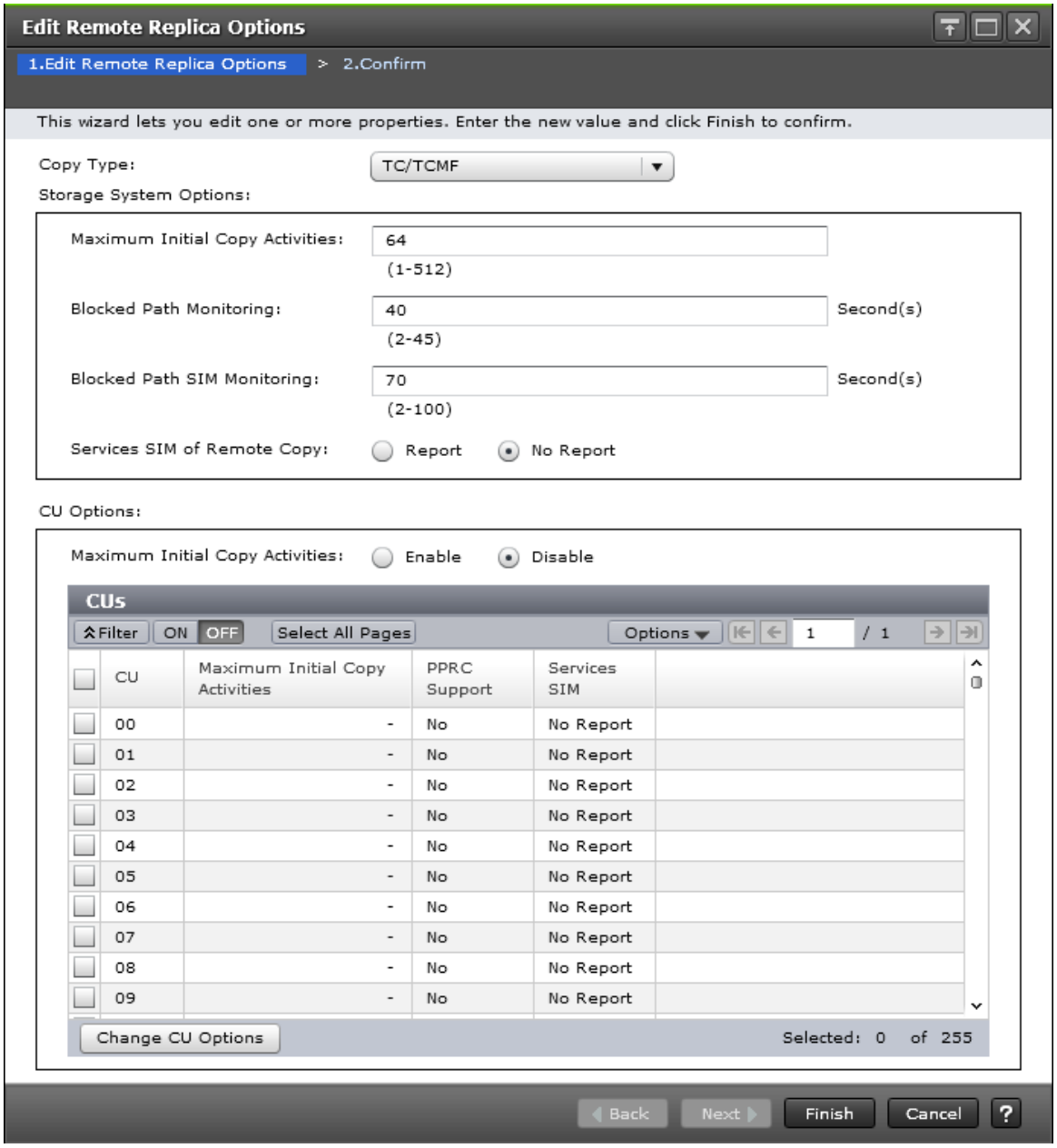
Item	Description
Local	Information about ports on the local storage system. • Port ID: Port identifier • Port Type: Port type (Fibre, iSCSI, or (VSP G1000, G1500, and VSP F1500) FCoE) • Virtual Port ID: Virtual port ID. Displayed when iSCSI is selected for Port Type.
Remote	Information about ports on the remote storage system. • Port ID: Port identifier • IP Address: IP address of the port. Displayed when iSCSI is selected for Port Type. • TCP Port Number: TCP port number of the port. Displayed when iSCSI is selected for Port Type.

Edit Remote Replica Options wizard

Use this wizard to change options that affect the replication system.

Edit Remote Replica Options window

Use this window to change options that affect the replication system.



In this topic, you can view the following tables.

- Setting Fields on page 220
- Storage System Options on page 221
- CU Options on page 221

Setting Fields

Item	Description
Copy Type	Type of pair:

Item	Description
	• (VSP G1000, G1500, and VSP F1500) TC/TCMF: TrueCopy or TrueCopy for Mainframe • (VSP G1000, G1500, and VSP F1500) UR/URMF: Universal Replicator or Universal Replicator for Mainframe • (VSP Gx00 models and VSP Fx00 models) TC: TrueCopy • (VSP Gx00 models and VSP Fx00 models) UR: Universal Replicator • GAD: global-active device
Maximum Initial Copy Activities (VSP Gx00 models and VSP Fx00 models)	Number of volumes that can be copied per initial copy operation (1 to 512). Displayed only when GAD is selected for Copy Type.

Storage System Options

This area is not displayed when GAD is selected for Copy Type.

Item	Description
Maximum Initial Copy Activities	Number of volumes that can be copied per initial copy operation. When the selected Copy Type is TC/TCMF or GAD: 1 to 512 (default = 64) When the selected Copy Type is UR/URMF: 1 to 128 (default = 64)
Blocked Path Monitoring*	Number of seconds for the system to monitor blocked paths. Displayed for TC or TCz pairs.
Blocked Path SIM Monitoring*	Number of seconds for the system to monitor SIMs reported for blocked paths. Displayed for TC or TCz pairs.
Services SIM of Remote Copy* (VSP G1000, G1500, and VSP F1500)	Whether services SIMs in the remote CU are reported to the host. Displayed for TC or TCz pairs.
* These options are displayed only when the selected Copy Type is TC/TCMF. This setting also applies when you are monitoring the path blockade or the SIM reported by path blockade in UR or GAD.	

CU Options

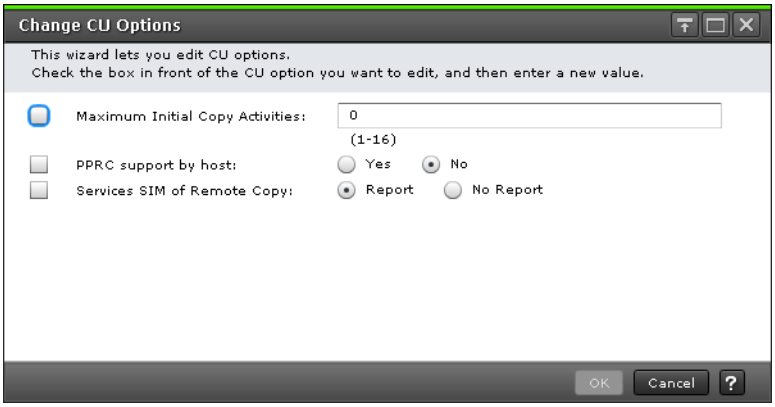
The CU options are not displayed when the selected Copy Type is GAD.

Item	Description
Maximum Initial Copy Activities[1]	• Enable: Allows you to change the maximum initial copy activities setting for the selected CUs. • Disable (default): The maximum initial copy activities setting applies to all CUs and cannot be changed per CU.
CU	CU number.
Maximum Initial Copy Activities*	Maximum initial copy activities setting for the CU. A hyphen is displayed if Disable is selected in Maximum Initial Copy Activities.
PPRC Support* (VSP G1000, G1500, and VSP F1500)	Whether PPRC is supported by the host (default = No).

Item	Description
Services SIM (VSP G1000, G1500, and VSP F1500)	Whether remote copy service SIMs are reported to the host (default = No Report).
Change CU Options	Opens the **Change CU Options** window to allow you to change the CU options for the selected CUs. This button cannot be used if the Disable radio button is selected for Maximum Initial Copy Activities.
* These items are displayed only when the selected Copy Type is TC/TCMF.	

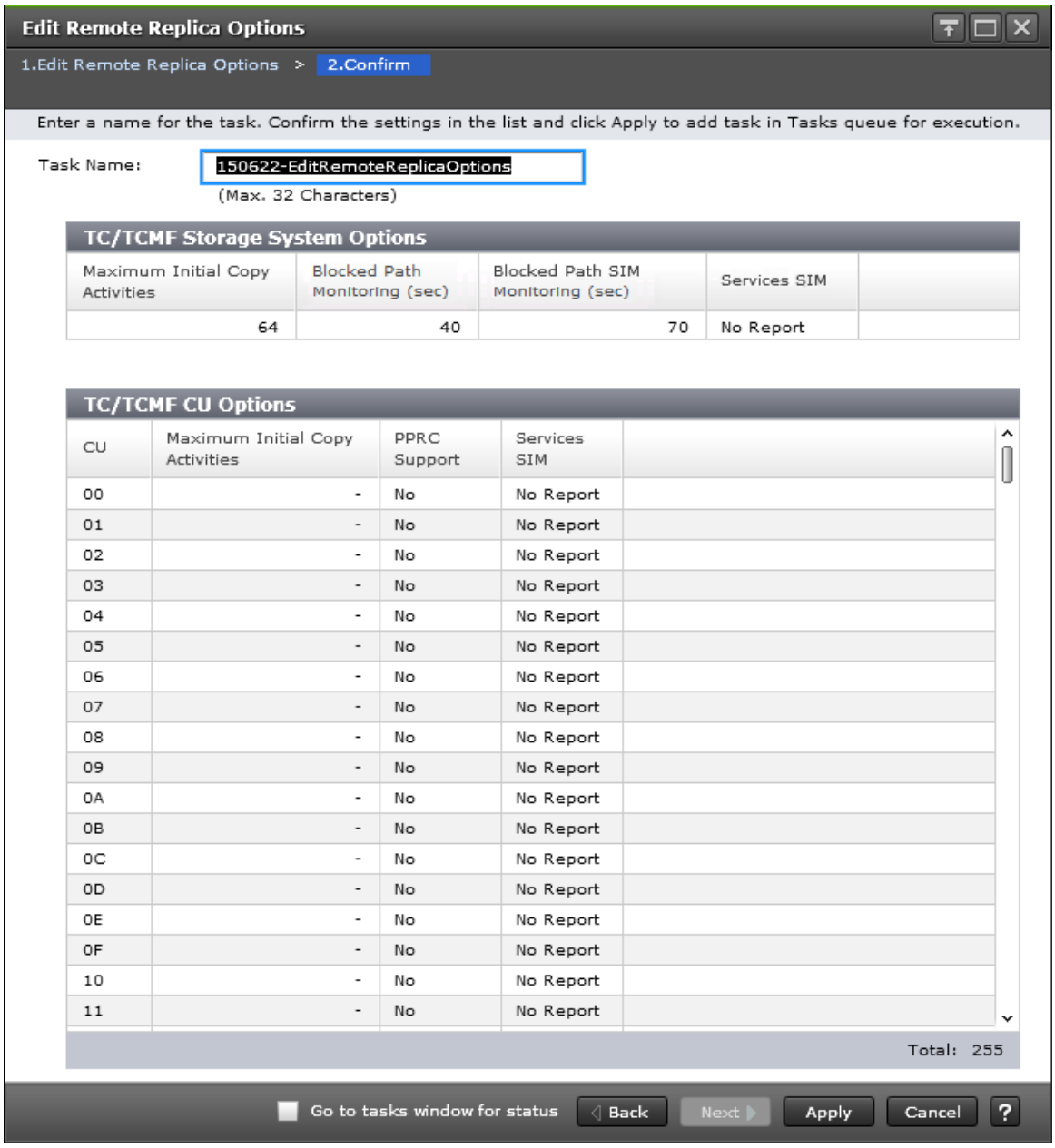
Change CU Options window

This window allows you to change the CU options for the CUs selected on the **Edit Remote Replica Options** window.



Item	Description
Maximum Initial Copy Activities	Maximum number of volumes that can be copied concurrently for the CUs selected on the **Edit Remote Replica Options** window. This setting is available only when Enable is selected for Maximum Initial Copy Activities.
PPRC support by host (VSP G1000, G1500, and VSP F1500)	TCz only. Whether PPRC is supported by the host.
Services SIM of Remote Copy (VSP G1000, G1500, and VSP F1500)	Whether services SIMs in the remote CU are reported to the host.

Edit Remote Replica Options confirmation window



In this topic, you can view the following tables.

- Storage System Options on page 223
- CU Options on page 224

Storage System Options

Item	Description
Maximum Initial Copy Activities	Number of volumes that can be copied per initial copy operation.

Item	Description
Blocked Path Monitoring (sec)	TC/TCz only. Number of seconds for the system to monitor blocked paths
Blocked Path SIM Monitoring (sec)	TC/TCz only. Number of seconds for the system to monitor SIMs reported for blocked paths
Services SIM (VSP G1000, G1500, and VSP F1500)	TC/TCz only. Whether services SIMs are reported to the host.

CU Options

Following will not be displayed if selecting GAD for Copy Type.

Item	Description
CU	CU number.
Maximum Initial Copy Activities	TC/TCz only. Number of volumes that can be copied per initial copy operation.
PPRC support by host (VSP G1000, G1500, and VSP F1500)	TC/TCz only. Whether PPRC is supported by the host.
Services SIM (VSP G1000, G1500, and VSP F1500)	Whether services SIMs are reported.

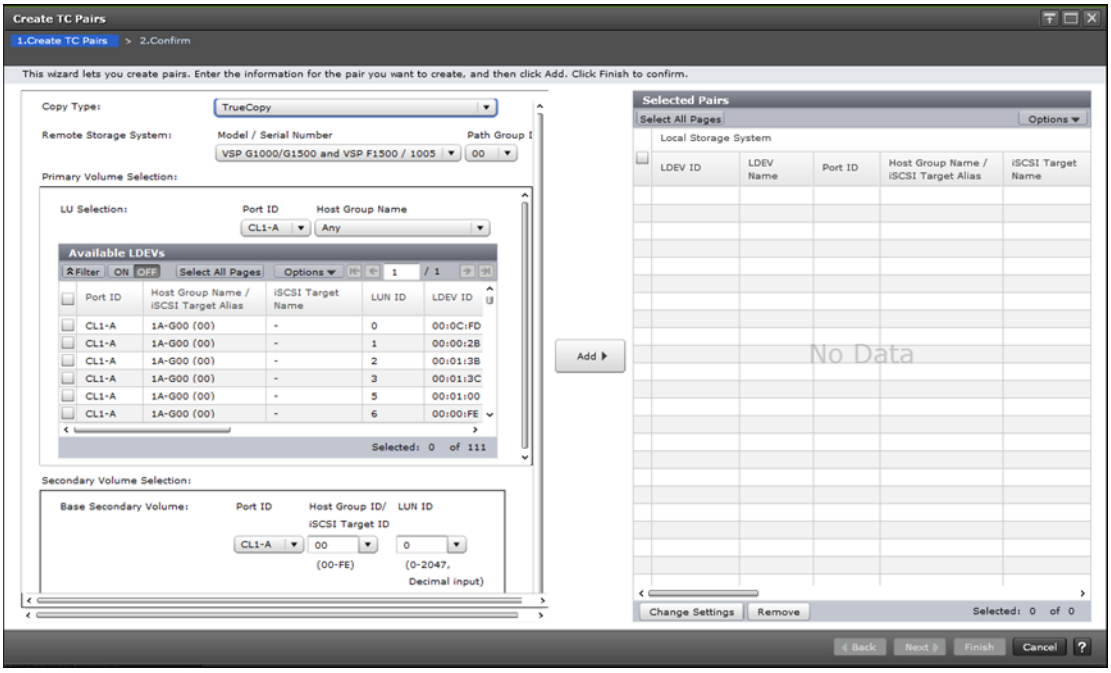
Create Pairs wizard

Use this wizard to create pairs.

Create TC Pairs window or Create UR Pairs window

Use this window to create pairs.

For complete information and instructions, see Creating pairs on page 113.



In this topic, you can view the following tables.

- Settings on page 225
- Primary Volume Selection on page 226
- Secondary Volume Selection on page 228
- Mirror Selection on page 228
- Options on page 229
- Selected Pairs table on page 231

Settings

Item	Description
Copy Type (VSP G1000, G1500, and VSP F1500)	Type of pair: • TrueCopy • Universal Replicator • TrueCopy for Mainframe • Universal Replicator for Mainframe
Local CU (VSP G1000, G1500, and VSP F1500)	TCz only. Local system's CU number. You can select the CU number of the local storage system between [00] and [FE].
Remote Storage System	Selections in the remote system. • Model / Serial Number: Model and serial number. (VSP Gx00 models and VSP Fx00 models) **Note:** VSP Gx00 is displayed for VSP Gx00 models and VSP Fx00 models. • Path Group ID: Select the ID of the path group. (VSP G1000, G1500, and VSP F1500) Does not display for TCz.

Item	Description
	• (VSP G1000, G1500, and VSP F1500) CU/SSID: CU number and SSID. TCz only. Specify this when you select a provisional CU number in Local CU.

Primary Volume Selection

Item	Description
Use Existing Volumes of UR Pairs	UR only. • Yes: Create a pair using the existing volumes of UR pairs. Select this item when creating a pair with 3DC multi-target by 3 UR sites or with cascade configuration. • No: Create a pair without using the existing volumes of UR pairs. Select this item when not creating a pair with 3DC multi-target by 3 UR sites or with cascade configuration.
Use Existing Volumes of URMF Pairs (VSP G1000, G1500, and VSP F1500)	URz only. • Yes: Create a pair using the existing volumes of URz pairs. Select this item when creating a pair with 3DC multi-target by 3 URz sites or with cascade configuration. • No: Create a pair without using the existing volumes of URz pairs. Select this item when not creating a pair with 3DC multi-target by 3 URz sites or with cascade configuration.
Selection Object (VSP Gx00 models and VSP Fx00 models)	Select the port type in the local storage system. • Fibre: Select when specifying LU for Fibre port. • iSCSI: Select when specifying LU for iSCSI port. • NAS Platform (User LU): Select when specifying LU for NAS port. Displayed only when NAS modules are installed. This option is not displayed for VSP G200. Ports without LUs cannot be selected. If only one port type (Fibre, iSCSI, or NAS Platform) has an LU, the port type is selected automatically.
LU Selection	TC and UR only. • Port ID: Local system's port identifier. • Host Group Name: Host group name. If Any is selected, every LUN for the specified port is displayed in the Available LDEVs table or in the Available Primary Volumes table. Displayed when Fibre port is selected for Port ID. • iSCSI Target Alias: iSCSI target Alias. If Any is selected, every LUN for the specified port is displayed in the Available LDEVs table or in the Available Primary Volumes table. Displayed when iSCSI port is selected for Port ID.
Available LDEVs table (TC/TCz) Available Primary Volumes table (UR/URz)	Information about P-VOLs. Displayed when Fibre port is selected in Port ID for LU Selection. • Port ID: Port identifier. TC and UR only. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. TC and UR only. • iSCSI Target Name: iSCSI target name. TC and UR only. • LUN ID: LUN identifier. TC and UR only. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name.

Item	Description
	• Pair Position: Whether the volume is a primary or secondary volume. A blank indicates an unpaired volume. UR/URz only. • Journal ID: Journal identifier. A blank indicates an unpaired volume. UR/URz only. • Mirror ID: Mirror identifier. A blank indicates an unpaired volume. UR/URz only. • Provisioning Type: Provisioning type of the volume. Whether the volume is Basic (internal) or External. • Attribute: ○ ALU: The volume has the ALU attribute. ○ SLU: The volume has the SLU attribute. ○ Data Direct Mapping: The volume has the data direct mapping attribute. ○ (VSP Gx00 models and VSP Fx00 models) NAS Platform (User LU): User LU for NAS. If the attribute is not set, a hyphen (-) is displayed. TC and UR only. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type. TC/TCz/URz only. • Capacity: LDEV's capacity. • CLPR: CLPR ID. • Encryption: Encryption information. ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume or migration volume, a hyphen (-) is displayed. For V-VOLs of Dynamic Provisioning or Dynamic Provisioning for Mainframe, the pool to which the LDEV belongs is an external volume or blocked. • Paired Volume: Information about a paired volume. A blank indicates that the volume is not used by the pair. UR/URz only ○ Model / Serial Number: Model and serial number. ○ LDEV ID: LDEV identifier. ○ Port ID: Volume's port identifier. UR only. ○ Host Group ID/iSCSI Target ID: Volume's host group ID or iSCSI target ID. UR only. ○ LUN ID: Volume's LUN identifier. UR only. • Capacity Saving: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used.

Item	Description
	○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume. ○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled. The T10 PI attribute status is displayed only for TC/UR pairs.

Secondary Volume Selection

Item	Description
Base Secondary Volume	Selections for the initial S-VOL. TC and UR only. • Port ID: Port identifier. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier. • LUN ID: LUN identifier. (VSP G1000, G1500, and VSP F1500) TCz and URz only. • LDKC: "00" is displayed, cannot be changed. • CU: For TCz: CU number of the volume. For URz: the CU number of the remote system, ranging from 00 to FF. • LDEV: LDEV number, ranging from 00 to FF.
Selection Type	Default is Interval. • Interval: Interval for allocating S-VOLs. • Relative Primary Volume: S-VOLs paired with P-VOLs relative to LUN or LDEV numbers.

Mirror Selection

UR and URz only.

Item	Description
Master Journal	Master journal number and type. (VSP G1000, G1500, and VSP F1500) The journal type option is enclosed by parentheses. If Yes is selected for Use Existing Volumes of UR Pairs or Use Existing Volumes of URMF Pairs, Depend on Selected P-Vols is selected.
Mirror ID	Mirror's identifier.
Restore Journal	Restore journal number. All journal IDs (000 to 0FF) are displayed.
Current Number of Master Journal Mirrors	Number of mirrors in the master journal.
Total Number of Master Journal Mirrors	Displays the following: • Number of mirrors in the master journal. • Number of mirrors added during the Create UR Pairs operation.

Item	Description
	• Number of mirrors for the selected volume in Selected Pairs table.
CTG ID	UR only. Displays the consistency groups registered in the storage system. An asterisk indicates that the group is assigned to a pair in the Select Pairs table.

Options

Item	Description
Primary Volume Fence Level	TC and TCz only Whether the P-VOL can be written to when the pair is split due to error. • Data: Cannot be written to. • Status: Can be written to only if the primary system can change the S-VOL status to PSUE for TC or Suspend for TCz. If the primary system cannot change the S-VOL status to PSUE for TC or Suspend for TCz, the P-VOL cannot be written to. • Never: Can be written to, even if the primary system cannot change the S-VOL status. The default.
Initial Copy Type	Whether data is copied to the S-VOL during this operation. • Entire Volume: Data is copied. The default. • None: Data is not copied. • Delta: Data is not copied. UR/URz only.
Copy Pace	Number of tracks to be copied per remote I/O during the operation. The default is 15. The range is different depending on the volume emulation type. • (VSP G1000, G1500, and VSP F1500) OPEN-V (TC): The range is 1 to 4. ○ 1 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 2 and 3 is medium. ○ 4 is fast. This setting increases the impact on host I/O and might result in decreased storage system performance. If you enter a number from 5 to 15, the speed of 4 (fast copy pace) is used. • (VSP G1000, G1500, and VSP F1500) Other than OPEN-V (TC): The range is 1 to 15. ○ 1 to 5 are a slow copy pace, and are used to reduce impact on host I/O. ○ 6 to 10 are a medium copy pace. ○ 11 to 15 are a fast copy pace, and the host I/O performance might be degraded. • (VSP G1000, G1500, and VSP F1500) TrueCopy for Mainframe: You can specify 3 or 15 from the list. ○ 3 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 15 is fast. This setting increases the impact on host I/O and might result in decreased storage system performance. • (VSP Gx00 models and VSP Fx00 models) Displayed for TC and GAD only. The range is 1 to 4.

Item	Description
	○ 1 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 2 and 3 is medium. ○ 4 is fast. This setting increases the impact on host I/O and might result in decreased storage system performance. If you enter a number from 5 to 15, the speed of 4 (fast copy pace) is used.
Initial Copy Priority	Scheduling order for the initial copy operation. The range is 1 to 256, and the default is 32. (VSP Gx00 models and VSP Fx00 models) For GAD pairs this is not displayed.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW (DASD fast write) data is copied to the S-VOL. • Primary Volume Only: Data is not copied to S-VOL (default). • Secondary Volume Copy: Data is copied to S-VOL.
DFW to Secondary Volume (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the primary system splits the pair when the secondary system cannot copy DFW data to the S-VOL. • Require: Splits the pair. • Not Require: Does not split. Some combinations of the DFW setting and the primary volume fence level setting might cause an eternal I/O error in a host application when the P-VOL is updated. Track pairs for which DFW is set to Require to make sure that this item is not blocked. IBM PPRC commands do not support this item. If you use the CESTPAIR TSO command to create a TCz pair, this item is set to Not Require.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the host I/O time stamp is transferred from P-VOL to S-VOL.
Error Level	UR and URz only. Whether to split all pairs in the mirror if a failure occurs during this operation: • Mirror: Pairs in the mirror are split. • LU: Only the failed pair is split. UR only. • (VSP G1000, G1500, and VSP F1500) Volume: Only the failed pair is split. URz only.
CFW (VSP G1000, G1500, and VSP F1500)	URz only. Whether to copy cache fast write (CFW) data to the S-VOL. • Primary Volume Only: Does not copy. Default. • Secondary Volume Copy: Copies.

Selected Pairs table

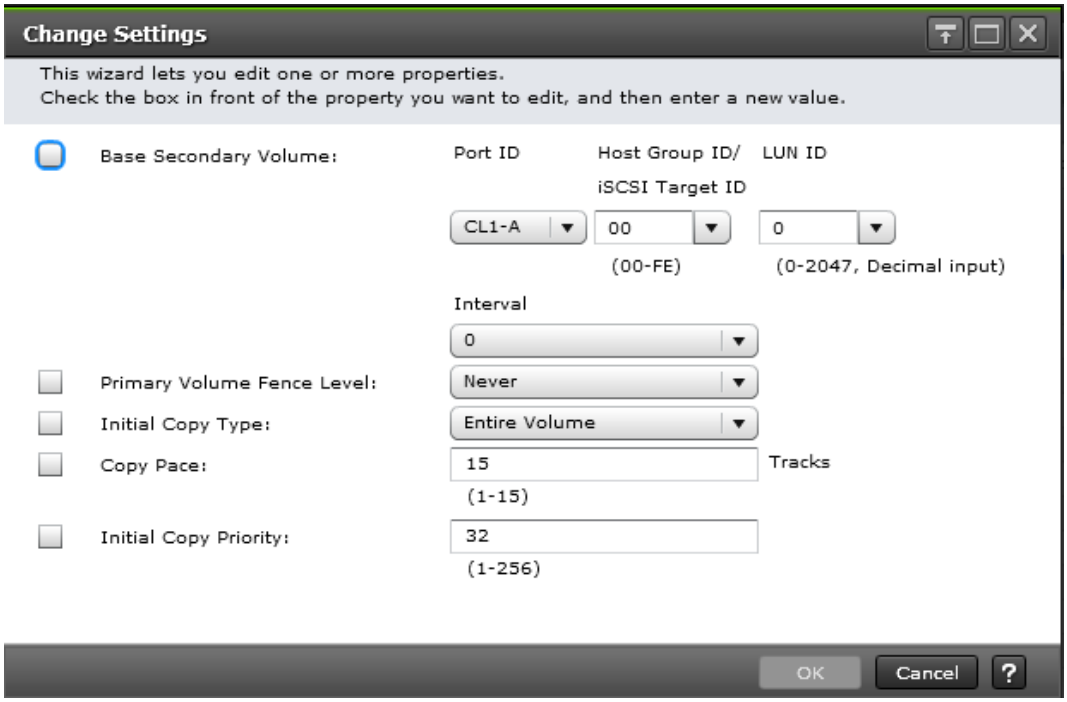
Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Port ID: Port identifier. TC/UR only. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. TC/UR only. • iSCSI Target Name: iSCSI target name. TC/UR only. • LUN ID: LUN identifier. TC/UR only. • Pair Position: UR or URz only. Indicates whether the volume is the P-VOL or S-VOL of the pair. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. TCz/TC/URz only. • Attribute: ○ ALU: The volume has the ALU attribute. ○ SLU: The volume has the SLU attribute. ○ Data Direct Mapping: The volume has the data direct mapping attribute. If the attribute is not set, a hyphen (-) is displayed. TC and UR only. • Journal ID: Journal's identifier. UR or URz only. • Mirror ID: Mirror identifier. UR or URz only. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume. • Encryption: Encryption information: ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume, a hyphen (-) is displayed. For V-VOLs of Dynamic Provisioning or Dynamic Provisioning for Mainframe, the pool to which the LDEV belongs is an external volume or blocked. • Journal Encryption: Journal's encryption status. UR or URz only. ○ Enabled: The journal contains encrypted volumes. ○ Disabled: The journal contains unencrypted volumes. ○ Mixed: The pool to which the journal volume belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume

Item	Description
	Note: Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked. • Capacity Saving: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used. ○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume. ○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled. The T10 PI attribute status is displayed only for TC or UR pairs.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • Port ID: Port identifier. TC/UR only. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier. TC/UR only. • LUN ID: LUN identifier. TC/UR only. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • (VSP G1000, G1500, and VSP F1500) LDEV ID: LDEV identifier. TCz/URz only • Journal ID: Journal's identifier. UR/URz only.
Path Group ID	Path group ID. Not used with TCz.
Fence Level	TC or TCz only. P-VOL fence level.
CTG ID	UR only. Consistency group identifier.
Initial Copy Type	Type of the pair create operation.
Copy Pace	TC or TCz only. Number of tracks copied per remote I/O operation.
Initial Copy Priority	Scheduling order for pair create operation.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW data is copied to the S-VOL.
DFW to Secondary Volume (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the primary system splits pairs when the secondary system cannot copy DFW data to the S-VOL.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the host's time stamp is transferred to the S-VOL.
Error Level	UR or URz only. Whether all pairs in the mirror are split if a failure occurs during this operation.

Item	Description
CFW (VSP G1000, G1500, and VSP F1500)	URz only. Whether CFW data is copied to the S-VOL.
Change Settings	Opens the **Change Settings** window.
Delete	Deletes the specified pair from the table.

Change Settings window

Use this window in the pair creation wizard to change options that affect how the pair is created.



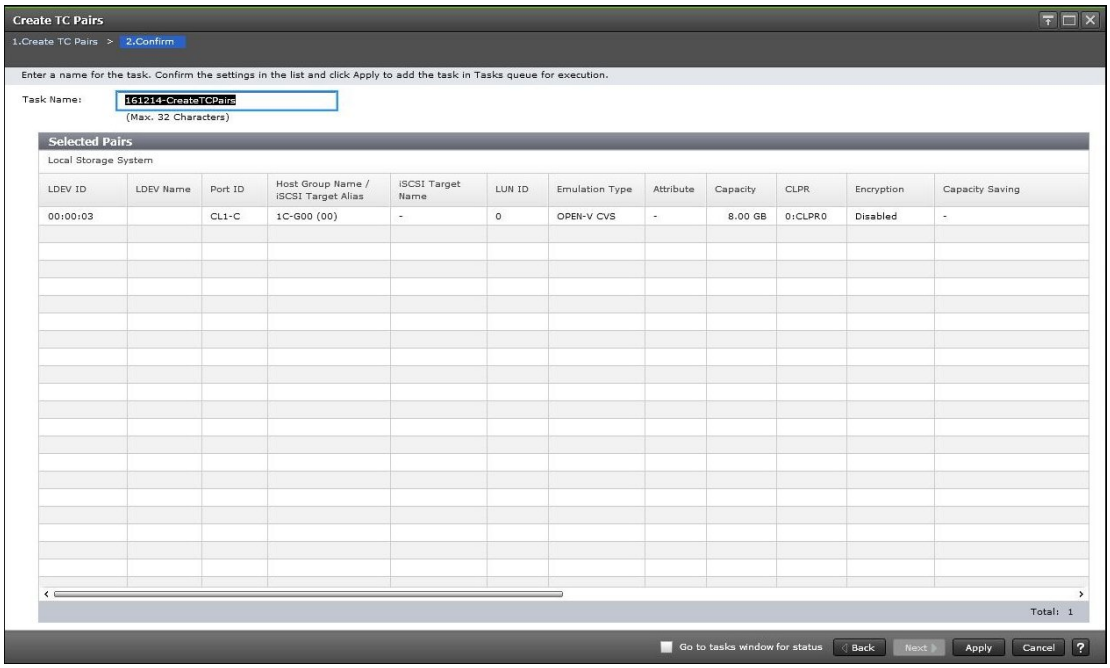
Item	Description
Base Secondary Volume	Selections for the initial S-VOL. TC, UR and GAD only. • Port ID: Port identifier. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier. • LUN ID: LUN identifier. • Interval: The interval for allocating S-VOLs to P-VOLs. (VSP G1000, G1500, and VSP F1500) TCz and URz only. • LDKC: "00" is displayed, cannot be changed. • CU: For TCz: the CU number of the volume.

Item	Description
	For URz: the CU number of the remote system, ranging from 00 to FF. • LDEV: LDEV number, ranging from 00 to FF.
Primary Volume Fence Level	TC or TCz only Whether the P-VOL can be written to when the pair is split due to error. • Data: The P-VOL cannot be written to. • Status: The P-VOL can be written to only if the primary system can change S-VOL status to PSUE (TC) or Suspend (TCz). If the primary system cannot change S-VOL status, the P-VOL cannot be written to. • Never: The P-VOL can be written to.
Initial Copy Type	Whether data is copied to the S-VOL when the pair is created. • Entire Volume: Data is copied. The default. • None: Data is not copied. If you choose this option, you must confirm the data be equal between the P-VOL and S-VOL. • Delta: Data is not copied. UR or URz only. For UR: The status is changed to HOLD or HOLDING as a pair for delta resync. For URz: The status is changed to Hold or Holding as a pair for delta resync.
Copy Pace	Number of tracks to be copied per remote I/O during the operation. The default is 15. The range is different depending on the volume emulation type. • (VSP G1000, G1500, and VSP F1500) OPEN-V (TC and GAD): The range is 1 to 4. ○ 1 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 2 and 3 is medium. ○ 4 is fast. This setting increases the impact on host I/O and might result in decreased storage system performance. If you enter a number from 5 to 15, the speed of 4 (fast copy pace) is used. • (VSP G1000, G1500, and VSP F1500) Other than OPEN-V (TC): The range is 1 to 15. ○ 1 to 5 are a slow copy pace, and are used to reduce impact on host I/O. ○ 6 to 10 are a medium copy pace. ○ 11 to 15 are a fast copy pace, and the host I/O performance might be degraded. • (VSP G1000, G1500, and VSP F1500) TrueCopy for Mainframe: You can specify 3 or 15 from the list. ○ 3 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 15 is fast. This setting increases the impact on host I/O and might result in decreased storage system performance. • (VSP Gx00 models and VSP Fx00 models) (TC and GAD) The range is 1 to 4. ○ 1 is slow. This setting limits the impact on host I/O to maintain storage system performance. ○ 2 and 3 is medium. ○ 4 is fast.

Item	Description
	This setting increases the impact on host I/O and might result in decreased storage system performance. If you enter a number from 5 to 15, the speed of 4 (fast copy pace) is used.
ALUA Mode	GAD only. Whether ALUA Mode is enabled: • Enabled: The LDEV is used in ALUA mode. • Disabled: The LDEV is not used in ALUA mode.
Initial Copy Priority	Scheduling order for the initial copy operation: range = 1 to 256, default = 32. Not displayed for GAD.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW (DASD fast write) data is copied to the S-VOL. • Primary Volume Only: Data not copied (default). • Secondary Volume Copy: Data is copied. **Note:** • To apply the pair option that is set on the P-VOL to the S-VOL, split and then resynchronize the TCz pair. • Do not specify Primary Volume Only if system option mode (SOM) 1091 is ON. If you do, I/O to the S-VOL might terminate abnormally. • Do not set SOM 1091 to ON if you changed the CFW data setting after you created the TCz pair. If you do, I/O to the S-VOL might terminate abnormally. For details about SOM 1091, see System option modes on page 35.
DFW to Secondary Volume (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the primary system splits the pair when the secondary system cannot copy DFW data to the S-VOL • Require: Splits the pair. • Not Require: Does not split. Some combinations of the DFW setting and the primary volume fence level setting might cause an eternal I/O error in a host application when the P-VOL is updated. Track pairs for which DFW is set to Require to make sure that this item is not blocked. IBM PPRC commands do not support this item. If you use the CESTPAIR TSO command to create a TCz pair, this item is set to Not Require.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. • Enable: The host I/O time stamp is transferred from P-VOL to S-VOL (default). • Disable: The host I/O time stamp is not transferred from P-VOL to S-VOL. Whether the host I/O time stamp is transferred from P-VOL to S-VOL.
Error Level	UR and URz only. Whether to split all pairs in the mirror if a failure occurs during this operation: • LU: Only the failed pair is split. UR only.

Item	Description
	• Mirror: Pairs in the mirror are split. • (VSP G1000, G1500, and VSP F1500) Volume: Only the failed pair is split.
CFW (VSP G1000, G1500, and VSP F1500)	URz only. Whether to copy cache fast write (CFW) data to the S-VOL. • Primary Volume Only: Does not copy. Default. • Secondary Volume Copy: Copies.

Create Pairs confirmation window



Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Port ID: Port identifier. TC/UR only. • Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. TC/UR only. • iSCSI Target Name: iSCSI target name. TC/UR only. • LUN ID: LUN identifier. TC/UR only. • Pair Position: UR or URz only. Indicates whether the volume is the P-VOL or S-VOL of the pair.

Item	Description
	• (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. TCz/TC/URz only. • Attribute: ○ ALU: The volume has the ALU attribute. ○ SLU: The volume has the SLU attribute. ○ Data Direct Mapping: The volume has the data direct mapping attribute. If the attribute is not set, a hyphen (-) is displayed. TC and UR only. • Journal ID: Journal's identifier. UR or URz only. • Mirror ID: Mirror identifier. UR or URz only. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume. • Encryption: Encryption information: ○ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled. ○ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled. ○ Mixed: The pool to which the LDEV belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. For an external volume, a hyphen (-) is displayed. For V-VOLs of Dynamic Provisioning or Dynamic Provisioning for Mainframe, the pool to which the LDEV belongs is an external volume or blocked. • Journal Encryption: Journal's encryption status. UR or URz only. ○ Enabled: The journal contains encrypted volumes. ○ Disabled: The journal contains unencrypted volumes. ○ Mixed: The pool to which the journal volume belongs contains two or more of the following: – Volume for which encryption is enabled – Volume for which encryption is disabled – External volume **Note:** Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled. A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked. • Capacity Saving: Information on the capacity saving function. ○ Compression: The compression function is used. ○ Deduplication and Compression: The deduplication function and the compression function are used. ○ Disabled: The capacity saving function is not used. • T10 PI[1]: T10 PI attribute of the volume.

Item	Description
	○ Enabled: T10 PI attribute of the volume is enabled. ○ Disabled: T10 PI attribute of the volume is disabled. The T10 PI attribute status is displayed only for TC pairs and UR pairs.
Copy Type (VSP G1000, G1500, and VSP F1500)	Type of pair: • TC: TrueCopy • UR: Universal Replicator • TCMF: TrueCopy for Mainframe • URMF: Universal Replicator for Mainframe
Remote Storage System	Information about volumes in the system connected to the system you accessed. • Model / Serial Number: Model and serial number. • Port ID: Port identifier. TC/UR only. • Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier. TC/UR only. • LUN ID: LUN identifier. TC/UR only. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • (VSP G1000, G1500, and VSP F1500) LDEV ID: LDEV identifier. TCz/URz only. • Journal ID: Journal's identifier. UR or URz only.
Path Group ID	Path group identifier. Not shown for TCz.
CTG ID	UR only. Consistency group identifier.
Fence Level	TC or TCz only Whether the P-VOL can be written to when the pair is split due to error. • Data: Cannot be written to. • Status: Can be written to only if the primary system can change the S-VOL status to PSUE. If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: Can be written to.
Initial Copy Type	Pair creation operation type.
Copy Pace	TC or TCz only Number of tracks to be copied per remote I/O operation.
Initial Copy Priority	Scheduling order for the initial copy operation. The range is 1 to 256, and the default is 32.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW (DASD fast write) data is copied to the S-VOL. • Primary Volume Only: Data not copied (default). • Secondary Volume Copy: Data is copied. This is displayed only for TCz pairs.
DFW to Secondary Volume (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the primary system splits the pair when the secondary system cannot copy DFW data to the S-VOL • Require: Splits the pair.

Item	Description
	• Not Require: Does not split.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. Whether the host I/O time stamp is transferred from P-VOL to S-VOL.
Error Level	UR or URz only. Whether to split all pairs in the mirror if a failure occurs during this operation: • Mirror: Pairs in the mirror are split. • Volume: Only the failed pair is split.
CFW (VSP G1000, G1500, and VSP F1500)	URz only. Whether to copy cache fast write (CFW) data to the S-VOL. • Primary Volume Only: Does not copy. Default. • Secondary Volume Copy: Copies.

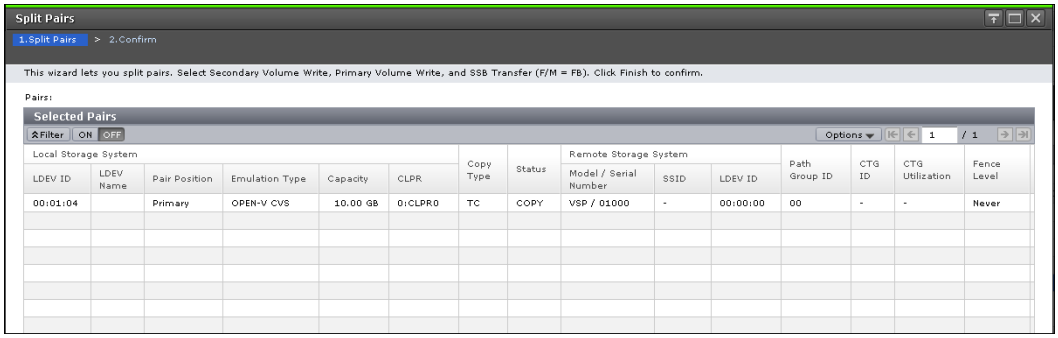
Split Pairs wizard

Use this wizard to split pairs.

Split Pairs window

Use this window to split pairs.

For complete information and instructions, see Splitting pairs on page 117.



In this topic, you can view the following tables.

- Selected Pairs table on page 239
- Setting Fields on page 240

Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system.

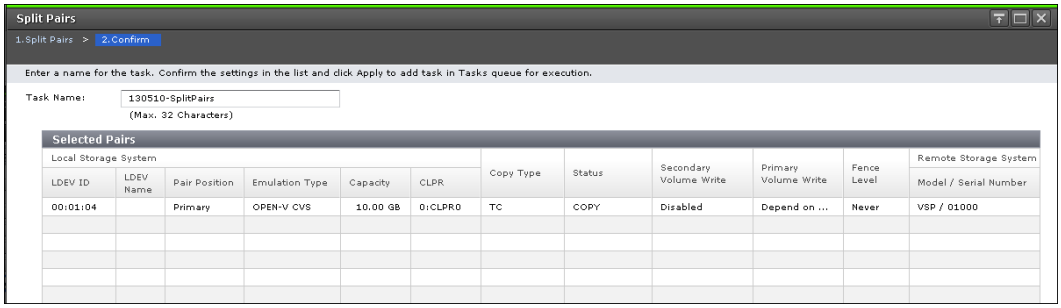
Item	Description
	• LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500)TCMF: TrueCopy for Mainframe
Status	Pair status.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.
Fence Level	P-VOL fence level.

Setting Fields

Item	Description
Secondary Volume Write	TC only. Whether the S-VOL can be written to while the pair is split. • Enable: Can write to S-VOL. Available only when performing the split operation from the pair's primary storage system. • Disable: Prevents writing to S-VOL. Default.
Primary Volume Write	Whether the P-VOL can be written to while the pair is split. • Depends on Primary Volume Fence Level: Writing to P-VOL depends on the Primary Volume Fence Level Setting. Default.

Item	Description
	• Disable: Prevents writing to the P-VOL. Available only when performing the split operation from the pair's primary storage system.
SSB Transfer (F/M=FB) (VSP G1000, G1500, and VSP F1500)	TCz only. Whether to report SSB (sense byte) to the host. Enable/Disable (the default). Enable is available only when performing the split operation from the pair's primary storage system.

Split Pairs confirmation window



Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status.
Secondary Volume Write	TC only. Whether the S-VOL can be written to while the pair is split. • Enable: Can write to S-VOL. • Disable (default): Prevents writing to S-VOL. A hyphen is displayed if performing the split operation from the pair's secondary storage system, regardless of the selected option.

Item	Description
Primary Volume Write	Whether the P-VOL can be written to while the pair is split. • Depends on Primary Volume Fence Level: Writing to P-VOL depends on the Primary Volume Fence Level Setting. Default. • Disable: Prevents writing to the P-VOL. A hyphen is displayed if performing the split operation from the pair's secondary storage system, regardless of the selected option.
Fence Level	P-VOL's fence level setting.
SSB Transfer (F/M=FB) (VSP G1000, G1500, and VSP F1500)	TCz only. Whether to report SSB (sense byte) to the host. Enable/Disable. A hyphen is displayed if performing the split operation from the pair's secondary storage system, regardless of the selected option.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.

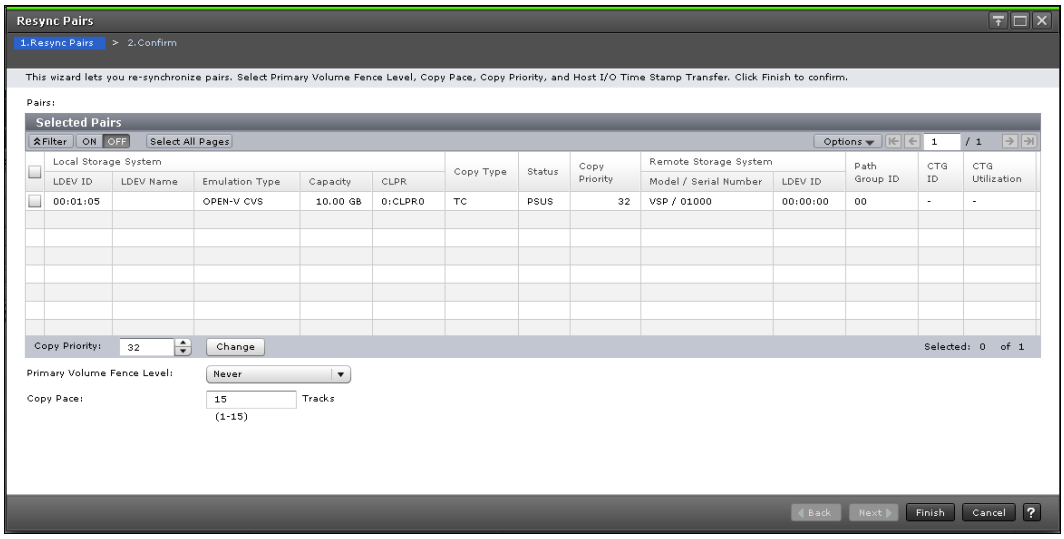
Resync Pairs wizard

Use this wizard to resynchronize pairs.

Resync Pairs window

Use this window to resynchronize pairs.

For complete information and instructions, see Resynchronizing pairs on page 119.



In this topic, you can view the following tables.

- Selected Pairs table on page 243
- Setting Fields on page 244

Selected Pairs table

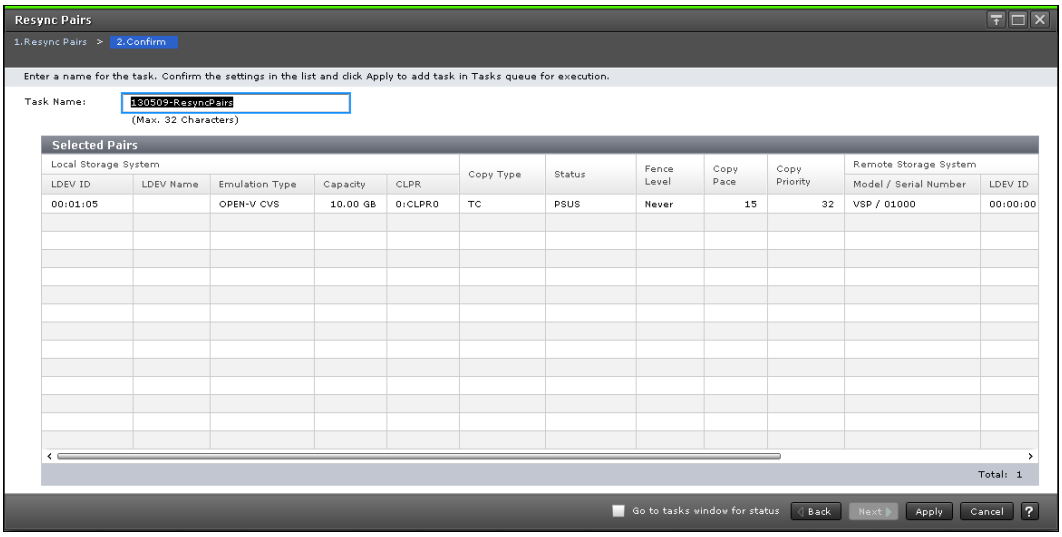
Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status.
Copy Priority	Order that pairs are resynchronized.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.

Item	Description
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.
Copy Priority	Order that pairs are resynchronized. Specify a value from 1 through 256 for TC, 0 through 256 for TCz.

Setting Fields

Item	Description
Primary Volume Fence Level	Whether the P-VOL can be written to when the pair is split due to error. • Data: The P-VOL cannot be written to. • Status: The P-VOL can be written to only if the primary system can change the S-VOL status to PSUE (TC) or Suspend (TCz). If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: The P-VOL can be written to.
Copy Pace	Maximum number of tracks to be copied per remote I/O during the operation. The default is 15. • For TC pairs, enter a value from 1 to 15 (VSP G1000, G1500, and VSP F1500) or 1 to 4 (VSP Gx00 models and VSP Fx00 models). (VSP G1000, G1500, and VSP F1500) When the emulation type is OPEN-V, if you enter a number from 5 to 15, the speed of 4 (fast copy pace) is used. • For TCz pairs, specify 3 or 15 from the list.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. • Enable: The host I/O time stamp is transferred from P-VOL to S-VOL. • Disable: The host I/O time stamp is transferred from P-VOL to S-VOL. Whether the host I/O time stamp is transferred from P-VOL to S-VOL.

Resync Pairs confirmation window



Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status.
Fence Level	Whether the P-VOL can be written to when the pair is split due to error. • Data: Cannot be written to. • Status: Can be written to only if the primary system can change the S-VOL status to PSUE (open) or Suspend (mainframe). If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: Can be written to.
Copy Pace	Number of tracks to be copied per remote I/O during the operation.
Copy Priority	Order that pairs are resynchronized.
Host I/O Time Stamp Transfer	TCz only. Whether the host I/O time stamp is transferred from P-VOL to S-VOL.

Item	Description
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.

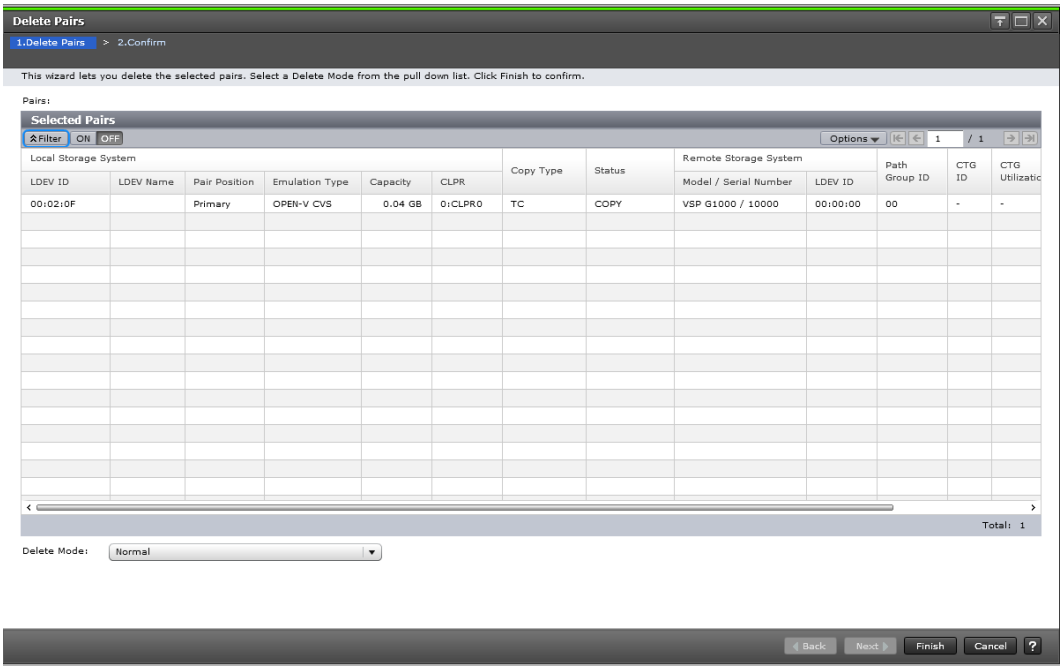
Delete Pairs wizard

Use this wizard to delete pairs.

Delete Pairs window

Use this window to delete pairs.

For complete information and instructions, see Deleting pairs on page 121.



In this topic, you can view the following tables.

- Selected Pairs table on page 247
- Settings on page 248

Selected Pairs table

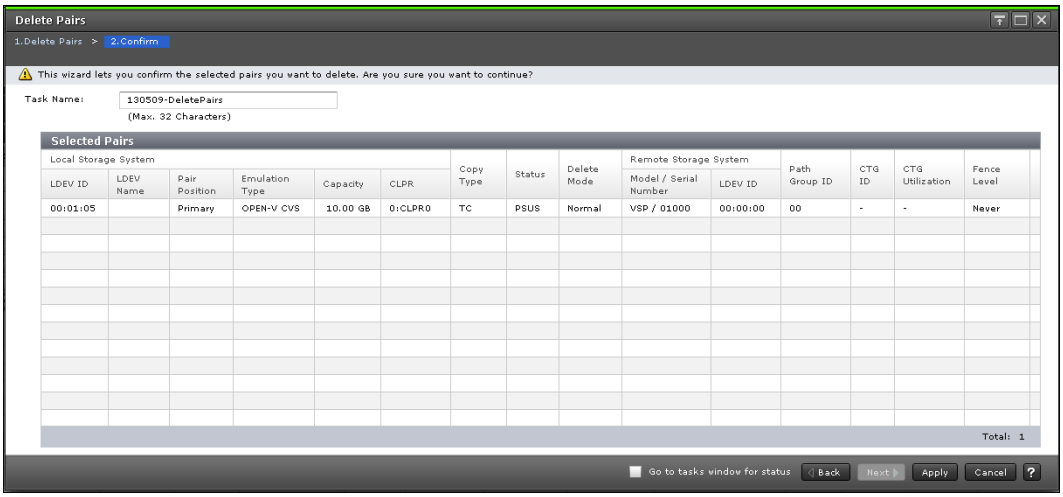
Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only.

Item	Description
	Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.
Fence Level	Whether the P-VOL can be written to when the pair is split due to error. • Data: The P-VOL cannot be written to. • Status: The P-VOL can be written to only if the primary system can change the S-VOL status to PSUE (TC) or Suspend (TCz). If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: The P-VOL can be written to.

Settings

Item	Description
Delete Mode	How the pair is deleted. • Normal: Deletes the pair if the local system can change both P-VOL and S-VOL to unpaired volumes. Default. • Force: Deletes the pair even when the local system cannot communicate with the remote system. • (VSP G1000, G1500, and VSP F1500) Force (All pairs in the same remote connections): Deletes forcibly all pairs using the same remote connection. TCz only.

Delete Pairs confirmation window



Selected Pairs table

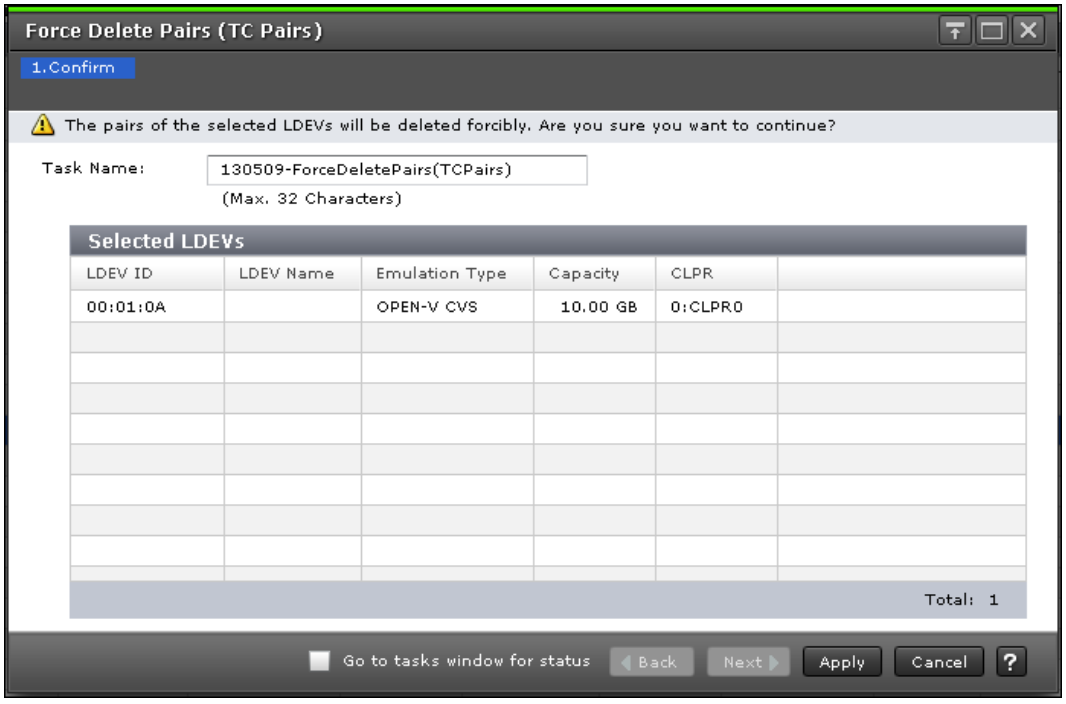
Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status.
Delete Mode	How the pair is deleted.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems.

Item	Description
	• Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.
Fence Level	P-VOL fence level.

Force Delete Pairs (TC Pairs) window

Use this window to forcibly delete pairs.

For complete information and instructions, see Forcibly deleting pairs on page 133.



Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier.
LDEV Name	LDEV name.

Item	Description
Emulation Type (VSP G1000, G1500, and VSP F1500)	Emulation type.
Capacity	Capacity.
CLPR	CLPR ID.

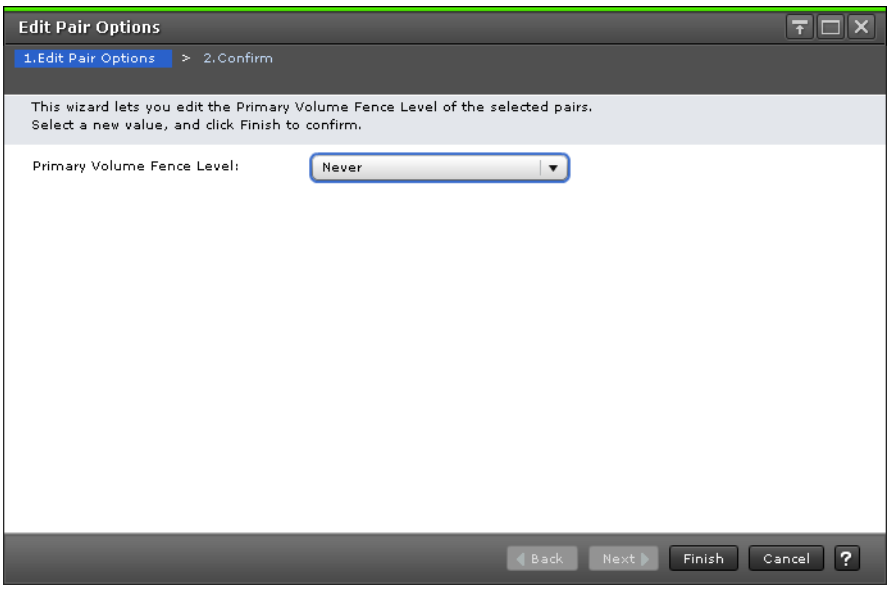
Edit Pair Options wizard

Use this wizard to change pair options.

Edit Pair Options window

Use this window to change pair options.

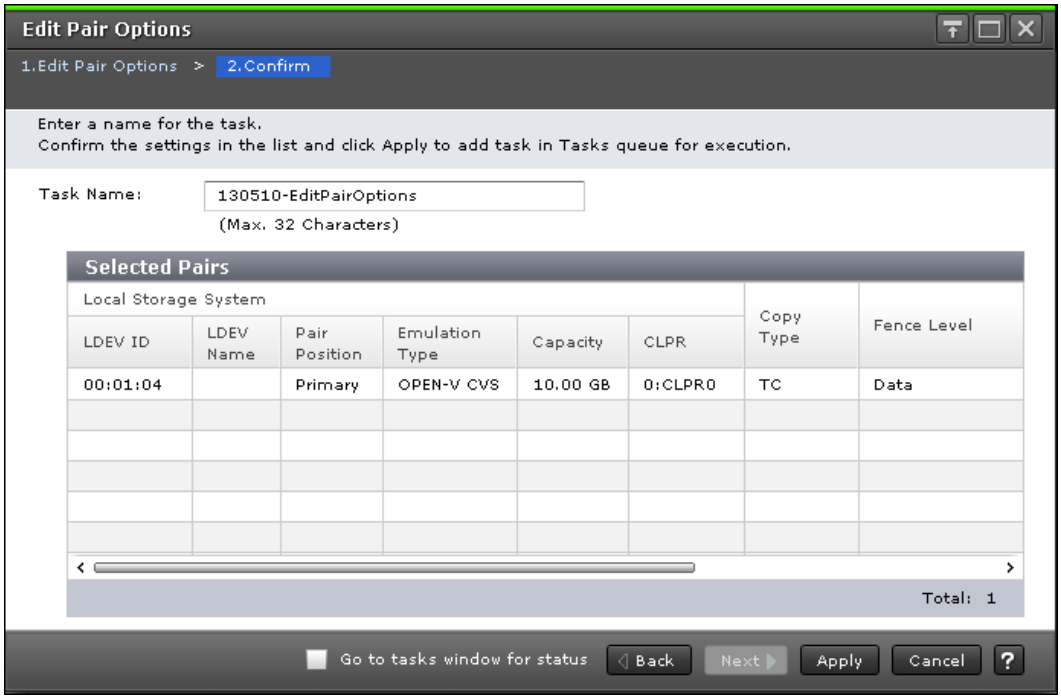
For complete information and instructions, see Changing P-VOL fence level on page 132.



Item	Description
Primary Volume Fence Level	Whether the P-VOL can be written to when the pair is split due to error. • Data: The P-VOL cannot be written to. • Status: The P-VOL can be written to only if the primary system can change the S-VOL status to PSUE (TrueCopy) or Suspend (TrueCopy for Mainframe). If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: The P-VOL can be written to.

Item	Description
	The value set for the selected pair is the default.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW (DASD fast write) data is copied to the S-VOL. • Primary Volume Only: Data not copied (default). • Secondary Volume Copy: Data is copied. The value set for the selected pair is the default. **Note:** • To apply the pair option that is set on the P-VOL to the S-VOL, split and then resynchronize the TCz pair. • Do not specify Primary Volume Only if system option mode (SOM) 1091 is ON. If you do, I/O to the S-VOL might terminate abnormally. • Do not set SOM 1091 to ON if you changed the CFW data setting after you created the TCz pair. If you do, I/O to the S-VOL might terminate abnormally. For details about SOM 1091, see System option modes on page 35.

Edit Pair Options confirmation window



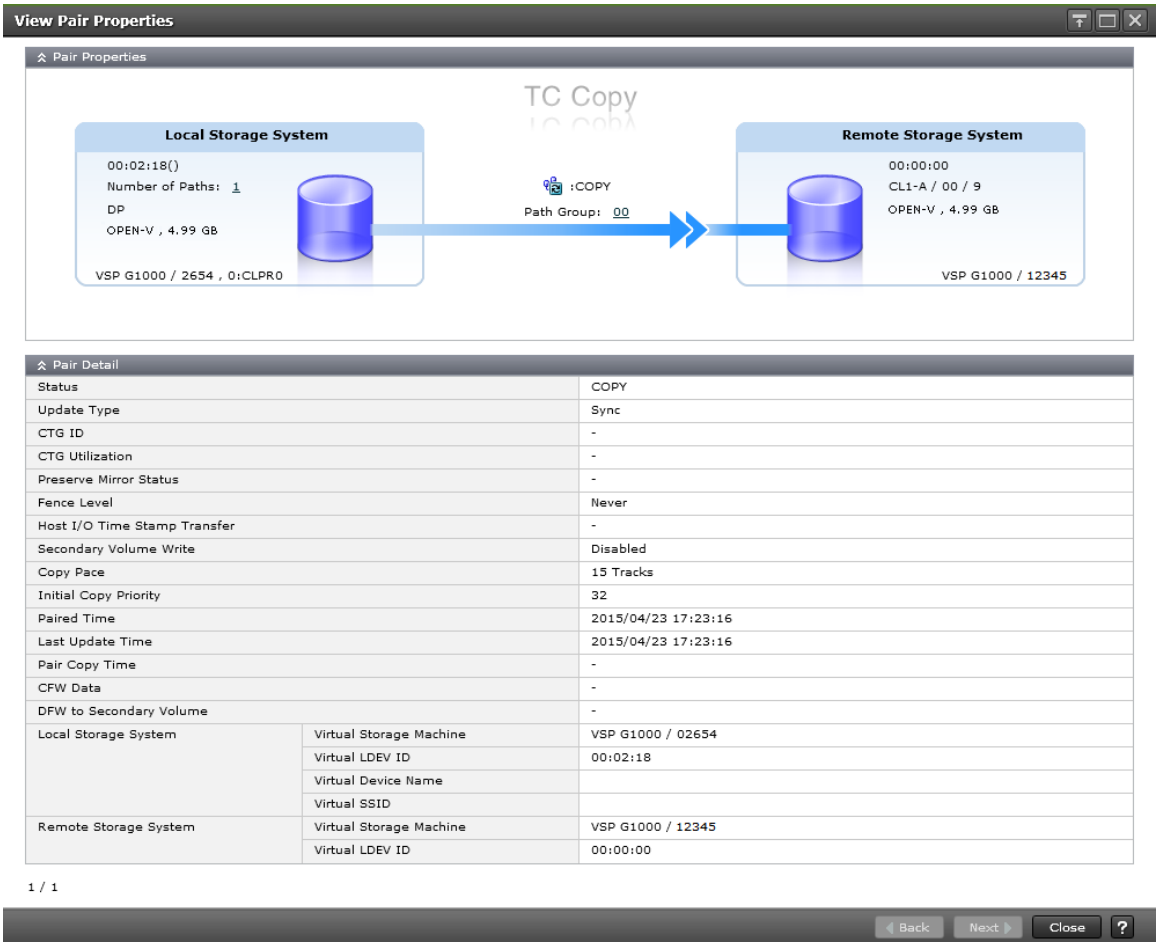
Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • LDEV Name: LDEV name. • Pair Position: Whether volume is a P-VOL or S-VOL. • (VSP G1000, G1500, and VSP F1500) Emulation Type: Emulation type of the volume. • (VSP Gx00 models and VSP Fx00 models) Attribute: LDEV attribute. • Capacity: Capacity of the volume. • CLPR: CLPR ID of the volume.
Copy Type	Type of pair: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Fence Level	P-VOL fence level.
CFW Data (VSP G1000, G1500, and VSP F1500)	TCz only. Whether CFW data is copied to the S-VOL.
Remote Storage System	Information about the remote system. • Model / Serial Number: Model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: SSID number. TCz only. • LDEV ID: LDEV identifier.
Path Group ID	TC only. Path group identifier.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	TCz only. • Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair. • Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy® V2.

View Pair Properties (Remote) window

Use this window to view the data related to pairs and their volumes.

For complete information and instructions, see Monitoring pair status and license capacity on page 124.



In this topic, you can view the following tables.

- Pair Properties on page 254
- Pair Detail on page 255

Pair Properties

Item	Description
Local Storage System	Displays the following information about the local system: • LDEV ID (LDEV name): P-VOL's LDEV identifier and name, which is displayed when you hover the cursor over it. • Number of Paths: Number of data paths between primary and secondary systems. • Provisioning Type, Encrypted, T10 PI: Provisioning type, encryption status, and T10 PI attribute of the volume in the local storage system. Encryption status is displayed only when the encryption status is Enabled or Mixed. If ... is displayed, place the cursor over ... to open the hidden contents as a tooltip. T10 PI attribute information is displayed only if the T10 PI attribute is enabled. • (VSP G1000, G1500, and VSP F1500) Emulation Type, Capacity: Emulation type and capacity of the local system.

Item	Description
	• (VSP Gx00 models and VSP Fx00 models) Attribute, capacity: Local system's volume attribute and capacity. If the volume does not have an attribute, only the capacity is displayed. • Model/Serial number, CLPR ID : CLPR name: Model, serial number, CLPR ID, and CLPR name of the local system.
Copy Type, Status	Copy type and pair status of the pair.
Path Group	Path group of the pair. If the P-VOL is in the primary storage system you can click one of the following to display the remote path list. • Path group ID (TC) • (VSP G1000, G1500, and VSP F1500) Remote Paths (TCz). Displayed only when the P-VOL is located at the local storage system.
Remote Storage System	Displays the following information about the remote system: • LDEV ID: S-VOL's LDEV identifier and name, which is displayed when you hover the cursor over it. • Port ID/Host Group ID or iSCSI Target ID/LUN ID: Port, host group or iSCSI target, and LUN identifiers. Information is useful when specifying an LDEV ID at pair creation. It does not change, even if path settings are changed. (TC only). • (VSP G1000, G1500, and VSP F1500) Emulation type: Remote system's volume emulation type. • (VSP Gx00 models, VSP Fx00 models) Capacity: Remote system's volume capacity. • Model/Serial number: Remote system's model, serial number. (VSP G1000, G1500, and VSP F1500) For CU-by-CU connection, SSID is also displayed.

Pair Detail

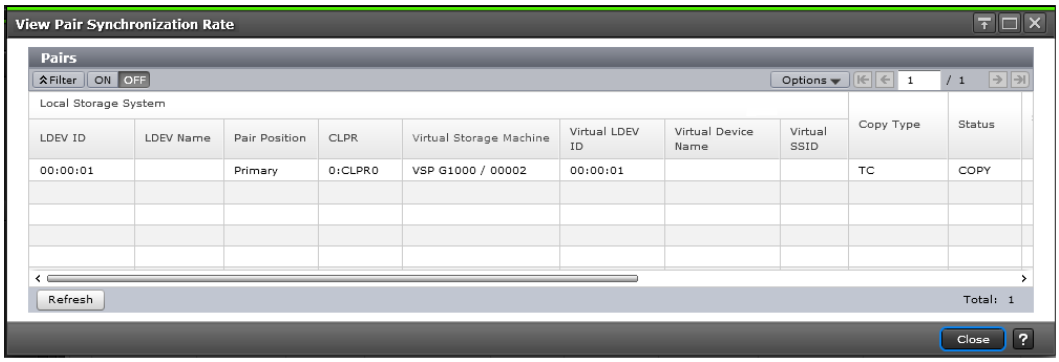
Item	Description
Status	Pair's status
Update Type	One of the following: • Sync: It is a TC or TCz pair which is not assigned to consistency group. • Sync (Specified CTG): It is a TC or TCz pair created by specifying consistency group.
CTG ID	Consistency group identifier
CTG Utilization	Whether the consistency group is shared by multiple storage systems. • Single: The consistency group consists of a single pair of primary and secondary storage systems. • Multi: The consistency group consists of multiple storage systems.
Preserve Mirror Status (VSP G1000, G1500, and VSP F1500)	Preserve Mirror Status. A hyphen (-) is displayed for TC.
Fence Level	Whether the P-VOL can be written to when the pair is split due to error. • Data: The P-VOL cannot be written to.

Item	Description
	• Status: The P-VOL cannot be written to only if the primary system cannot change the S-VOL status to PSUE (TC) or Suspend (TCz). If the primary system cannot change the S-VOL status, the P-VOL cannot be written to. • Never: The P-VOL can be written to.
Host I/O Time Stamp Transfer (VSP G1000, G1500, and VSP F1500)	TCz only. Specified time stamp transfer value.
Secondary Volume Write	Whether data can be written (Enabled) or not written (Disabled) to the S-VOL. The pair must be split for Enabled to display. If the volume accessed is an S-VOL and can be written to, Enabled/Received or Enabled/Not Received is displayed. Indicates whether a write operation is received from the host or not.
Copy Pace	Speed that data is copied.
Initial Copy Priority	Scheduling order for the initial copy operation. The default is 32. The range is 1 to 256 for TC. The range is 0 to 256 for TCz.(VSP G1000, G1500, and VSP F1500)
Paired Time	Date and time pair-creation was completed.
Last Update Time	Date and time that the last update was run.
Pair Copy Time	Elapsed time for paircreate or pairresync operation.
CFW Data (VSP G1000, G1500, and VSP F1500)	Whether CFW data is copied to the S-VOL as specified during pair creation. A hyphen (-) is displayed for TC pairs.
DFW to Secondary Volume (VSP G1000, G1500, and VSP F1500)	Whether the primary system splits the TCz pair when the secondary system cannot copy DFW data to the S-VOL. A hyphen (-) is displayed for TC pairs.
Local Storage System	• Virtual storage machine: Virtual storage machine's model type and serial number. • Virtual LDEV ID: Virtual LDEV identifier of the volume. • Virtual Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute. ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates no values are specified. • Virtual SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Remote Storage System	• Virtual storage machine: Virtual storage machine's model type and serial number. • Virtual LDEV ID: Virtual LDEV identifier of the volume.

View Pair Synchronization Rate window

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

For complete information and instructions, see Monitoring TC pair synchronization rate on page 130.



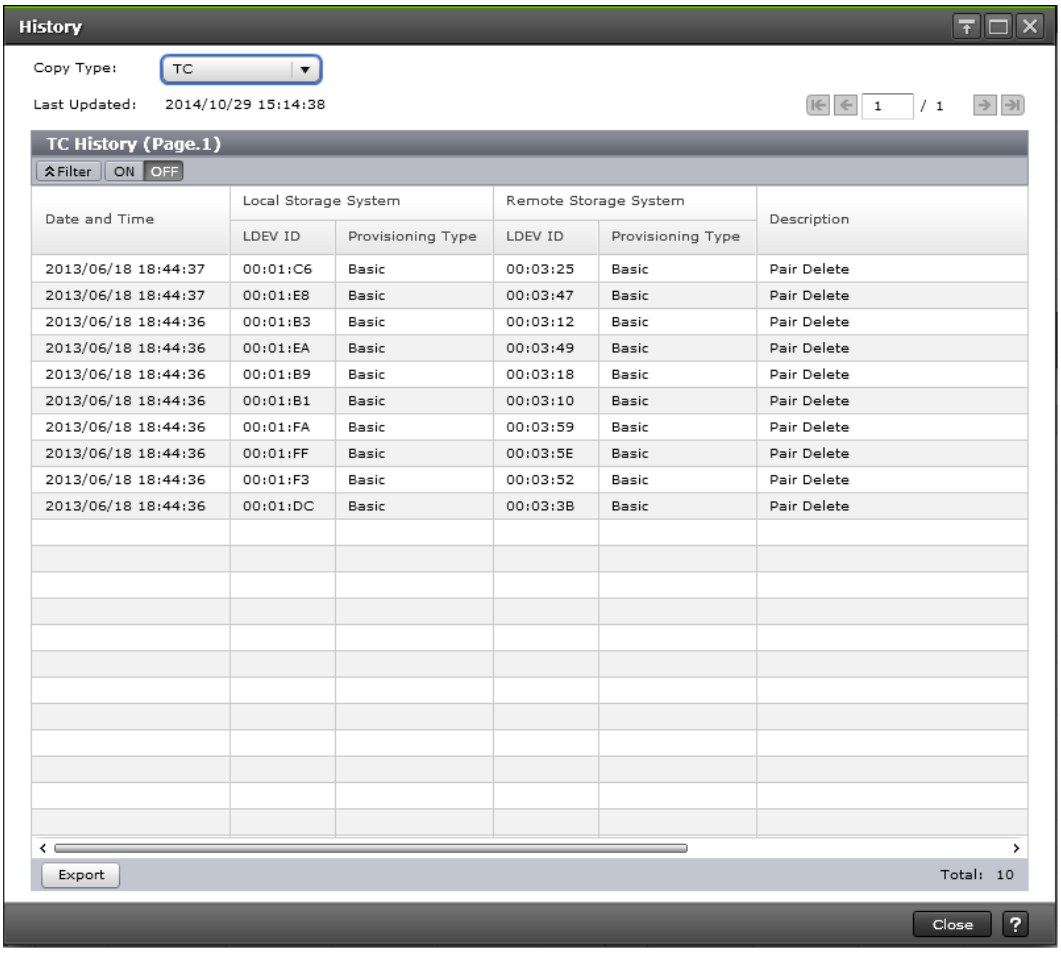
Pairs table

Item	Description
Local Storage System	Information about volumes in the local storage system. • LDEV ID: LDEV identifier. Clicking the link opens the **LDEV Properties** window. • LDEV Name: LDEV name. • Pair Position: Whether the volume is a primary or secondary volume. • CLPR: CLPR ID of the volume. • Virtual storage machine: Virtual storage machine's model type and serial number. • Virtual LDEV ID: Virtual LDEV identifier of the volume. • Virtual Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute. ○ Only attributes that are specified are displayed. ○ If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name. ○ A blank indicates no values are specified. • Virtual SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.
Copy Type	TC Pairs tab: • TC: TrueCopy • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe
Status	Pair status. For status definitions, see Pair status definitions on page 126
Synchronization Rate (%)	Displays the synchronization rate between the P-VOL and S-VOL: • Initial copy progress rate is displayed during the initial copy process. • Data synchronization rate of the P-VOL and S-VOL is displayed during pair split. • "(Queuing)" is displayed if processing has not started.

Item	Description
	For a TC pair, when the local storage system volume is the P-VOL, the percentage is displayed regardless of the pair status. When the local storage system volume is the S-VOL, the percentage is displayed only if the pair status is other than COPY. (VSP G1000, G1500, and VSP F1500) For a TCz pair, when the local storage system volume is the P-VOL, the percentage is displayed regardless of the pair status. When the local storage system volume is the S-VOL, a hyphen (-) is displayed.
Remote Storage System	Information about volumes in the system connected to the system you accessed. • Model / Serial Number: Remote system's model and serial number. • (VSP G1000, G1500, and VSP F1500) SSID: Remote system's SSID number. TCz only. • LDEV ID: LDEV identifier. • Virtual storage machine: Virtual storage machine's model type and serial number. • Virtual LDEV ID: Virtual LDEV identifier of the volume.
Path Group ID	Path group identifier. TC only.
Refresh	Updates the information.

History window

Use this window to review the operations that have been performed on a pair.



In this topic, you can view the following tables.

- Settings on page 259
- History table (when Copy Type is TC or TCMF) on page 260

Settings

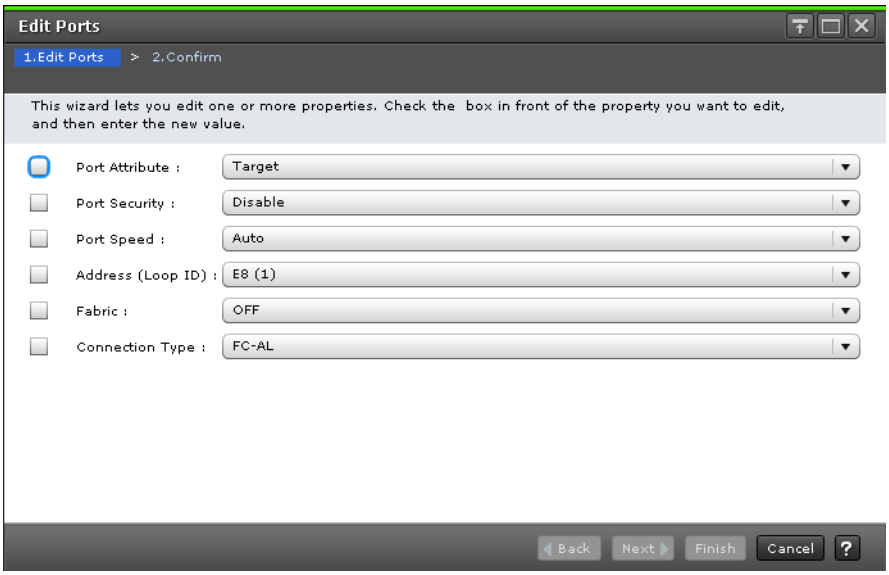
Item	Description
Copy Type	Type of pair: • TC: TrueCopy • UR: Universal Replicator • (VSP G1000, G1500, and VSP F1500) TCMF: TrueCopy for Mainframe • (VSP G1000, G1500, and VSP F1500) URMF: Universal Replicator for Mainframe • GAD: global-active device
Last Updated (VSP G1000, G1500, and VSP F1500)	Date and time of the last update. Displayed after Copy Type is specified.
Page Number (VSP G1000, G1500, and VSP F1500)	Page number. Click the button, turn over the page. Displayed after Copy Type is specified.

History table (when Copy Type is TC or TCMF)

Item	Description
Date and Time	Date and time of the operation.
Local Storage System	Information about volumes in the accessed system. • LDEV ID: LDEV identifier. • Provisioning Type: Provisioning type of the volume. • Pair Position: Whether the volume is a primary or secondary volume. GAD only. • Journal ID: Journal's identifier. UR or URz only. • Mirror ID: Mirror's identifier. UR or URz only.
Remote Storage System	Information about volumes in the system connected to the system you accessed. • LDEV ID: LDEV identifier. • Model / Serial Number: Remote storage system's model and serial number. GAD only. • Provisioning Type: Provisioning type of the volume.
EXCTG ID (VSP G1000, G1500, and VSP F1500)	EXCTG identifier. URz only.
Mirror ID	Mirror identifier. GAD only.
Quorum Disk ID	Quorum disk identifier. GAD only.
CTG ID (VSP G1000, G1500, and VSP F1500)	Consistency group identifier. GAD only.
Virtual Storage Machine	Information about volumes in the virtual storage machine. GAD only. • Model / Serial Number: Virtual storage system's model and serial number. • LDEV ID: LDEV identifier of the volume.
Description Code	Description code. GAD only.
Description	Describes the operation.
Copy Time	Elapsed time for create or resync pairs operation. When the Description is other than Pair Add Complete or Pair Resync Complete, a hyphen is displayed.
Started	Start time of create or resync pairs operation. When the Description is other than Pair Add Complete or Pair Resync Complete, a hyphen is displayed.
Export	Opens the window for exporting table information.

Edit Ports window

Fibre Channel

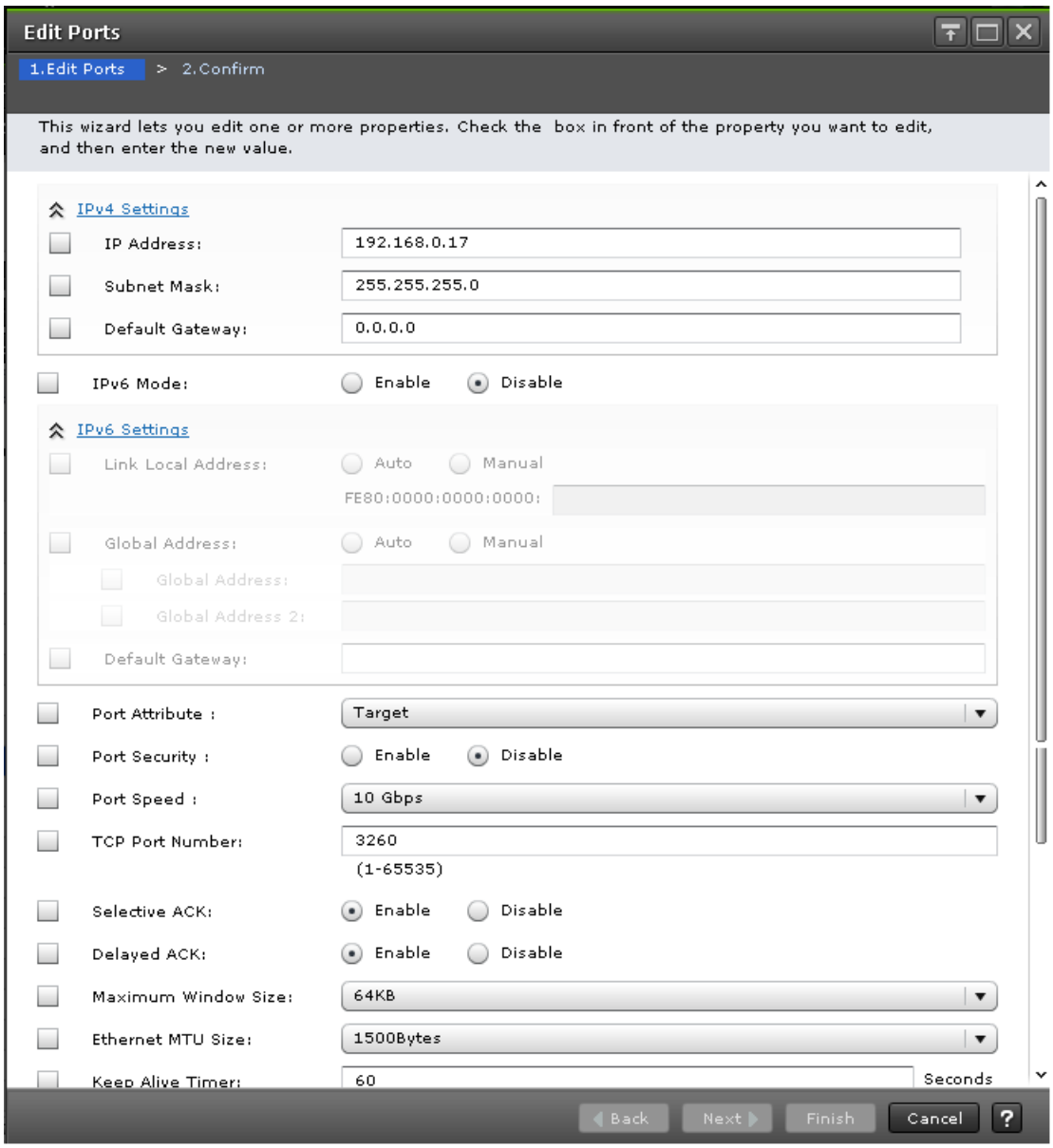


For Fibre Channel ports

Item	Description
Port Attribute (VSP G1000, G1500, and VSP F1500)	Select the attribute of the port indicating I/O flow. • Initiator: Issues I/O commands to a target port when I/O is executed between storage systems with TrueCopy, and so on. • Target: Receives I/O commands from a host. • RCU Target: Receives I/O commands from an initiator when I/O is executed between storage systems with TrueCopy, and so on. • External: Issues I/O commands to a target port of an external storage system with Universal Volume Manager. If this port attribute is changed from Target or RCU Target to Initiator or to External, the host group of this port belongs to meta_resource. Therefore, the host group of this port is not displayed in windows.
Port Security	Select whether LUN security is Enabled or Disabled.
Port Speed	Select the data transfer speed, in Gbps, for the selected Fibre Channel port. If Auto is selected, the storage system automatically sets the data transfer speed to 2, 4, 8, 10, or 16 Gbps for VSP G1000, VSP G1500, and VSP F1500, or 2, 4, 8, 10, 16, or 32 Gbps for VSP Gx00 models and VSP Fx00 models. **Caution:** If you are using 2-Gbps HBA and switch, set the transfer speed of the CHF (Fibre Channel adapter) port for VSP G1000, VSP G1500, and VSP F1500, or CHB(FC) (Fibre Channel board) for VSP Gx00 models and VSP Fx00 models as 2 Gbps. If you are using 4-Gbps HBA and switch, set the transfer speed of the CHF or CHB(FC) port as 4 Gbps. If you are using 8-Gbps HBA and switch, set the transfer speed of the

Item	Description
	CHF or CHB(FC) port as 8 Gbps. If you are using 16-Gbps HBA and switch, set the transfer speed of the CHF or CHB(FC) port as 16-Gbps. If you are using a 32-Gbps HBA and switch, set the transfer speed of the CHB(FC) port to 32 Gbps. If the Auto Negotiation setting is required, the linkup might become improper at server restart. Check a channel lamp, and if it is blinking, remove and re-insert the cable to perform the signal synchronization and linkup. When the transfer speed of the CHF port is set to Auto, the data might not be transferred at the maximum speed depending on the connected device. Confirm the transfer speed appearing in Speed in the Ports list when you start up the storage system, HBA, or switch. When the transfer speed is not the maximum speed, select the maximum speed from the list on the right or remove and reinsert the cable. (VSP G1000, G1500, and VSP F1500) Only 10 Gbps can be specified for the FCoE port. Auto cannot be specified for the FCoE port.
Address (Loop ID)	Select the address of the selected port. Do not set the address to the FCoE port for VSP G1000, VSP G1500, and VSP F1500.
Fabric	Select whether a fabric switch is set to ON or OFF. Only ON can be specified for the FCoE port for VSP G1000, VSP G1500, and VSP F1500.
Connection Type	Select the topology: • FC-AL: Fibre Channel arbitrated loop • P-to-P (point-to-point). Only P-to-P can be specified for the FCoE port. **Caution:** Some fabric switches require that you specify point-to-point topology. If you enable a fabric switch, check the documentation for the fabric switch to determine whether your switch requires point-to-point topology.

iSCSI



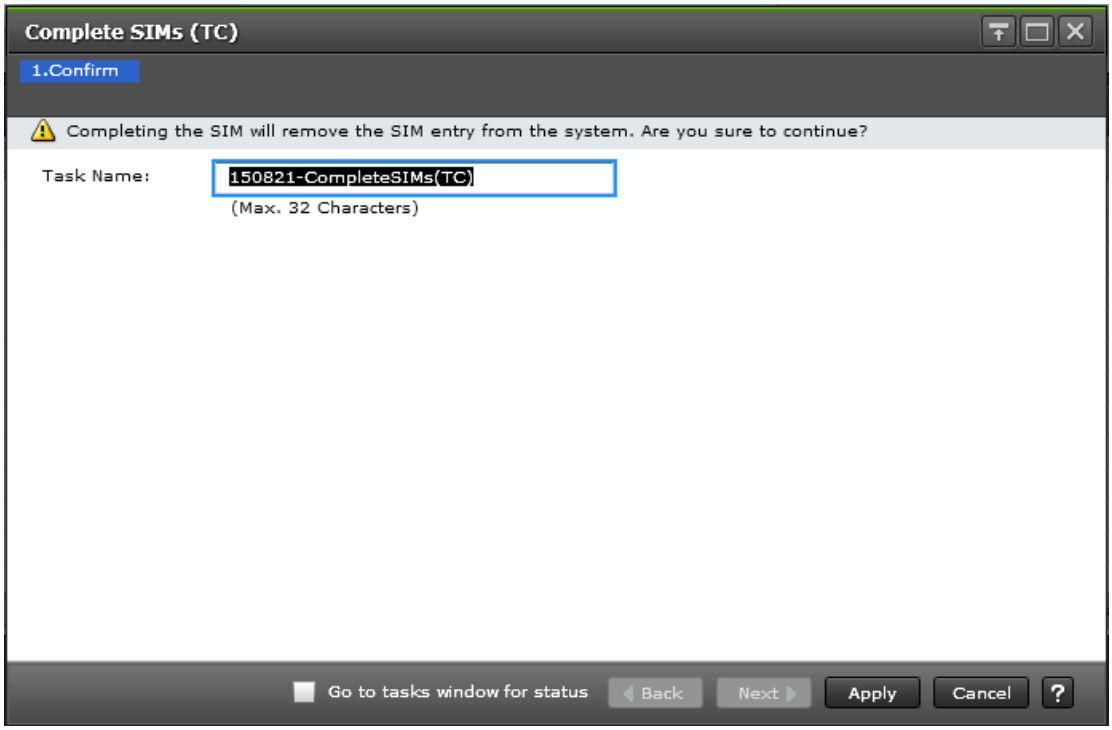
For iSCSI ports

Item	Description
IPv4 Settings	Information about IPv4. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • IP Address: IP address of the port. If 2 or more ports are selected, this information cannot be specified. • Subnet Mask: Subnet mask of the port. • Default Gateway: Default gateway of the port.
IPv6 Mode	Specify this information if IPv6 is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.

Item	Description
	• Enable: IPv6 mode is enabled. If Enable is selected, the IPv6 Settings can be specified. • Disable: IPv6 mode is disabled.
IPv6 Settings	Information about IPv6. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Link Local Address: Link local address for the port. Auto: Sets the link local address automatically. Manual: Sets the link local address manually. Specify the link local address in the text box. • Global Address: Global address for the port. Global Address: If Manual is selected, enter the address for the global address. Global Address 2: If Manual is selected, enter the address for the global address 2. • Default Gateway: Default gateway address for the port.
Port Attribute (VSP G1000, G1500, and VSP F1500)	Specify the attribute of the port: Initiator, Target, RCU Target, or External. If the port attribute is changed from Target or RCU Target to Initiator or External, iSCSI targets that belong to this port are included in meta_resource. iSCSI targets that belong to this port are not displayed in the window.
Port Security	Specify whether to use LUN security on the port. • Enable: Use LUN security on the port. • Disable: Do not use LUN security on the port.
Port Speed	(VSP G1000, G1500, and VSP F1500) The data transfer speed is fixed to 10 Gbps. (VSP Gx00 models and VSP Fx00 models) Select the data transfer speed for the selected port: 1 Gbps, 10 Gbps, or Auto.
TCP Port Number	Specify the TCP port number. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Selective ACK	Specify this information if the selective ACK is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The selective ACK is enabled. • Disable: The selective ACK is disabled.
Delayed ACK	Specify this information if the delayed ACK is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The delayed ACK is enabled. • Disable: The delayed ACK is disabled.
Maximum Window Size	Select the maximum window size from 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Ethernet MTU Size	Select Ethernet MTU size from 1500 bytes, 4500 bytes, or 9000 bytes. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Keep Alive Timer	Specify the interval time to perform the keep alive timer option. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
VLAN Tagging Mode	Specify this information if the VLAN tagging mode is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.

Item	Description
	• Enable: The VLAN tagging mode is enabled and specify the VLAN ID in the text box. • Disable: The VLAN tagging mode is disabled.
iSNS Server	Specify this information if the iSNS server is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The iSNS server mode is enabled. And specify the IP Address and TCP Port Number of the following. • Disable: The iSNS server mode is disabled.
IP Address	Specify the IP address for IPv4 or IPv6. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
TCP Port Number	Specify the TCP port number. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
CHAP User Name	Specify the CHAP user name.
Secret	Specify the secret to be used for host authentication.
Re-enter Secret	Specify the secret again for confirmation.

Complete SIMs (TC) window (VSP G1000, G1500, and VSP F1500)



Item	Description
Task Name	Displays the default name of the task (date in the format *yymmdd* and description) and allows you to enter a different task name (maximum 32 characters).
Go to tasks window for status	When selected, the **Tasks** window opens automatically after you click Apply.

Glossary

A

alternate path

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

ALU

See *administrative logical unit (ALU)*.

ALUA

See *asymmetric logical unit access*.

array

See disk array

array group

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

audit log

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

B

blade

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

C

C/T

See consistency time.

cache

A set of RAM (Random Access Memory) modules used to store data temporarily.

cache logical partition (CLPR)

Virtual cache memory that is set up to be allocated to hosts that are in contention for cache memory. CLPRs can be used to segment storage system cache that is assigned to parity groups.

capacity

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

cascade configuration

In a 3DC cascade configuration for remote replication, data is copied from a local site to an intermediate site and then to a remote site using TrueCopy and Universal Replicator. See also *3DC*.

In a ShadowImage cascade configuration, two layers of secondary volumes can be defined for a single primary volume. Pairs created in the first and second layer are called cascaded pairs.

cascade function

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

cascaded pair

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

CCI

Command Control Interface

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

CLPR

See cache logical partition.

cluster

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

Command Control Interface (CCI)

Software used to control volume replication functionality (such as TrueCopy or ShadowImage) by means of commands issued from a host to a storage system. A command device must be set up in the storage system to enable the storage system to receive commands from CCI.

In an open system, Replication Manager uses the CCI configuration definition files to modify copy pair configurations and to acquire configuration information. Copy pair modification processing, such as splitting and resynchronizing copy pairs, is executed on the storage system via CCI.

command device

A dedicated logical volume used to interface with the storage system. Can be shared by several hosts.

configuration definition file

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

consistency group (CTG)

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

consistency time (C/T)

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

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 pair

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

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

CTG

See *consistency group (CTG)*.

CU

See control unit.

D

data consistency

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

data path

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

data pool

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

delta resync

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

device (dev or DEV)

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.

DHCP

Dynamic Host Configuration Protocol

differential data

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

disaster recovery

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

DKCMAIN

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

DKU

Disk unit

DP-VOL

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

dynamic provisioning (DP)

Presents a virtual pool of shared capacity that is larger than the actual amount of physical storage available. Storage capacity can be allocated to an application without it actually being physically mapped until it is needed, so storage allocations can exceed the amount of storage that is physically installed.

For example, system administrators can deliver capacity on demand by provisioning storage from a virtual pool. This not only reduces administration costs by cutting the time to provision new storage, but also improves application availability by reducing the downtime needed for storage provisioning.

E

emulation

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

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

emulation group

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

external volume

A logical volume whose data resides on drives that are physically located in an externally connected storage system.

F

failback

The process of restoring a system, component, or service in a state of failover back to its original state (before failure).

failover

Automatic switching to a redundant or standby computer server, system, hardware component, or network upon the failure or abnormal termination of the previously active application, server, system, hardware component, or network. Failover and switchover are essentially the same operation, except that failover is automatic and usually operates without warning, while switchover requires human intervention.

free capacity

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

H

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

Custom grouping of hosts that segregates hosts in a meaningful way, for example, a group of hosts that is segregated by operating system. A host group can be shared with another virtual port or another physical port for alternate path support.

host mode

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

host mode option

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

HUR

Hitachi Universal Replicator

I

in-system replication

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

See also *remote replication*.

initial copy

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

initiator

An attribute of the port that is connected to the port with RCU target attribute.

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.

IOPS

I/Os per second

J

JNL

journal

journal group (JNLG)

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

journal volume

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

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

L

L1 pair

See *layer-1 (L1) pair*.

L2 pair

See *layer-2 (L2) pair*.

LBA

logical block address

LCU

logical control unit

LDKC

Logical disk controller

leaf volume

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

license key

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

local copy

See *in-system replication*.

logical device (LDEV)

A volume created in a storage system. See also LU.

logical device (LDEV)

A volume created in a storage system. See also LU.

logical disk controller (LDKC)

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

logical unit (LU)

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

logical unit (LU) path

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

logical unit number (LUN)

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

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

logical volume

An area on a disk consisting of device files that are logically integrated using a volume manager. Also referred to as an LDEV.

LU

See logical unit.

LUN

See logical unit number.

LV

logical volume. See *volume*.

M

M-JNL

See master journal.

master journal (M-JNL)

The primary, or main, journal volume. A master journal holds differential data on the primary replication system until the data is copied to the restore journal (R-JNL) on the secondary system. See also restore journal.

Mbps

megabits per second

MBps

megabytes per second

MIH

missing interrupt handler

mirror

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

MP

microprocessor

O

OPEN-V

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

OPEN-x

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

P

P-VOL

See primary volume.

pair

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

pair status

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

parity group

See *RAID group*.

physical device

See *device*.

pool

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

pool volume (pool-VOL)

A logical volume that is reserved for storing Copy-on-Write Snapshot data or Dynamic Provisioning write data.

port attribute

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

primary site

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

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

primary volume (P-VOL)

In a volume pair, the source volume that is copied to another volume using the volume replication functionality of a storage system. The data on the P-VOL is duplicated synchronously or asynchronously on the secondary volume (S-VOL).

Q

quick format

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

quick restore

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

quick split

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

R

R-JNL

See restore journal.

RAID group

A redundant array of inexpensive drives (RAID) that have the same capacity and are treated as one group for data storage and recovery. A RAID group contains both user data and parity information, which allows the user data to be accessed in the event that one or more of the drives within the RAID group are not available. The RAID level of a RAID group determines the number of data drives and parity drives and how the data

is "striped" across the drives. For RAID1, user data is duplicated within the RAID group, so there is no parity data for RAID1 RAID groups.

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

RAID level

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

RCU

See *remote control unit (RCU)*.

remote control unit (RCU)

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

remote site

See *secondary site*.

restore journal (R-JNL)

The secondary, or remote, journal volume. A restore journal holds differential data on the secondary replication system until the data is copied to the secondary volume (S-VOL). See also master journal (M-JNL).

resync

resynchronize

root volume

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

RPO

See recovery point objective.

RTC

real-time clock

RTO

recovery time objective

S

S-VOL

See secondary volume.

secondary site

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

secondary volume (S-VOL)

After a backup, the volume in a copy pair that is the copy of the original data on the primary volume (P-VOL). Recurring differential data updates keep the data in the S-VOL consistent with the data in the P-VOL.

service information message (SIM)

A message generated by the storage system when it detects an error or a service requirement.

severity level

Applies to service information messages (SIMs) and Device Manager - Storage Navigator error codes.

shared volume

A volume that is being used by more than one replication function. For example, a volume that is the primary volume of a TrueCopy pair and the primary volume of a ShadowImage pair is a shared volume.

sidefile

An area of cache memory that is used to store updated data for later integration into the copied data.

SM

shared memory

SSB

sense byte

T

TID

target ID

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.

V

V-VOL

See *virtual volume*.

V-VOL management area

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

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. Also called a custom volume (CV).

virtual volume (V-VOL)

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

VM

See virtual machine.

volume pair

See *copy pair*.

W

write order

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

WWN

World wide name. A unique identifier for an open systems host. It is typically a node name that is a 64-bit address assigned to HBAs (host bus adapters) or storage system ports that define the endpoints of a Fibre Channel connection between storage and hosts for purposes of volume input/output.

WWN is essential for defining the SANtinel™ parameters because it determines whether the open systems host is to be allowed or denied access to a specified logical unit or a group of logical units.

WWPN

Worldwide port name

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