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Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Universal Volume Manager User Guide

Hitachi Data Systems

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Contents

Preface

This document describes and provides instructions for performing external storage operations using the Universal Volume Manager software on Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP G200, G400, G600, G800) storage systems.

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

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who install, configure, and operate Hitachi Virtual Storage Platform G200, G400, G600, G800 storage systems.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- Hitachi Virtual Storage Platform G200, G400, G600, G800 storage systems and the Hardware Reference Guide for your storage system model.

Note: Universal Volume Manager is not supported on Virtual Storage Platform F400, F600, F800 storage systems.

- Storage systems that are connected to the Hitachi Virtual Storage Platform G200, G400, G600, G800 as external storage.

Product version

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

Release notes

The release notes for this product are available on Hitachi Data Systems Support Connect: https://support.hds.com/en_us/contact-us.html. Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document.

Changes in this revision

- You can now create volumes that are larger than 4 TB
- Added restrictions related to the T10 P1 attribulte.
- Added restrictions related to Data Direct Mapping in several locations.
- Added information about unspecified storage systems. For details, see Storage system with a product name displayed as (generic) on page A-19.
- Added troubleshooting information to HUS and AMS 2000 series guidelines on page A-10.

Referenced documents

Hitachi Virtual Storage Platform G200, G400, G600, G800 documents:

- *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide*, MK-94HM8014
- *Hitachi TrueCopy® User Guide*, MK-94HM8019
- *Hitachi ShadowImage® User Guide*, MK-94HM8021
- *Hitachi Universal Replicator User Guide*, MK-94HM8023

For a list of all documents for the Hitachi Virtual Storage Platform G200, G400, G600, G800 storage system, see the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Product Overview*.

Document conventions

This document uses the following terminology conventions:

Convention	Description
VSP Gx00 models	Refers to all models of the Hitachi Virtual Storage Platform G200, G400, G600, G800 storage systems, 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 models of the Hitachi Virtual Storage Platform F400, F600, F800 storage systems, 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: • Variables are not clearly separated from the surrounding text or from other variables. Example: `Status-<report-name><file-version>.csv`

Convention	Description
	• Variables in headings.
[ ] (square brackets)	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } (braces)	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| (vertical bar)	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.
↓*value*↓ floor floor(*value*)	Floor function (round down value to the next integer)
↑*value*↑ ceiling ceiling(*value*)	Ceiling function (round up *value* to the next integer)
_ (underlined text)	Default value

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

Icon	Label	Description
	Note	Calls attention to important or additional information.
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Important	Calls attention to important or additional information.
	Caution	Warns the user of adverse conditions or consequences (for example, disruptive operations).
	WARNING	Warns the user of severe conditions or consequences (for example, destructive operations).

Convention for storage capacity values

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

Physical capacity unit	Value
1 kilobyte (KB)	1,000 (10^3) bytes
1 megabyte (MB)	1,000 KB or $1{,}000^2$ bytes

Physical capacity unit	Value
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 storage capacity values (logical device capacity) are calculated based on the following values:

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

Accessing product documentation

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

Getting help

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

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

Comments

Please send us your comments on this document: doc.comments@hds.com. Include the document title, number, and 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

With Hitachi Universal Volume Manager, you connect volumes in external storage systems to Virtual Storage Platform G200, G400, G600, G800 and manage them as if they were one system.

This guide provides information and instructions for planning, set up, maintenance, and troubleshooting the use of external volumes with Virtual Storage Platform G200, G400, G600, G800 storage system and its software products.

Note that Universal Volume Manager is not supported on Virtual Storage Platform F400, F600, F800 storage systems.

- ☐ Features—multiple systems, common management
- ☐ How Universal Volume Manager works
- ☐ Typical components
- ☐ External storage system
- ☐ External volume
- ☐ Internal volume
- ☐ License
- ☐ Interfaces

Features—multiple systems, common management

When a system consists of multiple storage systems, a host must usually be connected to all of the systems. When a system administrator configures the connections from the host to volumes, he or she follows different instructions for each of the storage systems.

With Universal Volume Manager, the administrator configures the connection from the host to the Virtual Storage Platform G200, G400, G600, G800 storage system, then can manipulate mapped volumes in an external storage system in the same way as volumes in the Virtual Storage Platform G200, G400, G600, G800 storage system.

Operations between storage systems can also involve different procedures. But with Universal Volume Manager, you perform them with the same Hitachi software as when you use Virtual Storage Platform G200, G400, G600, G800 systems.

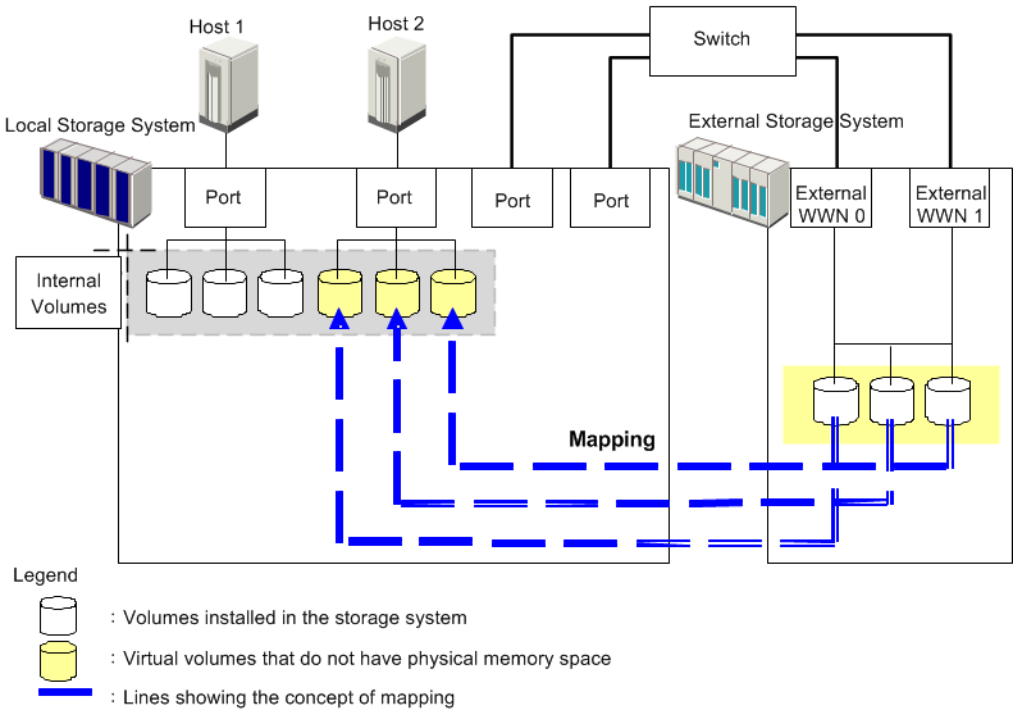
For example, you will use the desired Hitachi replication program for copy operations between Virtual Storage Platform G200, G400, G600, G800 and the external systems, including the following:

- Copying data from a volume in Virtual Storage Platform G200, G400, G600, G800 to a volume in the external system.
- Copying data from a volume in an external system to a volume in another external system.

How Universal Volume Manager works

A volume in an external storage system becomes an internal volume in Virtual Storage Platform G200, G400, G600, G800 when you map to it.

- A local system port must be connected to the external storage system port with a fiber cable. This route between ports is the "external path".
- The external volume is represented in the Virtual Storage Platform G200, G400, G600, G800 as an internal volume, and the path between them is the "mapping path".
- The figure below shows the connection between the local and external storage systems. In this figure, the external system is connected to the local system's "external ports" via a switch using the cable. An "external port" is an attribute assigned to Virtual Storage Platform G200, G400, G600, G800 ports.



Multiple external storage systems can be connected to one external port. You can add an additional external storage system even when the external port is already in use.

Note: Mapped external volumes must be accessed and copied only by hosts that are connected to the Virtual Storage Platform G200, G400, G600, G800, not by hosts connected to the external systems.

Logical devices (LDEVs) are created during or after the mapping operation. If created after mapping, the LDEVs are created in the same way they are when you create normal internal volumes using Virtual LUN. As shown in the figure, LDEVs in mapped external volumes are required for use in the local system.

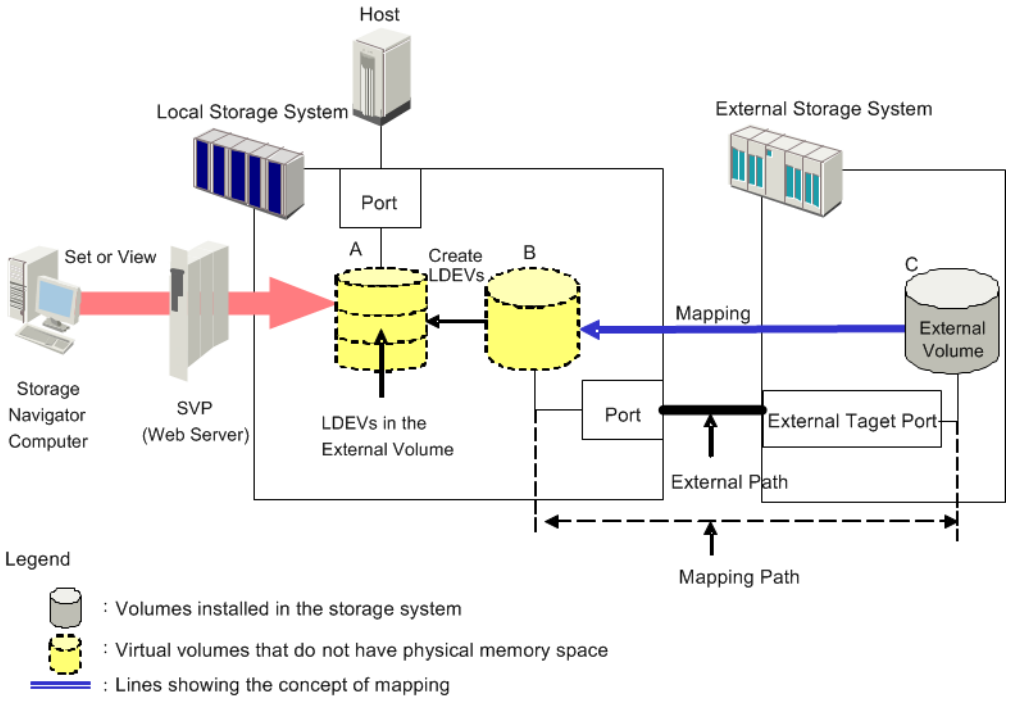
Typical components

Virtual Storage Platform G200, G400, G600, G800 consists of the following components:

- Virtual Storage Platform G200, G400, G600, G800 storage system, referred to as the "local storage system"
- Universal Volume Manager license
- An external storage system
- An external volume mapped to the local system. In the local system, the mapped external volume is referred to as an "internal volume", and is a virtual representation of the external volume.
- LDEVs (logical devices).

- Hitachi Storage Navigator, Command Control Interface software, and/or Hitachi Command Line Interface
- External path
- Mapping path

These components are illustrated in the following figure, and discussed in more detail below.



External storage system

Virtual Storage Platform G200, G400, G600, G800 can connect to other Hitachi storage systems, original equipment manufacturer (OEM) systems, and other vendors' systems (such as IBM or EMC). Hosts recognize volumes in these other systems as "internal volumes" of the Virtual Storage Platform G200, G400, G600, G800.

External volume

A volume in the external storage system that is mapped to the local storage system.

Internal volume

A volume managed by the local storage system. An internal volume can be a physical volume or the virtual representation of an external volume.

License

Universal Volume Manager is a Hitachi software product requiring installation of a license key.

Interfaces

You can perform Universal Volume Manager operations using the following interfaces:

- Hitachi Device Manager - Storage Navigator
- Command Control Interface
- Spreadsheets

Hitachi Device Manager - Storage Navigator

The Hitachi graphical user interface used to manage the Virtual Storage Platform G200, G400, G600, G800 system and the connected external storage volumes. Device Manager - Storage Navigator is run from a browser on the user-supplied computer. The operations described in this document are performed using Device Manager - Storage Navigator.

Command Control Interface software

CCI provides a command line interface to perform most of the same operations as Device Manager - Storage Navigator. CCI operations are issued directly from the host, and can be automated using scripts. External volumes can be used as remote command devices.

Spreadsheets

With spreadsheets, you can schedule and perform the following Universal Volume Manager operations.

- Map external volumes with multiple or single LDEVs to the local system
- Retrieve information about mapped external volumes
- Retrieve information about external volume groups configured to the local system
- Disconnect and reconnect an external volume or an external storage system
- Delete external volume mapping
- Move an external volumes from one path group to another existing group or to a new group.

Mapping policy

Mapping policy is a configuration overview which lists the information required for external volume mapping. Setting the mapping policy beforehand makes external volume mapping easier.

The policy is already available. You can change the default value of the policy.

Related Topics

- Editing mapping policies on page 5-29
- Edit Policies window on page D-29

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Requirements and considerations

This topic describes requirements and considerations.

Planning workflow

Before mapping an external volume to Virtual Storage Platform G200, G400, G600, G800, review the information in this chapter to make sure that you understand the Universal Volume Manager requirements and implementation procedures.

Use the general order in the following to prepare for Universal Volume Manager:

- Review System requirements on page 2-2.
- Ensure that the external system whose volumes you want to map is supported by Universal Volume Manager. See Appendix A, Supported external storage systems on page A-1.
- Ensure the functionality you want is supported for mapped external volumes. See Chapter 3, Supported software for external volumes on page 3-1.
- In the external system, select a port and set any necessary parameters.
- In the local system, identify the port that will connect to the external system.
- Plan data paths from the local to the external system. See Supported storage systems for external storage systems on page 2-12.
- In the external system, prepare volumes for use in the local system. For example, if you plan to use an external volume for replication, make sure it matches the Hitachi replication software's requirements.

  See Planning external volumes on page 2-7.
- In the local storage system, configure external volume groups to which you will assign the external volume during the mapping operation.
- You can change the defaults for some mapping settings before performing the operation. See Editing mapping policies on page 5-29.

System requirements

Universal Volume Manager (UVM) operations are performed between the local storage system—Virtual Storage Platform G200, G400, G600, G800—and volumes in an external storage system. General requirements for these and all UVM components are described below.

Item	Description
VSP G200, G400, G600, G800 **Note:** Universal Volume Manager is not supported on Virtual Storage Platform F400, F600, F800 storage systems.	• Required for the UVM local storage system. • All hardware and firmware levels must be installed.

Item	Description
External storage systems	One is required, multiple external systems are supported per Virtual Storage Platform G200, G400, G600, G800. See Appendix A, Supported external storage systems on page A-1 for related details about each supported external storage system.
UVM license key	Required.
Device Manager - Storage Navigator	Required.
External volume RAID level	External volumes are reported as RAID 1 in the following displays: • Virtual Storage Platform G200, G400, G600, G800 internal processing. (A hypen (-) displays on the Device Manager - Storage Navigator windows.) • Information about the external storage system that is reported to a higher-level device (OS). Internally, Virtual Storage Platform G200, G400, G600, G800 uses RAID 1 cache management for external volumes. The external storage controller is responsible for physical RAID methods.
Maximum ports in external storage system	• 1,024 ports can be connected with Virtual Storage Platform G200, G400, G600, G800. • (WWN is used as a port identification number)
Maximum No. of ext. vol. that can be mapped	• VSP G200: 2,048 • VSP G400, VSP G600: 4,096 • VSP G800: 14,080 • For Thin Image and Dynamic Provisioning: `Number of external volumes + Number of virtual volumes ≤ 14,080`
Maximum No. of ext. vol. groups	• VSP G200: 2,048 • VSP G400, VSP G600: 4,096 • VSP G800: 16,384
Maximum No. of vols. that can be registered per ext. vol. group	• VSP G200: 2,048 • VSP G400, VSP G600, VSP G800: 4,096
Maximum No. of mapping paths	• 8 per external volume
Maximum capacity of an internal volume	If mapping an external volume of up to 4TB in an external storage system, the internal volume will be defined as 1 LDEV (LU), which is the same as the external volume. You cannot access data that exceeds the maximum capacity of the external volume.
Minimum capacity of an ext. vol.	• If Data Direct Mapping is enabled: 16,777,216 blocks (about 8,192 MB) per external volume • If Data Direct Mapping is disabled: 96,000 blocks (about 47 MB) per external volume

Item	Description
Maximum capacity of an ext. vol.	• 59.99TB (128,849,011,200 blocks) • If it is 59.99TB or more, you can use a volume of up to 59.99TB. You cannot access a mapped external volume that exceeds 59.99TB.
Maximum No. of ext. vols. that can be mapped per port	If a port is connected through switches to several target ports on an external storage system, the maximum number of LUs defined for the connected target ports is: • VSP G200: 2,048 • VSP G400, VSP G600, VSP G800: 4,096
System Option Mode	Host I/O performance to mapped volumes (for sequential write performance only) can be improved by setting SOM 872 to ON. For more information, call Hitachi Data Systems customer support.

Considerations for Universal Volume Manager operations

This section provides information about considerations for Universal Volume Manager operations.

An external storage system's performance is affected by local system operations; conversely, performance of the host and local system are affected by the attributes assigned to the external system.

Note the following regarding performance:

- The performance and status of the external system affect read/write performance of the mapped external volume. A heavy load on the external system slows the processing speed of read/write operations.
- If the host connected to the local storage system issues numerous I/O to be processed by the external storage system, the commands from the host may time out.
- When you execute Virtual Storage Platform G200, G400, G600, G800 software commands that result in more I/O processed than the external storage system can handle, the commands could time out and an error may occur.
- When you manipulate an external volume from the host, check the Blocked Path Monitoring time for the external volume. If the value for this setting is longer than the timeout period of the host command, the host command may time out when the power supply is off or when an error occurs in the external storage system. If host I/O is a significant concern, make sure that the Blocked Path Monitoring time of the external volume is the same as or shorter than the timeout period of the host command.

Related Topics

- Considerations when mapping on page 2-5
- Considerations for external volume attributes on page 2-6

- Considerations for external storage system maintenance (remapping) on page 2-6
- Considerations for using iSCSI on page 2-8

Considerations when mapping

- An external volume that is set to reserved on the host cannot be mapped. The reservation must be removed before the volume is mapped or remapped.
- A mapped external volume should be accessed only from the local storage system.
  - The mapped external volume should not be accessed from a host connected to an external storage system.
  - Operations involving copy or other functions should not be run on a mapped external volume from an external storage system.
  - The mapped external volume must be disconnected from the external storage system before the mapped volume is accessed.
- External volumes that are set to reserved on the host cannot be mapped as internal volumes. Before mapping these volumes, the reserve settings must be cancelled and host access to the volumes must be removed.
- Do not map multi-platform volumes of external storage systems as internal volumes.
- When an external storage system that uses control unit path ownership is connected to the storage system, the external path to the primary controller of the external storage system should be set as the primary path.

  Ownership is exclusively restricted to the control volumes. A controller that has ownership is called a primary controller. If the external path is connected to a controller that does not have ownership, and the path is configured as primary path, the ownership will be transferred. That transfer could affect performance.
- Before the settings of an external storage system are changed, mapping to volumes on the local storage system must be removed by selecting **Disconnect External Volumes**. After the external storage system settings are changed, volumes can be remapped. Unless external volumes are remapped, they cannot be used on the local storage system.
- If an LU path is configured on an internal volume mapped to an external volume, the external volume mapping cannot be deleted.
- If the volume is used in creating a TrueCopy, Universal Replicator, ShadowImage, Thin Image pair, or global-active device pair, the external volume mapping cannot be deleted.
- If the external volume is configured as a pool volume, the external volume mapping cannot be deleted.
- If the external volume is configured as a quorum disk, the external volume mapping cannot be deleted.

Related Topics

- Mapping an external volume on page 4-8
- Deleting external volume mapping on page 5-30

Considerations for external volume attributes

- All the external volume attributes of an LDEV created within the external volume are the same. These attributes persist even when an LDEV is recreated with the VLL function.
- All LDEVs within an external volume have the same cache mode.
- Attributes, such as port or LUN security, set for a volume on the external storage system side persist when the volume is mapped.
- Mapped volume settings can be made on the local storage system side as necessary.
- Volumes for which the T10 P1 attribute is enabled cannot be specified as an external volume.

Related Topics

- Mapping an external volume on page 4-8

Considerations for external storage system maintenance (remapping)

You must disconnect the external system and delete external volume mapping before making changes on the external system. When the changes are concluded, you reconnect the system and remap the external volume.

The following changes to the external system require the removal and remapping of the external volume:

- Changing WWNs of target ports that connect to the local storage system
- Changing the serial number of the external system
- Changing LUNs of volumes in the external system
- Reducing the volume capacity of the external volume
- Modification on the host connected directly to a external storage system.

Changing the WWNs of the external storage system without deleting the external volume mapping

If you want to change the WWNs of part of the target ports that are connected to the local storage system, you do not need to delete the volumes that are mapped to the local storage system.

1. Change the WWN of the external storage.

See the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide* for detailed procedures. Changing the WWN blocks the external path that uses the target port with a WWN that has been changed.

2. Add an external path between the local storage system and target port with a WWN that has been changed
3. Delete the external path that was blocked in step 1.

Before deleting external volume mapping, make sure that the volume has no LU paths and is not part of a copy pair. See Deleting external volume mapping on page 5-30 for instructions.

Planning external volumes

External volumes must be set up to match Universal Volume Manager requirements. Note the following:

- You can use pre-existing data in an external volume after it is mapped to the local system, with the following restrictions:
  - To perform host I/O operations, an LU path from the Target port to the mapped volume must be set.
- An external volume's maximum or minimum available capacity depends on the emulation type you specify when mapping the volume.
- You cannot access data stored in an external volume beyond the allowed maximum capacity. See the Maximum capacity of an external volume row in System requirements on page 2-2.
- You cannot map an external volume whose capacity is smaller than the minimum capacity required for internal volumes.
- Make sure that a mapped external volume is accessed only from the local Virtual Storage Platform G200, G400, G600, G800 storage system.
  - Make sure that a mapped external volume is not accessed from a host that is connected to the external storage system.
  - Make sure that a mapped external volume is not manipulated by a copy function or any other functions of the external storage system.
  - Accessing a mapped external volume from the external storage system requires that the volume mapping be disconnected first.
- External volumes that are reserved by a host cannot be mapped as internal volumes. To map these volumes, cancel the reserve settings, remove host access to the volumes, and then perform the mapping operation.
- Do not map multi-platform volumes of external storage systems as internal volumes.
- When an external storage system that uses control unit path ownership is connected to Virtual Storage Platform G200, G400, G600, G800, configure the external path to the primary controller in the external storage system as the primary path.

Ownership is the exclusive right to control volumes. A controller that has ownership is called a primary controller. If the external path is connected to a controller that does not have ownership, and the path is configured as primary path, the ownership will be transferred, which may affect performance.

Cache use and external storage performance

Performance for external storage used with Virtual Storage Platform G200, G400, G600, G800 is highly dependent on proper cache configuration. The Cache Mode setting, which you specify during the mapping operation, affects external storage performance.

When data is written to the mapped external volume, Cache Mode controls when the write-complete response is sent to the host,

- When Enabled is specified, the write-complete response is sent when the write data is in Virtual Storage Platform G200, G400, G600, G800 cache.
- When Disabled is specified, the write-complete response is sent when the write data is accepted by the external system.

Disabled is the safest setting and is recommended when there is a possibility that the I/O rate will exceed the short term capabilities of the external storage.

Enabled can adversely impact overall Virtual Storage Platform G200, G400, G600, G800 performance if the I/O rate exceeds the performance capabilities of the external system. If you specify Enabled, you should use the same formula for sizing cache in both the internal and external systems.

A cache partition should be defined when Enabled is used for the Cache Mode setting. A CLPR helps to protect overall Virtual Storage Platform G200, G400, G600, G800 performance when the I/O rate tends to exceed the capabilities of the external system.

Cache Mode effects with other Hitachi software

Note the following additional effects regarding the **Cache Mode** setting:

- The external volumes in a Dynamic Provisioning pool must all use the same Cache Mode setting, either Enabled or Disabled.
- Dynamic Tiering pool volumes require Cache Mode to be set to Enabled.
- Data that is not written by the host (for example, data written by ShadowImage) is asynchronously destaged to the external storage system regardless of the Cache Mode setting.

Considerations for using iSCSI

Before configuring a system that uses iSCSI, review the following considerations. For details about iSCSI, see the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide*. For other

consdireations when using Universal Volume Manager, see Considerations for Universal Volume Manager operations on page 2-4.

Considerations for external paths

When adding an external path to a path group, make sure that it uses the same protocol as the other paths in the group. External paths for Fibre Channel and iSCSI cannot exist in the same path group.

Considerations for data paths

- When replacing Fibre Channel or iSCSI data paths, first remove any external paths that use the data paths to be replaced.
- Use the same protocol for data paths between a host and a storage system, or between storage systems.

When Fibre Channel is used in a data path between a host and a storage system, and iSCSI is used for a data path between storage systems, different protocols are used in the data path. In this case, set a value which is equal to or greater than the timeout period for the command between storage systems as the timeout period of the command between the host and the storage system.

Considerations for ports

- When you change parameter settings for an iSCSI port, the iSCSI connection is temporarily disconnected, and then reconnected. Therefore, you should change parameter settings when the I/O load is low to reduce impact on the system.
- When you change settings for an iSCSI port connected to a host, log information might be output to the host. However, this does not indicate a failure. In a system that monitors system logs, if an alert is issued, change the iSCSI port settings, and then check if the host is reconnected.
- If you use iSCSI for the connection between storage systems and the same port for the connection to hosts, in the **Edit Ports** window, set **Delayed ACK** to **Disable**.

  If **Delayed ACK** is set to the default value **Enable**, the host might take a long time to recognize external volumes. For example, 2,048 volumes might take 8 minutes.
- In the **Edit Ports** window, **Selective ACK** is set to **Enable** by default. Do not change this setting.
- In an environment in which a delay occurs in a line between storage systems, such as long-distance connections, we recommend trying various sizes, and then setting an optimal window size of iSCSI ports in storage systems at the primary and secondary sites. The maximum value you can set is 1,024 KB. Note that the default window size is 64 KB.
- In Universal Volume Manager, an external path connection is established for each iSCSI target of an external storage system. The maximum number of iSCSI external paths for each storage system is 512. However, we recommend you set no more than 127 external paths for each port.

- iSCSI ports do not support the fragmentation (splitting packets) functionality. If the maximum transfer unit (MTU) of a switch is smaller than the MTU of the iSCSI port, packets are lost and communication might not be performed correctly. To avoid this problem, set the same MTU value for the iSCSI port and switch. Note that the MTU value for the iSCSI port must be 1500 or higher.

  In a WAN environment in which the MTU value is smaller than 1500, fragmented data cannot be sent or received. In such environment, set a smaller value for the maximum segment size (MSS) of the WAN router according to the WAN environment, and then connect the iSCSI port. Alternatively, use iSCSI in an environment in which the MTU value is 1500 or higher.
- A single port can be used for connections to hosts (target attribute) and storage systems (initiator attribute). However, to minimize the influence to the system if a failure occurs either in a host or storage system, we recommend that you connect ports for hosts and storage systems to separate CHBs.

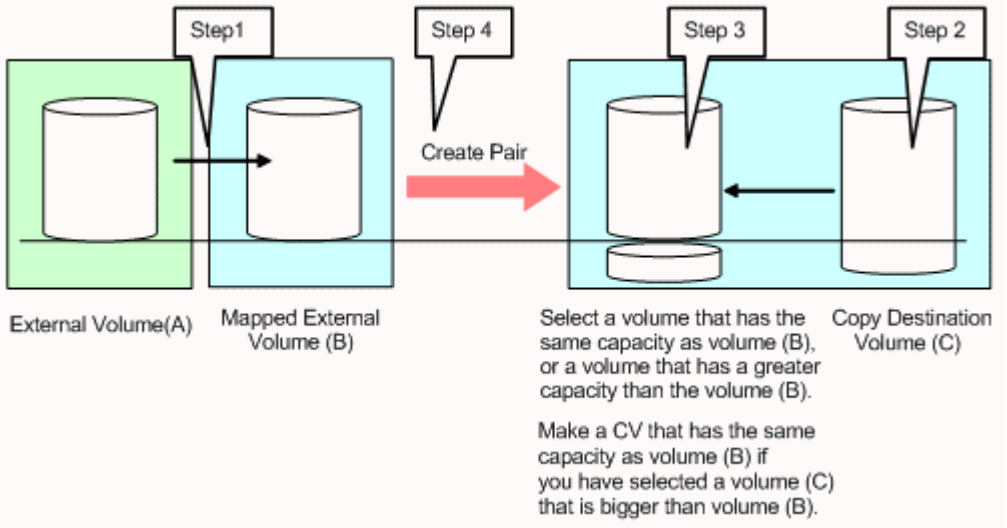
Notes on network settings

- We recommend that you disable the spanning tree setting on the port of a switch connecting to an iSCSI port. If you enable the spanning tree functionality of a switch, packets might not be looped in the network when the link is up or down. If this happens, the packets might be blocked for approximately 30 seconds. If you must enable the spanning tree settings, enable the port fast functionality of the switch.
- In a network path between storage systems, if you use a line whose transfer speed is slower than the iSCSI port, packets are lost and the line quality is degraded. To avoid this problem, configure the system so that the transfer speed for iSCSI ports and lines is the same.
- The delay in the line between storage systems varies depending on the system environment. Therefore, validate the system first, and then check the optimum window size settings of iSCSI ports. If the influence of the line delay is unacceptable, consider using devices for optimizing or accelerating the WAN speed.
- If you use iSCSI, packets are sent or received using TCP/IP. Therefore, the number of packets might exceed the capacity of the communication line, or packets might be resent. As a result, performance might be greatly affected. Therefore, in critical systems that rely on performance, use Fibre Channel.
- If the external storage system is in the HUS 100 series, the number of iSCSI targets you can search for is limited. If the iSCSI target name is 47 characters (default), you can search up to 170 iSCSI targets.

Copying external storage system data

The following procedure explains how to use external volumes as P-VOLs and S-VOLs of copy pairs in order to copy data to and from external storage systems.

To use an external volume as a P-VOL in order to copy data from the external storage system:

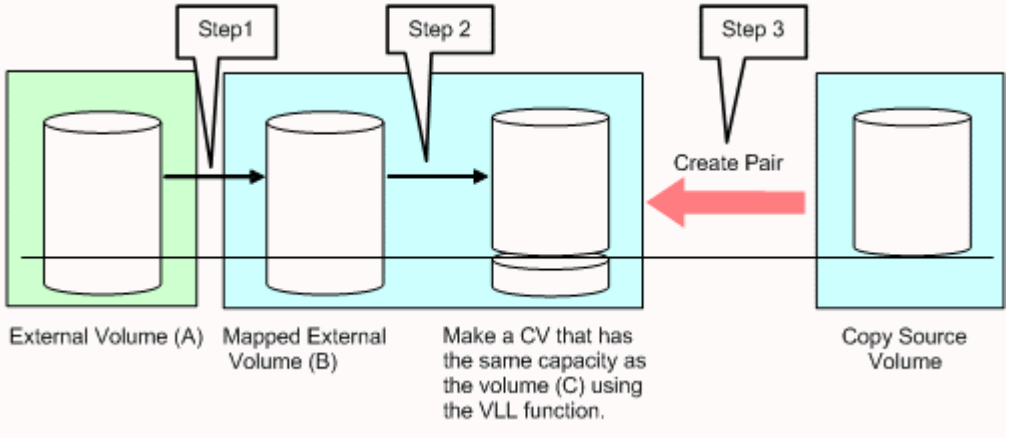


1. Map external volume (A) to internal volume (B) of the local storage system using Universal Volume Manager. You will use volume (B) as the P-VOL of a copy pair.
2. Check the capacity of internal volume (B) to which external volume (A) is mapped, and select a copy destination volume (C) that has the same or greater capacity than volume (B). You will use copy destination volume (C) as the S-VOL of the copy pair.
3. If the copy destination volume (C) is bigger than volume (B), create a CV that has the same capacity as volume (B) using the VLL function. Create the CV using the block value displayed in the **Mapped Volumes** tab in the selected external path group window.
4. Create the copy pair using volume (B) as the P-VOL and volume (C) as the S-VOL. This configuration makes a copy of external volume (A).

Related Topics

- Selected external path group window on page D-10
- Chapter 3, Supported software for external volumes on page 3-1

To use an external volume as an S-VOL in order to copy data to the external storage system:



1. Map external volume (A) to internal volume (B) of the local storage system using Universal Volume Manager. You will use volume (B) as the S-VOL of a copy pair.
2. Check the capacity of internal volume (B) to which external volume (A) is mapped. If the capacity of internal volume (B) is different than the copy source volume (C), create a CV that has the same capacity as the copy source volume (C) using the VLL function.
3. Create the copy pair using copy source volume (C) as the P-VOL and volume (B) as the S-VOL. This configuration makes a copy of the source volume on external volume (A).

Related Topics

- Chapter 3, Supported software for external volumes on page 3-1

Supported storage systems for external storage systems

The following table shows the path mode for many of the supported external storage systems. The table also shows the abbreviation used in Device Manager - Storage Navigator.

If your system is not shown below, contact Hitachi Data Systems customer support.

Storage System	Reference
VSP G200, G400, G600, G800	• Path Mode: Multi • Displays as "VSP Gx00".
Hitachi Virtual Storage Platform G1000	• Path Mode: Multi • Displays as "Hitachi Virtual Storage Platform G1000".
Unified Storage VM	• Path Mode: Multi • Displays as "HUS VM".

Storage System	Reference
Hitachi Virtual Storage Platform	• Path Mode: Multi • Displays as "VSP".
Hitachi Universal Storage Platform V	• Path Mode: Multi • Displays as "USP V".
Hitachi Universal Storage Platform VM	• Path Mode: Multi • Displays as "USP VM".
Hitachi TagmaStore® Universal Storage Platform	• Path Mode: Multi • Displayed "USP".
Hitachi TagmaStore® Universal Storage Platform	• Path Mode: Multi • Displays as "NSC".
Hitachi Unified Storage	• Path Mode: Multi • Displays as "HUS".
Hitachi Adaptable Modular Storage	• Path Mode: - Multi: AMS2500, AMS2300, AMS2100, or AMS2010 - Single: AMS1000, AMS500, or AMS200 • Displays as "AMS".
Hitachi Workgroup Modular Storage	• Path Mode: Single • Displays as "WMS".
Hitachi Simple Modular Storage	• Path Mode: Multi • Displays as "SMS".
Hitachi Lightning 9900 V Series	• Path Mode: Multi • Displays as "9970V" and "9980V".
Hitachi Lightning 9900 Series	• Path Mode: Multi • Displays as: - Lightning 9960: "0400". - Lightning 9910: "0401".
Hitachi Thunder 9500V series	• Path Mode: Single • Displays as "9500V".
Hitachi SANRISE Universal Storage Platform	• Path Mode: Multi • Displays as "USP".
Hitachi SANRISE Network Storage Controller	• Path Mode: Multi • Displays as "NSC".
Hitachi SANRISE 9900V series	• Path Mode: Multi • Displays as "9970V" and "9980V".
Hitachi SANRISE 9500V series	• Path Mode: Single • Displays as "9500V".

Storage System	Reference
Hitachi SANRISE 2000 series	• Path Mode: Multi • Displays as: - SANRISE 2800: "0400". - SANRISE 2200: "0401".
HP Virtual Storage Platform VX7	• Path Mode: Multi • Displays as "XP7".
HP Virtual Storage Platform VP9500	• Path Mode: Multi • Displays as "P9500".
A/H-6593	• Path Mode: Multi • Displays as "300".
HP H24000	• Path Mode: Multi • Displays as "24000".
HP H20000	• Path Mode: Multi • Displays as "20000".
HP SANRISE H12000	• Path Mode: Multi • Displays as "12000".
HP SANRISE H10000	• Path Mode: Multi • Displays as "10000".
HP SANRISE H1024/ H128	• Path Mode: Multi • Displays as "1024" and "128".
HP SANRISE H512/H48	• Path Mode: Multi • Displays as "512" and "48".
HP SANRISE H256	• Path Mode: Multi • Displays as "256".
HP XP7 Storage	• Path Mode: Multi • Displays as "XP7".
HP StorageWorks P9500	• Path Mode: Multi • Displays as "P9500".
HP XP24000	• Path Mode: Multi • Displays as "24000".
HP XP20000	• Path Mode: Multi • Displays as "20000".
HP XP12000	• Path Mode: Multi • Displays as "12000".
HP XP10000	• Path Mode: Multi • Displays as "10000".
HP XP1024/XP128	• Path Mode: Multi • Displays as "1024" and "128".

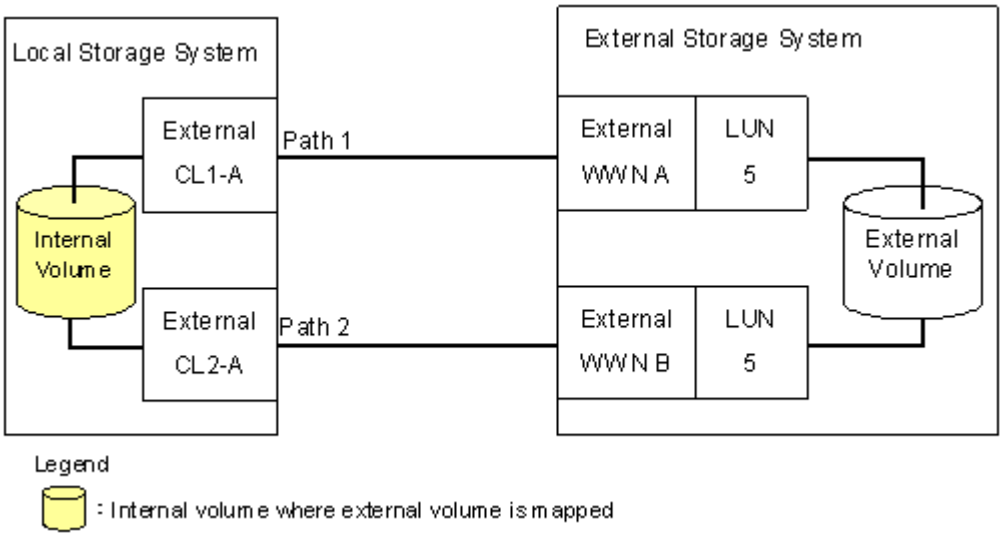
Storage System	Reference
HP XP512/XP48	• Path Mode: Multi • Displays as "512" and "48".
HP XP256	• Path Mode: Multi • Displays as "256".
HP StorageWorks Enterprise Virtual Array 3000/4000/5000/6000/8000	• Path Mode: Single • Displays as "EVA".
SVS200	• Path Mode: Multi • Displays as SVS200.

External path configurations — direct and switch

This topic provides recommendations for setting up direct and switch external path configurations.

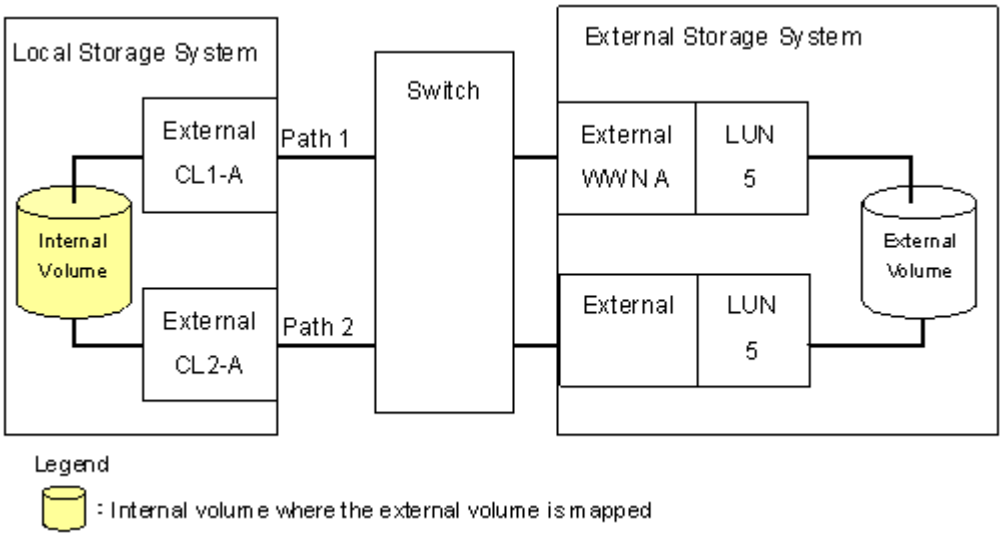
Direct connection

The following figure shows redundant paths in a direct connection configuration. External storage system ports, "WWN A" and "WWN B", are connected to the local system ports, "CL1-A" and "CL2-A". For greater redundancy, Path 2, the alternate path, uses ports of a different cluster in both the local and external storage systems.



Switch connection

The following figure shows redundant paths with switches. Ports in the local system are connected to ports in the external system through the switch. The paths use ports of different clusters for increased redundancy.


Local Storage System
External
CL1-A
Path 1
Switch
External Storage System
External
WWN A
LUN
5
Internal
Volume
External
Volume
External
CL2-A
Path 2
External
LUN
5
Legend
: Internal volume where the external volume is mapped

3

Supported software for external volumes

You will use Virtual Storage Platform G200, G400, G600, G800 software products and functionality to manage and manipulate data in your mapped volumes: for example, Virtual LUN, TrueCopy, LUN Manager, and so on.

This topic provides requirements and restrictions for the Hitachi software supported with external volumes.

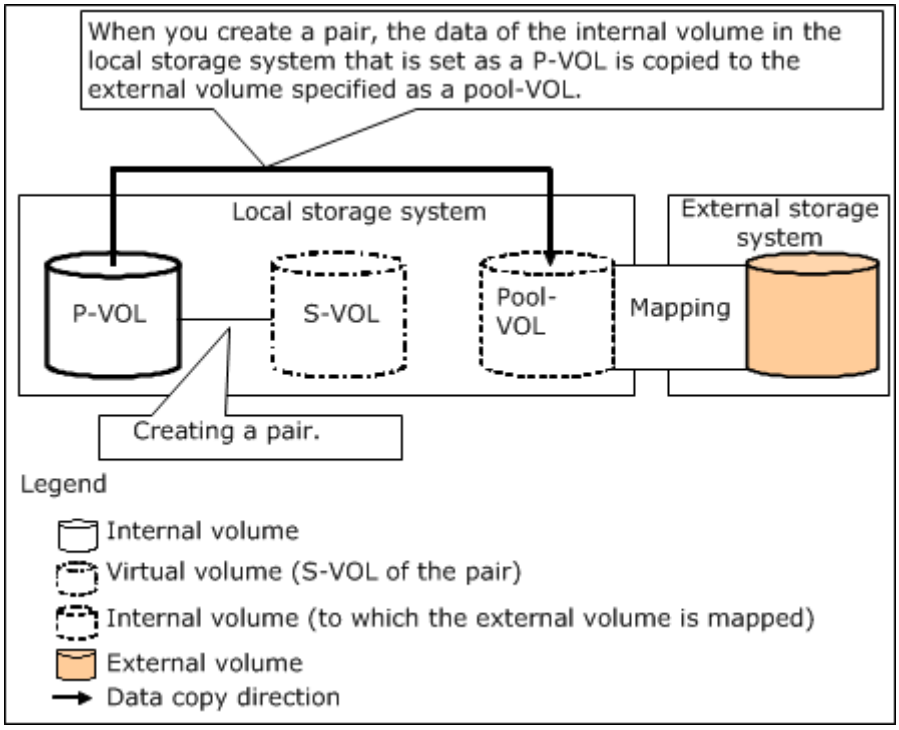
- Thin Image
- Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image
- Global-active device
- Local replication software
- LUN Manager and Configuration File Loader
- Performance Monitor
- Remote replication software
- SNMP Agent

Thin Image

Mapped volumes can be used in pairs for Thin Image, with the following restrictions:

- Both internal and external volumes cannot be used together in the same pool.
- All external volumes in a pool must use the same **Cache Mode** setting.

After mapping and formatting an external volume, it is ready to use as a pair volume. The following figure shows an example of an external volume used as a Pool-Vol.



Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image

Mapped external volumes can be used as pool volumes for Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image.

- If you are using Thin Image pool, all external volumes in the same pool must use the same **Cache Mode** setting. For more information about this setting, see Cache use and external storage performance on page 2-8.
- With Dynamic Tiering, the **Cache Mode** setting must be **Enabled**.
- Mapped external volumes can be used as a quorum disk of a global-active device, but cannot be used as a pair volume for a global-active device.

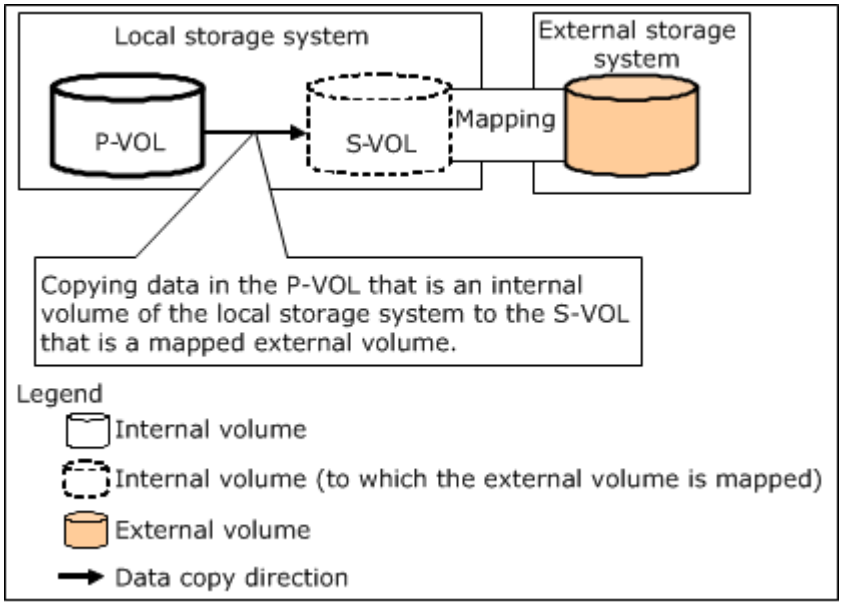
Global-active device

Mapped external volumes can be used as the global-active device quorum disk. They cannot be used as a pair volume for a global-active device.

Local replication software

Mapped volumes can be used in pairs for ShadowImage.

After mapping and formatting an external volume, it is ready to use as a pair volume. The following figure shows an example of an external volume used as an S-VOL.



LUN Manager and Configuration File Loader

Use LUN Manager to set the LU path.

Some LUN Manager operations can be performed using spreadsheets and the Configuration File Loader function. When using external volumes, you can use Configuration File Loader for the following operations:

- Set the LU path definition for an external volume (add, delete, or change LU paths).
- Set an external volume as a command device (add or delete the setting).
- Setting the channel adapter (CHA) mode, host group, and WWN for the port connected to the external storage system is not supported. When an external volume is mapped through a port, the port setting operation of the topology is not available.

Performance Monitor

Performance Monitor can be used to display monitoring information for mapped external volumes.

Remote replication software

Mapped external volumes can be used with the following remote replication software:

- TrueCopy
- Universal Replicator

After mapping and formatting an external volume, it is ready to use as a pair volume. The following figures show examples of an external volume used as an S-VOL.

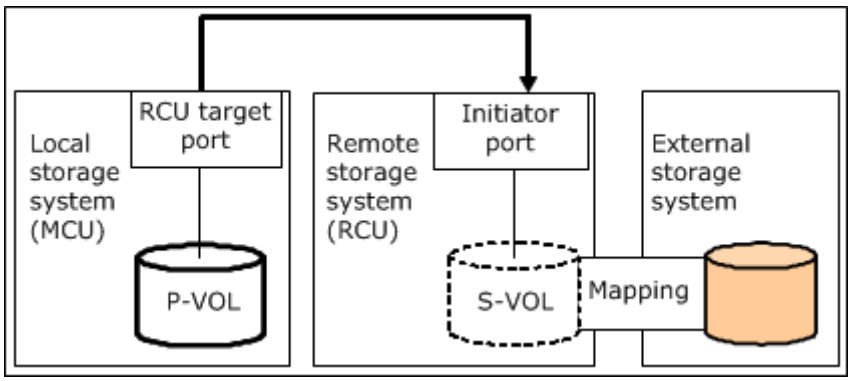


Figure 3-1 UR example using a mapped external volume

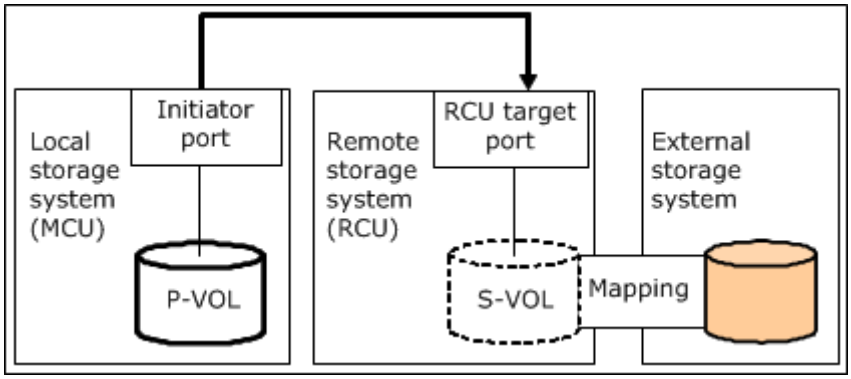


Figure 3-2 TC example using a mapped external volume

SNMP Agent

Information about the port connected to external storage can be displayed by SNMP Agent.

4

Setting up external volume connections

This section provides information and procedures for setting up external volume connections.

Setup workflow

When you begin setting up Universal Volume Manager, all planning tasks and considerations should be completed. Consult the topics in Planning workflow on page 2-2 to review.

Set up external volumes as follows:

1. To edit certain mapping settings prior to the mapping operation, see Editing mapping policies on page 5-29. Otherwise, you can make changes during the operation or accept the default settings.
2. Map the external volume as the internal volume.
   For more information, see Mapping an external volume on page 4-8.
3. When the external volume is successfully mapped, define LU paths to a host using LUN Manager. See the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide*.

Related Topics

- Recognizing the local system from the external system on page 4-16.

Setting up a port

When you connect a port to an external storage system, the external storage system information can be viewed from the client PC. With the exception of Hitachi, multiple external storage systems can be connected and can be mixed per port as well. Another external storage system can be added even if the port connected to external storage system is running.

Limitations on mapping an external volume

After connecting a port to the external storage system, an external volume can be mapped as internal volume. Make sure to check the capacity requirements of the external volume you intend to map as an internal volume.

Following are the limitations on mapping an external volume:

- You cannot access data in an external volume that exceeds the capacity of the internal volume to which it is mapped. For example, if you map 100GB of an external volume as 70GB of the internal volume, 30GB of external volume cannot be accessed from the local storage system side.
- You cannot map an external volume as internal volume if the external volume capacity is less than the internal volume. For example, you cannot map 10GB of the external volume as an internal volume with a minimum capacity requirement of 30GB.

Setting up an external volume group

When you map an external volume as an internal volume, the external volume must be registered to external volume group. You can separate external volumes by the external volume groups of your choice. For example, multiple volumes within one external storage system can be registered as one external volume group. In addition, you can register volumes in different external storage systems as one external volume group.

A number is required in each external volume group.

External volume attributes

When you map a new external volume as an internal volume, you need to configure the external volume attributes. You can configure these attributes before or during mapping.

The settings and their functions are described in the following bullets. To skip to the procedure, see Editing mapping policies on page 5-29.

- **Cache Mode**. I/O to and from the local storage system always uses cache. Write operations are always backed up in duplex cache. The **Cache Mode** setting specifies whether write data from the host is written to the external volume asynchronously (**Enable**) or synchronously (**Disable**).
  - If **Enable** is specified: After receiving the data into the local system's cache memory, the system signals the host that the I/O operation has completed and then asynchronously destages the data to the external volume.
  - When **Disable** is specified (the default): After synchronously writing the data to the external volume, the local system signals the host that an I/O operation has completed.

  For further discussion, see Cache use and external storage performance on page 2-8.
- **Cache Partition**. Cache memory can be partitioned using Virtual Partition Manager to configure a cache logical partition (CLPR) for the mapped volumes. Cache logical partitions are often used to limit cache-use by accessing slower external storage volumes.

  Hitachi strongly recommends that you place external storage array groups in a CLPR other than CLPR0. See the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide* for detailed information on CLPR.
- **Inflow Control**. When the write operation to the external volume cannot be completed, **Inflow Control** specifies whether the write operation to cache memory is limited (**Enable**) or continued (**Disable**).
  - If **Enable** is specified, the write operation to cache is limited and I/O from the host is not accepted. Limiting the write operation prevents the accumulation of data that cannot destage to cache memory.

- When **Disable** (the default) is specified, I/O from the host during the retry operation is written to cache memory. When write operations to the external volume are again possible, data in cache memory is written to the external volume (all data is destaged).

- **ALUA mode** (**Use ALUA as Path Mode**:**Enable** or **Disable**).

  In the local storage system, you can select whether **ALUA mode** is used as the path mode. If ALUA is supported in the profile information of the external storage, **Enable** is used by default. Otherwise, **Disable** is used. For information on ALUA mode, see Supported external systems path mode for external volumes on page 4-7.

- **Load Balance Mode**. Select **Depend on the selected external volume(s)**, **Normal Round-robin**, **Extended Round-robin**, or **Disable** as a Load Balance Mode for the external storage system. By default, Normal Round-robin is used. However, when the product name of the storage system is displayed as "generic", **Depend on the selected external volume(s)** is used by default.

  If Single is set as the **Path Mode** or **Disable** is set for **Use ALUA as Path Mode**, Load Balance Mode cannot be specified.

  - **Depend on the selected external volume(s)**: If **Enable** is set for **ALUA Settable** on the external volume, **Normal Round-robin** is set for **Load Balance Mode** automatically. If **Disable** is set for **ALUA Settable**, **Disable** is set for **Load Balance Mode** automatically.
  - **Normal Round-robin**: I/O is distributed to several paths on which I/O operation is enabled for the external storage system.
  - **Extended Round-robin**: I/O is distributed to several paths on which I/O operation is enabled for the external storage system. For sequential I/O, the external volume is divided into sections at regular intervals. In this case, the same path is used for I/O within the same section which reduces the frequency of I/O distribution.
  - **Disable**: As in Single mode, I/O operation is performed using the path that has the highest priority of all paths on which I/O operation is enabled for the external storage system.
  - **CLPR**. Specify CLPR when accessing a mapped volume if cache memory is split in Virtual Partition Manager. For detailed information, refer to the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Performance Guide*.

Setting external paths and path groups

The external path is the physical link from the local storage system port to the external storage system port. You prepare the ports on the local and external systems and then set up the external path prior to mapping your external volumes.

External paths

A path consists of cables and possibly switches. You configure your path according to bandwidth considerations, which include distance, speed, and performance requirements.

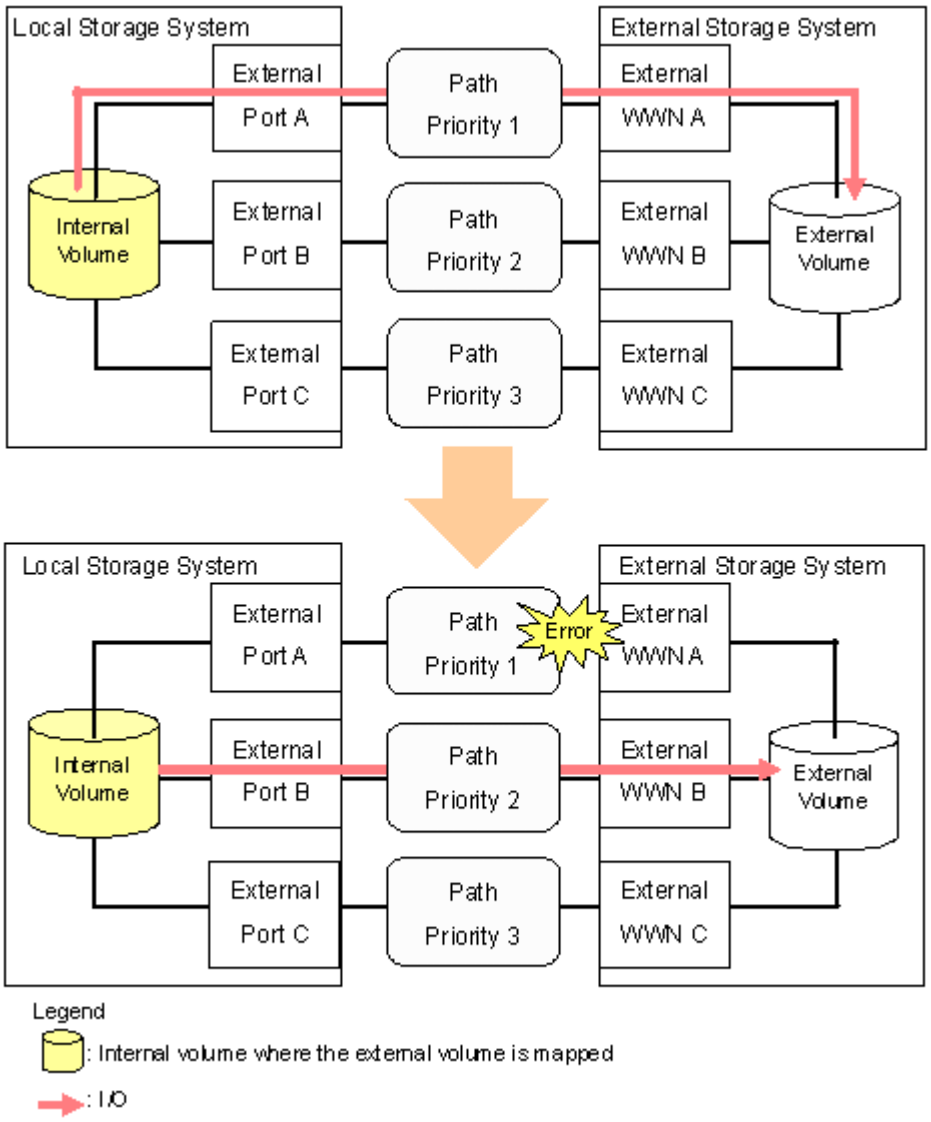
Because workload can spike and cable or switch failures can occur, Hitachi strongly recommends that you set up redundant external paths. A maximum of eight paths can be used per mapped external volume. Multiple paths—redundancy—allows you to perform I/O operations with external volumes regardless of workload and/or path failure.

With multiple paths, the external storage system determines how they are used: some systems use one primary path with alternates available as backups (Single path mode); other systems allow all paths to be used at the same time, distributing I/O among them (Multi path mode). The path storage system's mode cannot be changed. With both modes, you place the paths in path groups and prioritize each path.

Single path mode

For Single path mode, the external path with the highest priority (primary path) is used to execute I/O to the external volume. If the primary path cannot be used, it is switched to an alternative path, after a 3-minute period.

The following figure illustrates how failure is handled with redundant paths in Single path mode.

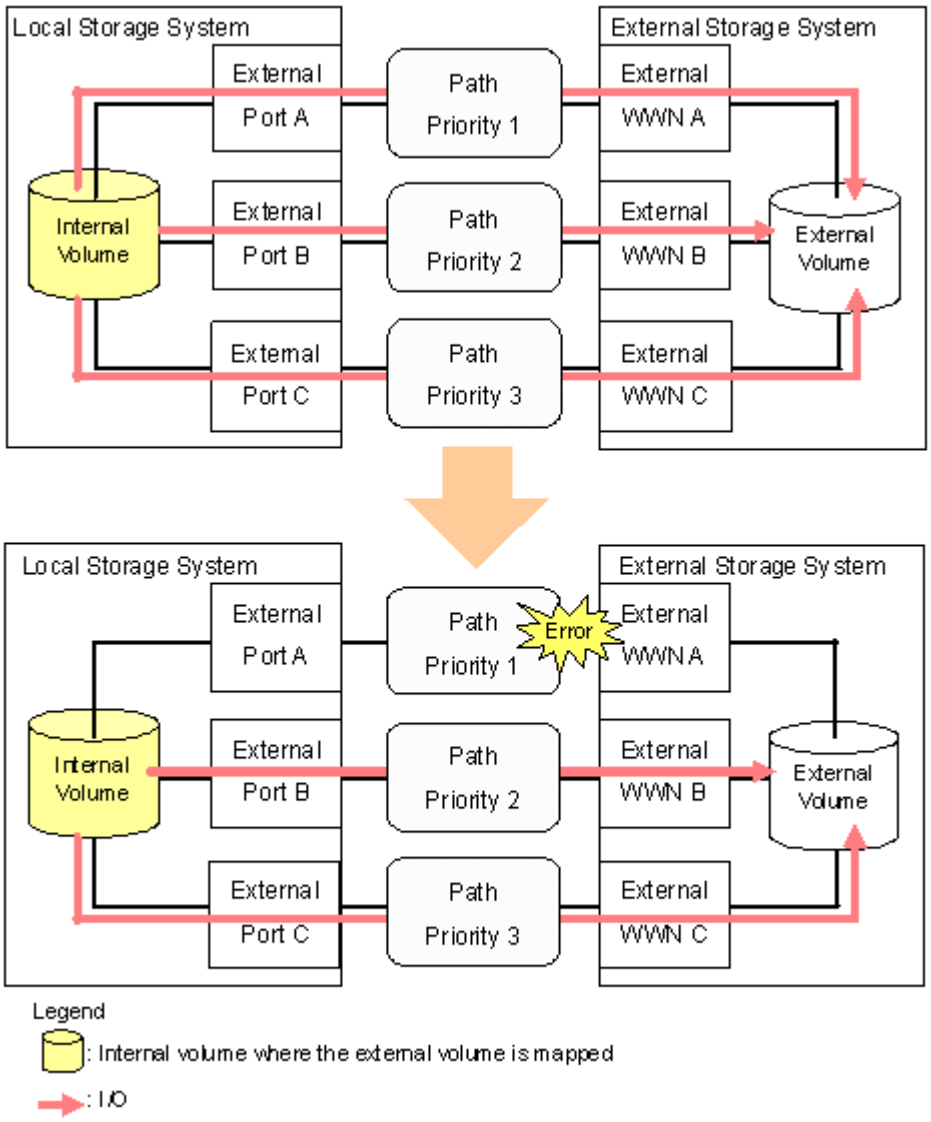


When you restore a path with higher priority than the currently-used path, I/O is switched to the restored path.

Multi path mode

For Multi path mode, all paths are used for I/O to the external volume. This distributes workload in a round-robin process.

The following figure illustrates how failure is handled with redundant paths in Multi mode.



Note: When you restore a path, use of the restored path is resumed.

Supported external systems path mode for external volumes

"Single" or "Multi" path mode displays in Device Manager - Storage Navigator for external volumes on the **External Path Group** window. Path modes are based on the external storage system and cannot be changed.

In ALUA mode, all paths that are defined are used. I/O operation for external volumes is performed through load balancing with the use of several paths (round-robin control). External paths connected to ports in Passive status are not used.

Load Balance Mode

When the path mode of an external volume is Multi or ALUA, you can select an I/O control system for the external storage system.

- **Depend on the selected external volume(s)**: If **Enable** is set for **ALUA Settable** on the external volume, **Normal Round-robin** is set for Load Balance Mode automatically. If **Disable** is set for **ALUA Settable**, **Disable** is set for Load Balance Mode automatically.
- **Normal Round-robin**: Normal multi-path I/O control system. This distributes I/O to several paths on which I/O operation is enabled for the external storage system. Specify this if Extended Round-robin may lower I/O performance. This mode is recommended when the number of sequential I/O operations is small.
- **Extended Round-robin**: Extended multi-path I/O control system. I/O is distributed to several paths on which I/O operation is enabled for the external storage system. For sequential I/O, the external volume is divided into sections at regular intervals. In this case, the same path is used for I/O within the same section which reduces the frequency of I/O distribution. Read speed can be improved by using the cache function of the external storage system for sequential I/O operations. This mode is recommended when the number of sequential I/O operations is large.
- **Disable**: I/O operation is performed with only one path that is normal and has the highest priority. The same operation applies as that for Single path mode. When **Disable** is set for **Load Balance Mode**, load distribution is not performed. This mode is not recommended.

Caution: Depending on the external storage type and system configuration, performance may not be improved when **Extended Round-robin** is set. In that case, **Normal Round-robin** is recommended.

Mapping an external volume

You can use the information in this section to map an external volume as an internal volume.

Prerequisites

- Attributes set for the external volume before mapping, such as port security, LUN security, Volume Retention Manager attributes, and so on are discarded when the external volume is mapped. If the original attributes are required, reset them in the local storage system after mapping.
- When the external volume is a command device, it is mapped as a remote command device. For important information about mapping command devices, see Appendix B, Remote command devices on page B-1.
- Before you map the external volume, check whether any application is using the volume. If so, stop the application before mapping.

  For example, if mapping a command device, make sure CCI commands are not being executed during the mapping operation.

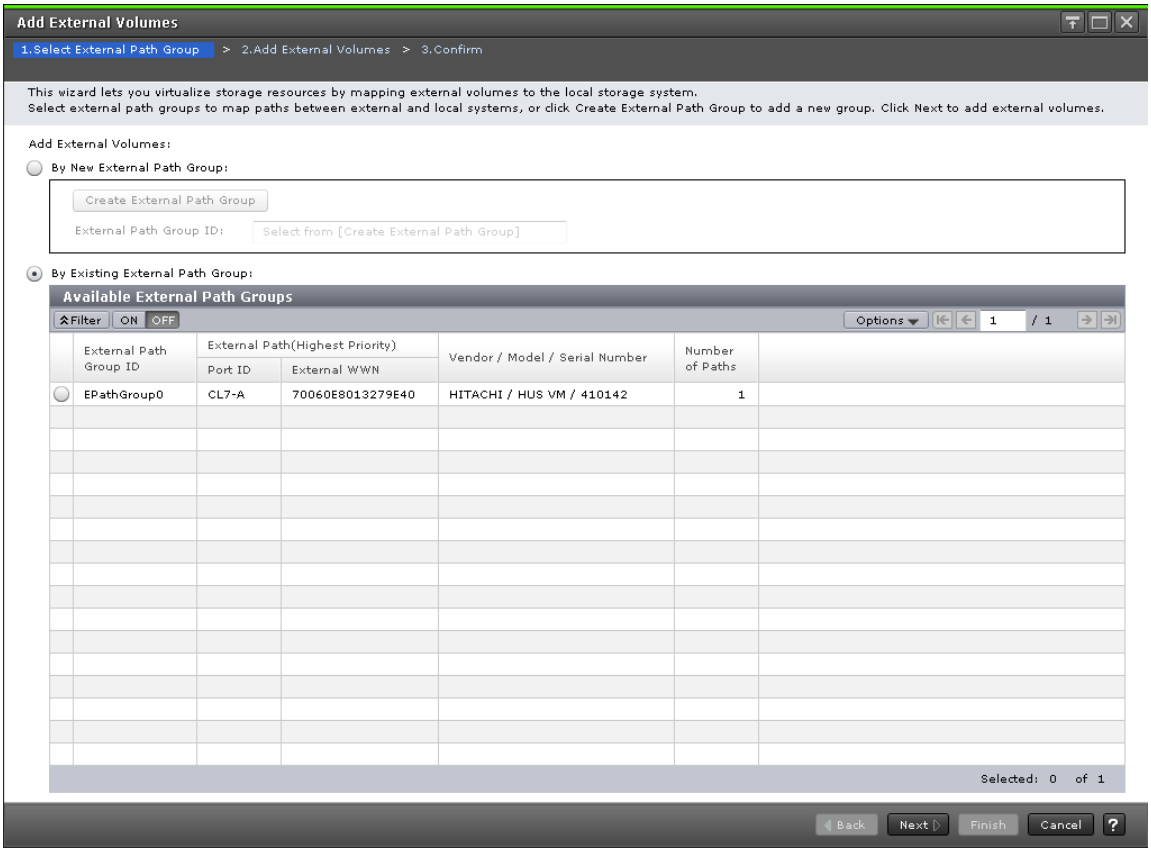
Note: When you create an LDEV at the same time that you map an external volume, you cannot select the following LDEV numbers:

- Numbers already in use.
- Numbers not assigned to the user.

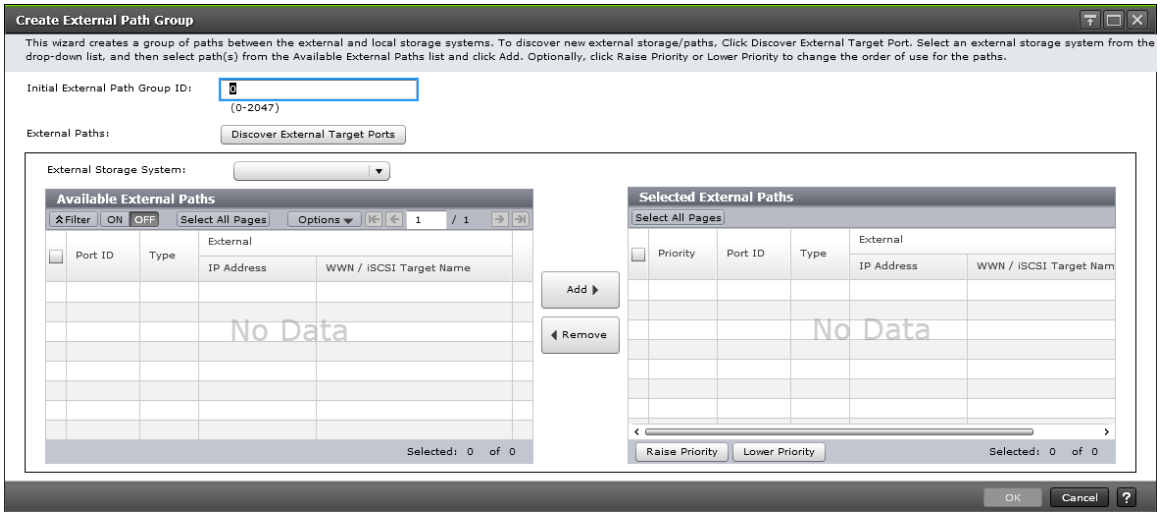
- You must have Storage Administrator (Provisioning) role to perform this task.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click **Add External Volumes**.
3. In the **Add External Volumes** window, add the external volume by clicking either **By New External Path Group** or **By Existing External Path Group**.



- To add the external volume **By New External Path Group**:
  a. Click **Create External Path Group**.
  b. In the **Create External Path Group** window, enter the following:



— **Initial External Path Group ID**. The storage system searches IDs from the initial ID you specify in ascending order and allocates an ID that can be used. The default range that you can specify is from 0 to 2,047 for VSP G200, 0 to 4,095 for VSP G400 and VSP G600, and 0 to 14,079 for VSP G800.

— **External Paths**. If you do not see the port or WWN you want in the **Available External Paths** box, click **Discover External Target Ports**. In the new window, select the desired ports and click **Add**, then click **OK**.

— **External Storage System**. If the external system is not selected, scroll down the list and select it.

— **Available External Paths**. Select the desired port IDs and click **Add**, then click **OK**.

c. Set the priority for a path by selecting it and clicking **Raise Priority** or **Lower Priority**.

d. Click **OK**.

- To add the external volume **By Existing External Path Group**:

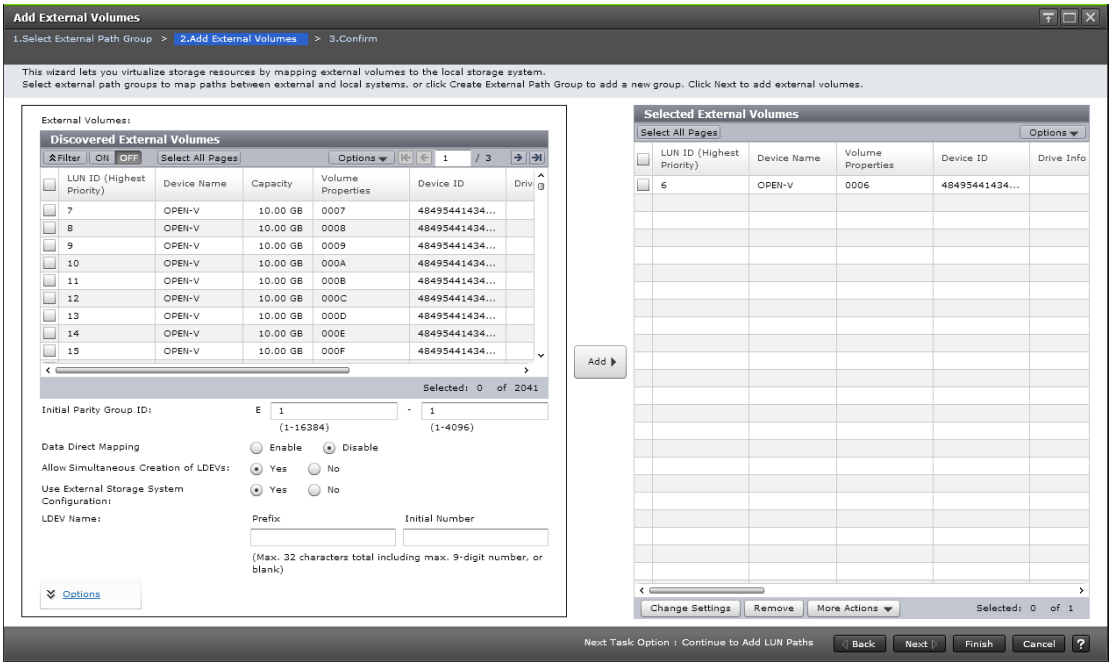
  a. Click **By Existing External Path Group**.

  b. If you have not identified the external storage system that you want to connect the external path to, click the storage system button and select the system.

  c. In the **Available External Paths** list, select the desired path group. Path groups consist of the external paths previously set up and prioritized.

  d. Click **Next**.

4. In the **Add External Volumes** window's **Discovered External Volumes** table, select the desired external volumes.



5. In **Initial Parity Group ID**, enter an external volume group number and sequential number. A group allows you to place similar external volumes in a group; for example, volumes used for a copy function.

   - The range is from 1 - 1 to 16384 - 4096.
   - If you are mapping an external volume with more than 4 TB by using a virtual volume for which Data Direct Mapping is enabled:

Select **Enable** in **Data Direct Mapping**. When you do, **Yes** is automatically selected for **Allow Simultaneous Creation of LDEVs** and **Use External Storage System Configuration**.

For details about mapping using virtual volumes for which Data Direct Mapping is enabled, see the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide*.

6. In **Allow Simultaneous Creation of LDEVs**, select **Yes** to allow the system to automatically create LDEVs in the external volume, otherwise select **No**.

   If the external volume is a command device, select **Yes** in both **Allow Simultaneous Creation of LDEVs** and **Use External Storage System Configuration**.

7. In **Use External Storage System Configuration**, select **Yes** to use the external storage system's configuration when the local system create LDEVs (if **Allow Simultaneous Creation of LDEVs** is also **Yes**). Otherwise, select **No**.

   If the capacity of the external volume is over 4 TB, select **Yes** in **Allow Simultaneous Creation of LDEVs** and **No** in **Use External Storage System Configuration**. Then enter the number of LDEVs to be created in **Number of LDEVs per External Volume**. Several LDEVs (maximum of 4 TB, up to the number indicated in **Number of LDEVs per External Volume**) will be created. If the external volume is a command device, the LDEV will be mapped as a remote command device.

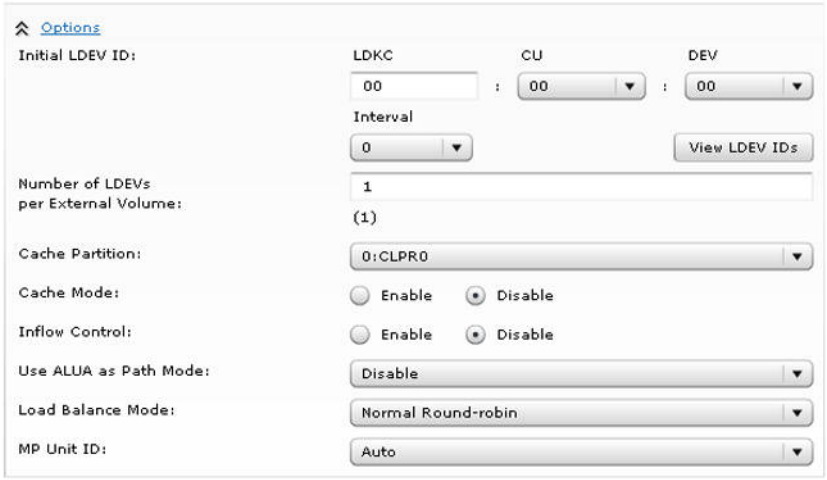
   If the external volume is a command device, select **Yes** in both **Allow Simultaneous Creation of LDEVs** and **Use External Storage System Configuration**. Cache mode for the remote command device will be **Disabled** regardless of the selection in **Cache Mode**.

8. In **LDEV Name**, enter the prefix character and the initial number.

   The entire value can be a maximum of 32 characters including the initial number (numerical value of 9 digits or less), or blank. Blank is displayed by default. Note the following numbering rule:

   - 1:total 9 numbers (1,2,3,…9)
   - 08:total 92 numbers (08,09,10,…99)
   - 23:total 77 numbers (23,24,25,…99)
   - 098:total 902 numbers (098,099,100…999)

9. Click **Options** (if not already expanded). If you have previously edited mapping settings (policies), you may not want to change the options. However, review the following steps—since some fields in **Options** are affected by preceding steps.



10. In the expanded **Options** box, for **Initial LDEV ID** enter the initial LDEV ID for the external volume. The local storage system searches from this number in ascending order and allocates the next available ID. You can review used, available, and disabled LDEVS by clicking **View LDEV IDs**.
    - For **LDKC**, enter 00.
    - For **CU**, enter the CU number, which can be from 00 to 07 for VSP G200, from 00 to 0F for VSP G400 and VSP G600, from 00 to 3F for VSP G800. 00 is the default.
    - For **DEV**, enter the LDEV ID, which can be from 00 to FF. 00 is the default.
    - For **Interval**, enter an interval between LDEV IDs, which can be from 0 to 255. 0 is the default.
11. In **Number of LDEVs per External Volume**, enter the number of LDEVs to be created when the external volume is mapped. This field is greyed out if you selected **Yes** in **Allow Simultaneous Creation of LDEVs** and **Use External Storage System Configuration**, and **1** displays.
12. In **Cache Partition**, select the CLPR for accessing the mapped external volume.

Note: For more information about the **Cache Partition**, **Cache Mode**, and **Inflow Control** settings, see Editing mapping policies on page 5-29.

13. In **Cache Mode**, click **Enable** to propagate write data asynchronously from cache to the external storage system. Click **Disable** to propagate data synchronously.
    - When the external volume is a command device, **Cache Mode** for the remote command device is automatically set to **Disable** regardless of your setting.
    - Data that is not written by the host (for example, data written by pair operation) is asynchronously destaged to the external storage system regardless of the **Cache Mode** setting.
14. In **Inflow Control**, click **Enable** to limit or prevent write data from being written to cache memory when the write operation to the external volume

cannot be performed. Click **Disable** to allow write data to be written to cache.

15. In **MP Unit ID**, select the MP unit ID for the external volume. MP unit assignment should evenly distribute work across the available processors.

    The range is from MPU-10, MPU-11, MPU-20, or MPU-21. The value depends on the configuration of the device.

    Select **Auto** (the default) to cause an MP unit ID to be automatically assigned by the system. If **Auto** cannot be selected, the MP unit ID with the lowest number is selected by default.

16. Click **Add**.
17. If you need to change the added volume's settings, in the **Selected External Volumes** list click the volume, click **Change Settings**, make necessary changes, and click **OK**.
18. To to add LUN paths, click **Next** in the **Add External Volumes** window. See the *Hitachi Virtual Storage Platform G200, G400, G600, G800 Provisioning Guide* for information.
19. Click **Finish** when ready.
20. In the **Confirm** window, check all settings, accept or enter a new task name.

    When you select the external volume and click **LDEV Detail**, the **External LDEV Properties** window is displayed for you to check the LDEV information.

21. In the **Confirm** window, click **Apply**. The setting is queued as a task and it is performed in order.
22. Open the **Tasks** window to verify the result of the operation. A task can be suspended or canceled if the process has not started.

Related Topics

- Considerations when mapping on page 2-5
- Add External Volumes wizard on page D-17
- Create External Path Group window on page D-52
- Change Settings window on page D-54
- View External LUN Properties window on page D-56
- External LDEV Properties window on page D-63
- Discovery Result Detail window on page D-64
- Table B-1 Restrictions on remote command device on page B-3

Considerations before performing the external volume mapping operation

- A management LU cannot be used as an external volume.

  A management LU receives commands from an application; it controls or manages the application, and stores control information from the

application. An example of a management LU is a Universal Xport LU. (A CCI command device is not a management LU.)

Before performing the external volume mapping operation, perform one of the following operations on the external storage system.

- Delete the management LU from the port to be connected to the Virtual Storage Platform G200, G400, G600, G800.
- Make sure that at least one LU is used for data storage and has a smaller LUN (LU number) than the management LU's LUN. Also make sure that the data storage LU is set to the port connected to Virtual Storage Platform G200, G400, G600, G800.
- Use the security function and configure the access attribute of the management LU to prohibit read and write operations.

An external storage system that has a management LU might not be recognized by the local storage system.

Preparing mapped volumes for use

After external volumes are mapped to the local storage system, you can take the following steps to prepare the volumes for use.

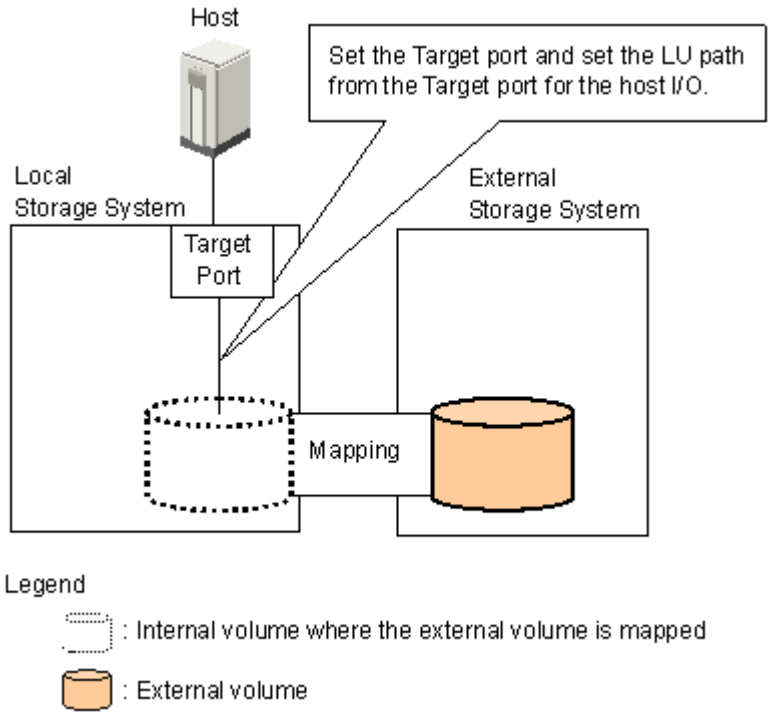
Prerequisites

- You must have Storage Administrator (Provisioning) role to perform this task.

Procedure

1. The status of the mapped volume automatically becomes **Normal**. If you need to initialize the data area of the mapped volume, format the volume using Virtual LUN.
2. Set an LU path from a Target port to the internal volume, as shown in the following figure.

   The LU path enables host I/O to the mapped volume.



Using mapped volumes

When external volumes are mapped and ready for use, you can perform the operations supported by Universal Volume Manager. Review supported software products and operations in Chapter 3, Supported software for external volumes on page 3-1.

Note: A mapped external volume can be accessed only from the local system. Do not access the volume from a host connected to the external storage system.
Also, do not use external storage system functions to access the mapped external volume, including copy functions.

Recognizing the local system from the external system

Though the local and external systems are connected, the external system may not recognize the local system. If desired, you can try to make this happen by performing the Discover External Target Ports operation. See Adding an external path to an existing path group on page 5-3 for instructions. If the path does not become mapped after 15 minutes, though, the external system might not be able to recognize the local system.

5

Universal Volume Manager operations

This topic provides information and procedures used for operations involving external volume connections.

- ☐ Monitoring external volumes and paths
- ☐ Setting the external path
- ☐ Powering off and on the external storage system
- ☐ Powering off and on local and external storage systems
- ☐ Disconnecting external systems and volumes
- ☐ Reconnecting external systems and volumes
- ☐ Changing path mode to ALUA mode (Enable or Disable)
- ☐ Changing I/O mode for external storage systems
- ☐ Changing the port setting of an external storage system
- ☐ Editing mapping policies
- ☐ Deleting external volume mapping
- ☐ Changing the MP Unit of an external volume

Monitoring external volumes and paths

You can view system details about mapped external volumes, the ports used, and the external paths.

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, click the link for a path group.
4. On the **Mapped Volumes** tab, select one or more external volumes, and then select **View External LUN Properties**.

Related Topics

- View External LUN Properties window on page D-56

Setting the external path

You can add external paths to a path group, change a path's priority, disconnect and reconnect paths (which must be performed before removing or replacing paths), remove or replace a path, or replace all paths. The following topics provide instructions.

- Removing and replacing an external path on page 5-12
- Replacing all external paths on page 5-13

Adding an external path to an existing path group

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, select a path group.
4. Click **Edit External Path Configuration**.
5. In the **Edit External Path Configuration** window, select an external path or paths from the **Available External Paths** list and click **Add**.
   If the **External Storage System** or the **External WWN** that you want is not available in the dialog box, click **Discover External Target Ports** and add the port that connects to the WWN.
6. To change the priority of external paths, click **Raise Priority** or **Lower Priority** in the **Selected External Paths** list.
7. Click **Finish**.
8. In the **Confirm** window, check settings, accept the task name or enter a new one, and then click **Apply**.

Related Topics

- Edit External Path Configuration wizard on page D-35
- Discover External Target Ports window on page D-51

Adding an iSCSI path

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. In the **External Storage** window, click **iSCSI Paths** tab, and then click **Add iSCSI Paths**.
3. Click **Discover iSCSI Targets**. The **Discover iSCSI Targets** window displays.
4. For **Local Port ID**, select the port connected to the external storage system of the local storage system.
5. For **Remote IP Address**, enter the IP address of the external storage system port.
6. For **Remote TCP Port Number**, enter the TCP Port Number of the external storage system port (1 to 65535).
7. Click **Add**. The targets that you entered will be added to the **Discovery List** table. You can add up to eight targets.
8. Click **OK**. The **Add iSCSI Paths** window displays.
9. Select the iSCSI path to be added from the **Available iSCSI Paths** table.
10. For **Authentication Method**, select **CHAP** or **None**.
    If you select **CHAP**, set the following contents.
    a. **Mutual CHAP**: Select **Enable** or **Disable**. If you select **Enable**, the authentication will be bidirectional. If you select **Disable**, the authentication will be unidirectional.
    b. **User Name**: If you select **Disable** for **Mutual CHAP**, this setting is optional. If you select **Enable** for **Mutual CHAP**, this setting is mandatory.
    c. **Secret**: If you select **Disable** for **Mutual CHAP**, this setting is optional. If you select **Enable** for **Mutual CHAP**, this setting is mandatory.

11. Click **Add**. The selected iSCSI path will be added to the **Selected iSCSI Paths** table.

    Up to 4,096 iSCSI paths can be added including those paths that were already added.
12. Click **Finish**.
13. In the **Confirm** window, check settings, enter a task name, and then click **Apply**.

Tip: To display the **Tasks** window automatically, select **Go to tasks window for status** then click **Apply**.

14. Check the result in the **Tasks** window. You can suspend or cancel the task if the task is not executed.

Related Topics

- Add iSCSI Paths wizard on page D-66
- Discover iSCSI Targets window on page D-71

Editing an iSCSI target

Prerequisites

- Storage Administrator (Provisioning) role
- There are no I/O operations being performed on the host.

Procedure

1. Open the **External Storage** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.

   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.

   b. Click **External Storage**.
2. In the **External Storage** window, click the **iSCSI Paths** tab, and then click **Edit iSCSI Targets**.
3. For **Authentication Method**, select **CHAP** or **None**.

   If you select **CHAP**, set the following contents.

   - **Mutual CHAP**: Select **Enable** or **Disable**. If you select **Enable**, the authentication will be bidirectional. If you select **Disable**, the authentication will be unidirectional.

- **User Name**: If you select **Disable** for **Mutual CHAP**, this setting is optional. If you select **Enable** for **Mutual CHAP**, this setting is mandatory.
- **Secret**: If you select **Disable** for **Mutual CHAP**, this setting is optional. If you select **Enable** for **Mutual CHAP**, this setting is mandatory.

If you select **None** for **Authentication Method**, set the following contents.

Mutual CHAP: Select **Enable** or **Disable**. If you select **Enable**, the authentication will be bidirectional. If you select **Disable**, the authentication will be unidirectional.

4. Click **Finish**.
5. In the **Confirm** window, check settings, enter a task name, and then click **Apply**.

Tip: To display the **Tasks** window automatically, select **Go to tasks window for status** then click **Apply**.

6. Check the result in the **Tasks** window. You can suspend or cancel the task if the task is not executed.

Related Topics

- Adding an iSCSI path on page 5-4

Changing external path priority

You can change the priority of your primary and alternate external paths, moving them higher or lower depending on your requirements. See Setting external paths and path groups on page 4-4 for more information on path priorities for Single and Multi mode.

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.

   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.

2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, select a path group.
4. Click **Edit External Path Configuration**.
5. In the **Edit External Path Configuration** window, in the **Selected External Paths** list, select the desired path and click **Raise Priority** or **Lower Priority**.
6. Repeat the previous step to continue moving the path higher or lower. Move other paths as needed.
7. Click **Finish**.
8. In the **Confirm** window, check settings, accept the new task name or enter a new one, and then click **Apply**.

Related topics

- Edit External Path Configuration wizard on page D-35

Executing login test to the iSCSI target

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. In the **External Storage** window, click **iSCSI Paths** tab.
3. Select the iSCSI path which you want to execute login test, then click **Test Login iSCSI Target**.

Related Topics

- External Storage window on page D-3

Disconnecting an external path

You can disconnect all external paths connected either to a port on the local system or to a WWN on the external system. Disconnecting paths affects the external volumes mapped using the port.

An external path is disconnected for the following reasons:

- Before removing a path.
- To replace a path or switch
- To perform maintenance on a path
- To perform maintenance on the external system or volume

Prerequisites

- When you disconnect a path, make certain that alternate paths are available for mapped external volumes using the path.
- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. Click the **External Paths** tab.
3. On the **External Paths** tab, select a path group.
4. Click **Disconnect External Paths**.
5. In the **Disconnect External Paths** window, select one of the following:
   For Fibre Channel Ports:
   - **By Ports** to disconnect all external paths connected to the specified port in the local storage system.
   - **By External Storage Ports** to disconnect only external paths connected to the external storage system.

   For iSCSI port:
   - **By Ports** to disconnect all external paths connected to the specified port in the local storage system.
   - **By External Storage Ports** to disconnect only external paths connected to the external storage system.
6. Click **Finish**.

7. In the **Confirm** window, check settings, accept or enter a new task name, and then click **Apply**.

Related topics

- Edit External Path Configuration wizard on page D-35

Deleting an iSCSI path

Prerequisites

- Storage Administrator (Provisioning) role
- The specified iSCSI path must not be used as the external path of the Universal Volume Manager.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. In the **External Storage** window, click the **iSCSI Paths** tab.
3. Select the iSCSI path which you want to delete, then click **Delete iSCSI Paths**.
4. Check settings, enter a task name, and then click **Apply**.

Tip: To display the **Tasks** window automatically, select **Go to tasks window for status** then click **Apply**.

5. Check the result in **Tasks** window. You can suspend or cancel the task if the task is not executed.

Related Topics

- Delete iSCSI Paths window on page D-68

Reconnecting an external path

You can reconnect an external path that was disconnected. You reconnect paths either to a port on the local system or to a WWN on the external system. When you reconnect, original path settings are resumed.

Prerequisites

- Storage Administrator (Provisioning) role
- Make sure the path is in a status that can be restored.
- You must have Storage Administrator (Provisioning) role to perform this task.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. Click the **External Paths** tab.
3. On the **External Paths** tab, select a path group.
4. Click **Reconnect External Paths**.
5. In the **Reconnect External Paths** window, select one of the following:
   For a Fibre Channel Port:
   - **By Ports** to reconnect all external paths connected to the specified port in the local storage system.
   - **By External WWNs** to reconnect all external paths connected to the external storage system.

   For iSCSI port
   - **By Ports** to disconnect all external paths connected to the specified port in the local storage system.
   - **By External Storage Ports** to disconnect only external paths connected to the external storage system.
6. Click **Finish**.
7. In the **Confirm** window, check settings, accept the task name or enter a one, and then click **Apply**.

Related Topics

- Reconnect External Paths wizard on page D-48

Changing the cache mode setting of the external volume

You can change the cache mode of the external volume in the Edit External Volumes window.

Before changing the cache mode of the external volume, check each item listed in the following table.

Item to Check	Description
Cache mode and pool volumes	When a volume is registered to a pool as a pool volume, the cache mode setting should be the same among all the pool volumes in the pool.
Cache mode and remote command devices	When the volume is a remote command device, you cannot change the cache mode from Disable to Enable.

If the system cannot communicate with external volumes, the **Inflow Control** setting specifies whether the write operation to cache is limited (**Enable**) or continued (**Disable**). **Disable** is set by default. You can change the setting in the **Edit External Volumes** window.

Prerequisites

- Storage Administrator (Provisioning) role
- If the external volume is registered in Thin Image pool as a pool volume, cache mode settings for all pool volumes registered in the pool must be the same.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, select a path group.
4. On the **Mapped Volumes** tab, select an external volume, and then click **Edit External Volumes**.
5. On the **Edit External Volumes** window, select the **Inflow Control** property, and then click **Enable** or **Disable**.
6. Click **Finish** to display the **Confirm** window.
7. Confirm the settings and enter the task name in the **Task Name** box.
8. In the **Confirm** window, click **Apply**.

Related Topics

- Edit External Volumes wizard on page D-31
- Supported external systems path mode for external volumes on page 4-7

Removing and replacing an external path

You can remove a path so it is no longer available to the external volume. In addition, you can remove a path to replace it with another external path or to perform maintenance on the physical link.

Note: All external paths must be removed before detaching a channel adaptor, otherwise the channel adaptor cannot be detached.

Prerequisites

- Before removing a path, make sure it is disconnected. See Disconnecting an external path on page 5-8 for instructions.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, select a path group.
4. Click **Edit External Path Configuration**.
5. In the **Edit External Path Configuration** window, in the **Selected External Paths** list, select the path to be removed and click **Remove**.
   The external path is deleted from the **Selected External Paths** list.
6. Click **Finish**.
7. In the **Confirm** window, check settings, accept or enter a new task name, and then click **Apply**.

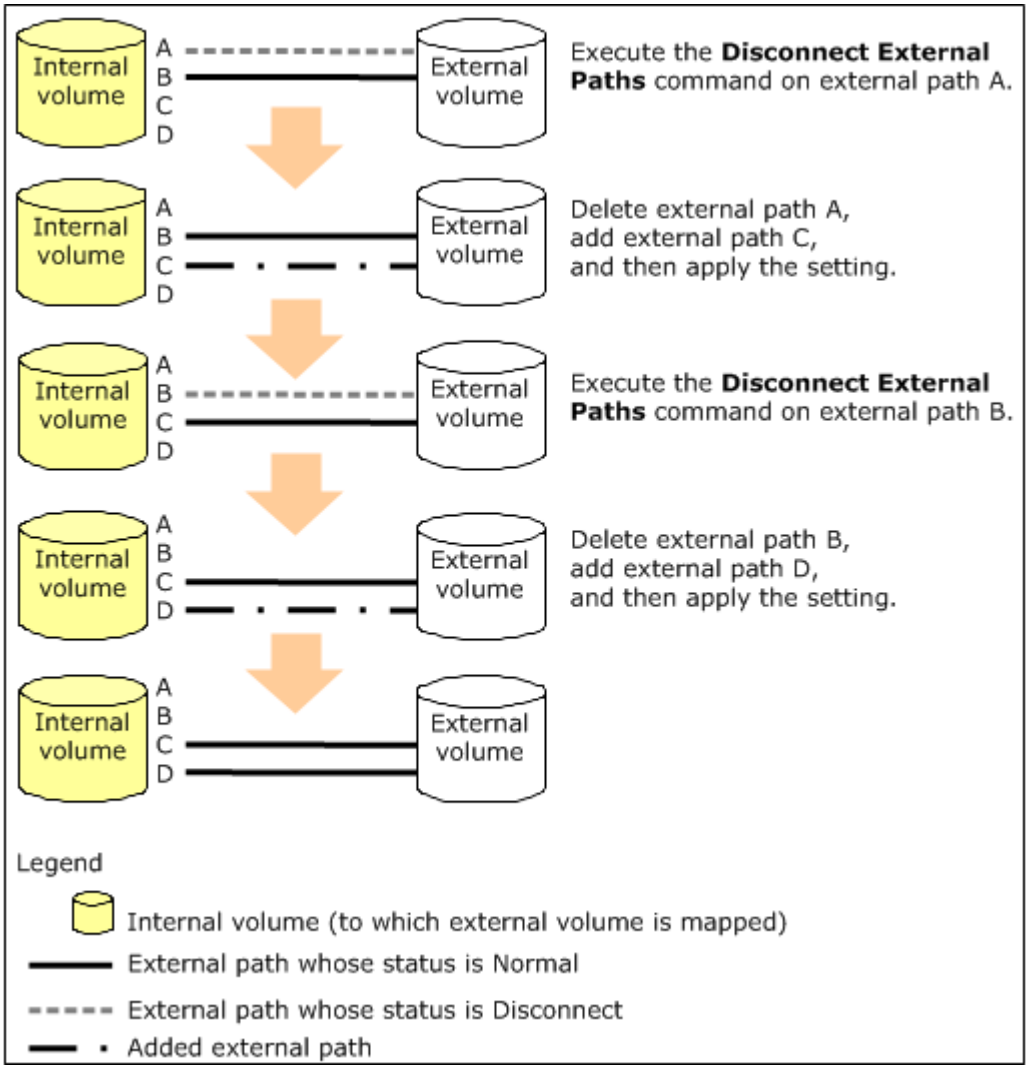
If you are replacing the path, see Adding an external path to an existing path group on page 5-3.

Related Topics

- Edit External Path Configuration wizard on page D-35

Replacing all external paths

You can replace the primary and alternate paths used by an external volume. Doing this requires one path to remain in Normal status at all times, which is shown in the following figure.



Procedure

1. This procedure uses the illustration above.
   Disconnect **external path A**. See Disconnecting an external path on page 5-8.
2. Disconnect the cable for **external path A**, then remove it. See Removing and replacing an external path on page 5-12.

3. Make sure the cable for **external path C** is connected, and then add this path to an existing path group. See Adding an external path to an existing path group on page 5-3.

   When **external path C** status is Normal, then both **external path B** and **external path C** are set, and you can replace the next path.
4. Disconnect **external path B**.
5. Disconnect the cable for **external path B**, then remove it.
6. Make sure the cable for **external path D** is connected, and then add this path to an existing path group.

   When **external path D** status is Normal, then both **external path C** and **external path D** are set. The paths have all been replaced.

Powering off and on the external storage system

If you power off and on the external storage system when the local storage system is on, the following Universal Volume Manager operation is required.

Disconnect External Storage Systems: Execute this command before you perform maintenance on, or a scheduled shutdown of, an external storage system. When **Disconnect External Storage Systems** is selected, the I/O response from host of the external volume mapped as a local storage system volume will stop. At that point, data for the external volume will be written to the external volume (destaged) from data stored in cache memory of the local storage system.

Tip: The same task can be performed on individual volumes with the **Disconnect External Storage Volumes** command. External volume mapping can be removed by executing **Disconnect External Storage Volumes** followed by the **Delete External Volumes** command. See Deleting external volume mapping on page 5-30.

Reconnect External Storage Systems: This command is selected to check whether the defined configuration information of the external volume that is mapped as a local storage system volume matches the status of the external volume. If the external volume can be used as a mapped volume, I/O to the external volume is accepted and the volume can be used again.

The **Reconnect External Storage Systems** command is used to recover from an I/O failure after the **Disconnect External Storage Systems** command has been executed.

If there is an issue on the path, it is resolved first before the **Reconnect External Storage Systems** is executed.

Tip: The same task can be performed on individual volumes with the **Reconnect External Volumes** command.

When the **Reconnect External Storage Systems** or **Reconnect External Volumes** command is executed and the external volume can be used, I/O to the external volume is accepted and volume can be used again. The status of the external volume is blocked if it cannot be used.

See Reconnecting external systems and volumes on page 5-22.

Powering off the external storage system (scheduled shutdown)

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Stop read and write I/O operations to the external volume that is mapped as the local storage volume in the external storage system that you want to power off.
2. If the volume in the external volume is defined as a pool volume of the DP pool in the local storage system, perform the following steps to block all DP-VOLs in the pool for maintenance.

   If not, skip the steps below, and go to step 4.

   a. Open the **Pool** window.

      In Hitachi Command Suite:

      On the **Resources** tab, click **Storage Systems** to expand it. In the local storage system, right-click **DP Pool** and select **System GUI**.

      In Device Manager -Storage Navigator:

      In the **Storage Systems** tree, click **Pools**.

      The list of pools is displayed on the **Pools** tab.

   b. On the **Pools** tab, click the link for the pool that you want to block.

   c. Select the **Virtual Volumes** tab.

   d. Click **Select All Pages**.

   e. On the **Virtual Volumes** tab, click **More Actions > Block LDEVs** to open the **Block LDEVs** window:

   f. In the **Block LDEVs** window, check the settings, and enter the task name in the **Task Name** text box.

   g. Click **Apply** to apply the changes to the storage system.

      The changes are queued as tasks, and processed in sequence.

Tip: To display the **Tasks** window automatically after the wizard is closed, select **Go to tasks window for status**, and then click **Apply**.

3. In the **Tasks** window, check the operation result.
4. Disconnect the external storage system you want to power off.

   I/O operations to the external volume are not allowed, and data in cache memory of the local storage system is written to the external volume (destaged).
5. Perform other operations required for powering off the external storage system if any.
6. Power off the external storage system.

Tip: After disconnecting external storage volumes, if you want to use the mapped external volume again as the local storage volume, you can reconnect the external storage systems.

Related topics

- Disconnecting external systems and volumes on page 5-19
- Block LDEVs window in the *Provisioning Guide for Open Systems*

Reconnecting the external storage system after scheduled shutdown

When you disconnect external storage systems, and then power off the external storage system, you cannot access the external volume from the local storage system if you power on the external storage system again. To access the external storage system, you need to reconnect external storage systems. This process checks whether the defined configuration information of the external volume mapped as a local storage volume matches the status of the external volume. If the external volume can be used as a mapped volume, I/O operations to the external volume are accepted, and the volume can be used again.

Procedure

1. Power on the external storage system where the mapped external volume physically exists.
2. Perform the **Reconnect External Storage Systems** command.
3. If you define the local storage system volume as a pool volume of the DP pool for the local storage system, restore all the blocked DP-VOLs.

   To restore all DP-VOLs in the pool in a batch, perform the steps below.

   a. Open the **Pool** window.

      In Hitachi Command Suite:

      On the **Resources** tab, click **Storage Systems** to expand it. Right-click **DP Pool** under the local storage system, and then select **System GUI**.

      In Device Manager -Storage Navigator:

      In the **Storage Systems** tree, select the pool to be blocked.

      The list of pools is displayed on the **Pools** tab.

   b. Click the link for the pool to be blocked on the **Pools** tab.

   c. Select the **Virtual Volumes** tab.

   d. Click **Select All Pages**.

   e. In the **Virtual Volumes** tab, click **More Actions > Restore LDEVs** to open the **Restore LDEVs** window:

   f. In the **Restore LDEVs** window, check the settings, and enter the task name in the **Task Name** text box.

   g. Click **Apply** to apply the changes to the storage system. The changes are queued as tasks, and processed in sequence.

Tip: To display the **Tasks** window automatically after the wizard is closed, select **Go to tasks window for status**, and then click **Apply**.

h. In the **Tasks** window, check the operation result.

Related topics

- Reconnecting external systems and volumes on page 5-22
- Block LDEVs window in the *Provisioning Guide for Open Systems*

Powering off the local storage system (scheduled shutdown)

When you power off the local storage system, data for the external volume in the cache memory of the local storage system is written to (destaged) the external volume.

Procedure

1. Stop read and write I/O operations to the local storage system.
2. Split all pairs that used external volumes (pairsplit operation).
   For information on the pairsplit operation, see the user guide for the relevant software.
3. Confirm that the status of each external volume is **Normal** or **Disconnect**.
4. Perform other operations required for powering off the local storage system if any.
5. Power off the local storage system.

Reconnecting the local storage system after scheduled shutdown

When you disconnect external storage systems, and then power off the local storage system, you cannot access the external volume from the local storage system if you power on the external storage system again. To access the external storage system, you need to reconnect external storage systems. This procedure checks whether the defined configuration information of the external volume mapped as a local storage volume matches the status of the external volume. If the external volume can be used as a mapped volume, I/O operations to the external volume are accepted, and the volume can be used again.

If you disconnect external storage systems or disconnect external storage volumes, the status of the external volume changes to Disconnect when the data in the local cache memory is written to the external volume.

Procedure

1. Power on the local storage system.
2. Resynchronize all pairs.

For information on resynchronizing pairs, see the user guide for the relevant software.

3. Start I/O operations to the local storage system.

Powering off and on local and external storage systems

If you power off the local system, data for the external volume in the cache memory of the local system is written to the external volume (destaged).

You do not need to disconnect the external system when powering off only the local system. However, if you do disconnect the external system, when you power on the local system again, access is disabled to the external system until you reconnect the external system.

You must temporarily halt Universal Volume Manager operations before powering off the external storage systems. When the systems are powered on, you can resume all operations.

You must follow the steps in the procedures in this topic in the following order:

- When you power off the local and external systems, the local system must be turned off first before the external system.
- When you power on both systems, the external system must be turned on first before the local system.

Powering off local and external storage systems

Procedure

1. Stop read or write I/O operations to the local storage system.
2. Split all pairs using external volumes (pairsplit operation).
   For information on the pairsplit operation, see the user guide for the relevant software.
3. Confirm that the status of each external volume is **Normal** or **Disconnect**.
4. Power off the local storage system.
5. Power off the external storage system only after confirming that the local storage system is completely powered off.

Powering on local and external storage systems

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Power on the external storage system.
2. After the external storage system is completely powered on, power on the local storage system.
3. Confirm that the local storage system is completely powered on.
4. Resynchronize all pairs.
   For information on resynchronizing pairs, see the user guide for the relevant software.
5. Start read and write I/O operations to the local storage system.

Disconnecting external systems and volumes

You can disconnect a single mapped external volume, or all the mapped volumes in an external system. You disconnect all volumes by disconnecting the system itself.

You disconnect a volume or system in order to perform the following operations:

- Turn off the power supply of the local or external storage system
- Delete an external volume's mapping
- Access a mapped external volume or volumes from the external storage system

When you disconnect a volume or volumes, they stop accepting host I/O, and all data in cache is written to the volumes (data is destaged). Also, the mapping settings are preserved. When the volumes are reconnected, they are assigned the same settings.

Prerequisites

Before you disconnect any volumes or systems, processes must be resolved or stopped, as described in the following table.

Activity in the external volume	Required operation
I/O to the external volume from the host is in progress.	Stop I/O to the volume and un-mount the volume from the host. Host I/O is forcibly stopped if you disconnect when I/O is in progress.
The external volume includes LDEVs used in pair operations with copy software products*	Delete the pair. You can disconnect without deleting a ShadowImage pair when pair status is PSUE or Suspend/SUSPER.
The external volume includes LDEVs registered to a Thin Image data pool.	Delete Thin Image data pool.

Activity in the external volume	Required operation
The external volume includes LDEVs registered to a Dynamic Provisioning pool volume (DP-VOL).	Perform the following operations on DP-VOLs associated with the external volume: • Stop using the DP-VOLs. • Block the DP-VOLs using Virtual LUN. • If the Data Direct Mapping attribute is enabled for the external volume, block only the related DP-VOL.
The external volume includes LDEVs for which Volume Migration processing is in progress.	Delete the migration plans.
The external volume is used in the GAD quorum disk.	Release the quorum disk settings.
Note: * Copy software products are: • ShadowImage • Universal Replicator • TrueCopy • Thin Image • Global-active device	

Disconnecting an external storage system, all mapped volumes

When you disconnect an external system, the mapped external volumes in the system are also disconnected. This is the primary method for disconnecting all the mapped volumes in an external system.

Before disconnecting a mapped volume, review Prerequisites on page 5-19.

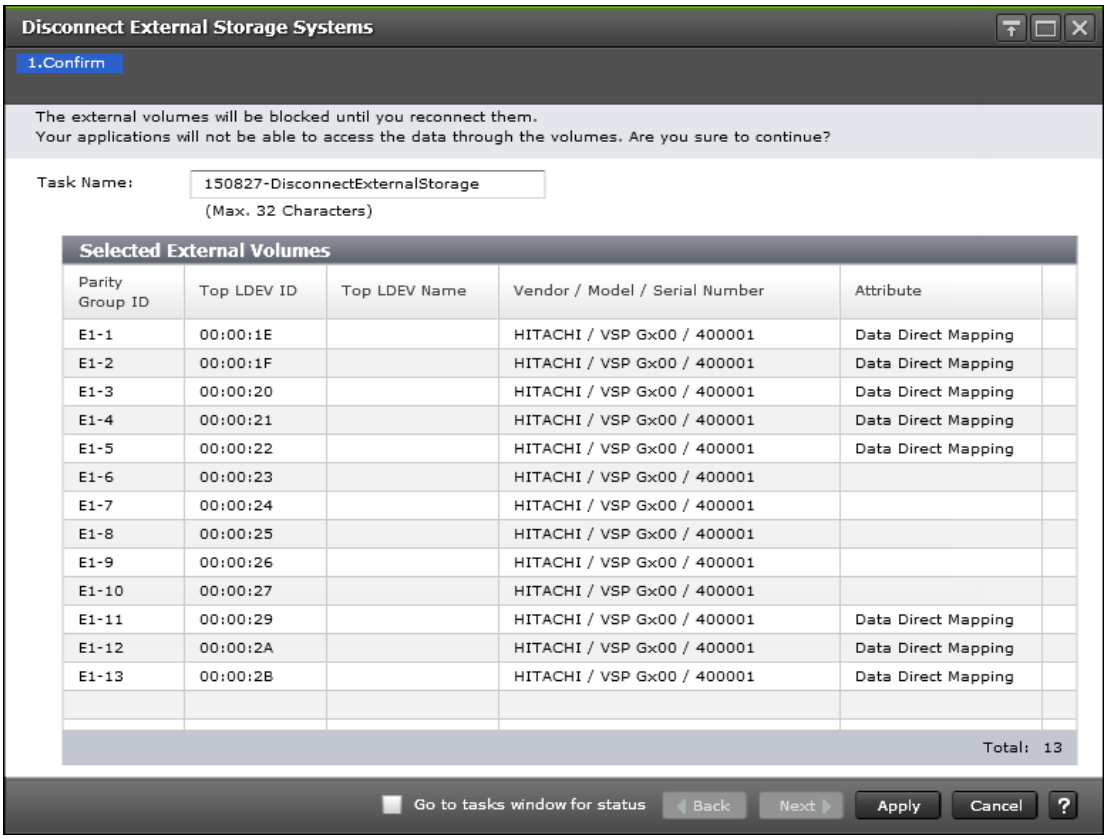
Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.

2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, select a path group.
4. Click **Disconnect External Storage Systems**.
5. In the **Disconnect External Storage Systems** window, review the volumes that will be disconnected, then click **Apply**.



6. In the **Confirm** window, click **Apply** again.

When you finish the procedure, external volume's status displays as **Cache Destage**, even if there is no data left in the cache. You can click **Refresh View** to update the status. When processing is completed, the volumes' status changes to **Disconnect**.

Related Topics

- Disconnect External Storage Systems window on page D-59

Disconnecting a single mapped volume

Before disconnecting a mapped volume, review Prerequisites on page 5-19.

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link of the storage system with the volume that you want to disconnect.
3. On the **External Path Groups** tab, click the link for a path group.
4. In the **Disconnect External Volumes** window, check the volume that you want to disconnect, accept or enter a new task name, and then click **Apply**.

When you finish the procedure, the status of the external volume displays as **Cache Destage**, even if there is no data left in the cache. You can click **Refresh View** to update the status. When the processing is completed, the status of the volume changes to **Disconnect**.

Related Topics

- Disconnect External Volumes window on page D-60

Reconnecting external systems and volumes

When you disconnect an external volume or volumes, you can start using them again by reconnecting.

When you reconnect a volume or system, the preserved mapping settings and path status are compared to the current status of the volume. When the status and settings match, the volume is again placed in mapped, Normal status and is available for I/O operations. However, if the external volume is not ready to be resumed, the status of the disconnected volume is Blockade. If this occurs, see General troubleshooting on page 6-2 and proceed as directed.

Reconnecting an external storage system and all mapped volumes

When you reconnect an external system, all the mapped external volumes in the system are also reconnected. This is the primary method for reconnecting the disconnected volumes in an external system.

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, select the row for the external system to be reconnected, and then click **Reconnect External Storage Systems**.
3. In the **Reconnect External Storage Systems** window, check the volumes that will be reconnected, accept or enter a new task name, and then click **Apply**.
4. In the **Confirm** window, click **Apply** again.

When you finish the procedure, the external volumes' status displays as **Checking**, then **Normal**. If the external storage system cannot be reconnected, the status becomes **Blockade**.

Related Topics

- Reconnect External Storage Systems window on page D-58

Reconnecting a single mapped volume

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

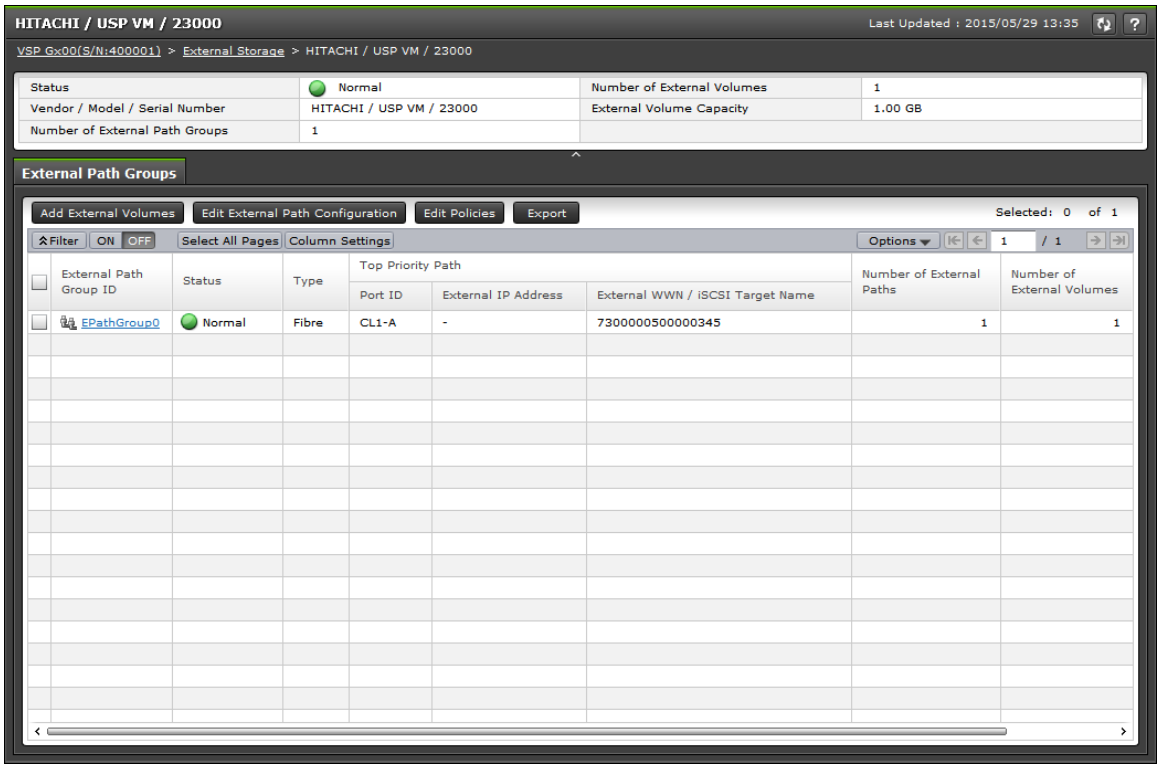
1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:

a. Click **Storage Systems**, and then expand the **Storage Systems** tree.

b. Click **External Storage**.

2. On the **External Storage Systems** tab, click the link for the storage system with the volume to be reconnected.

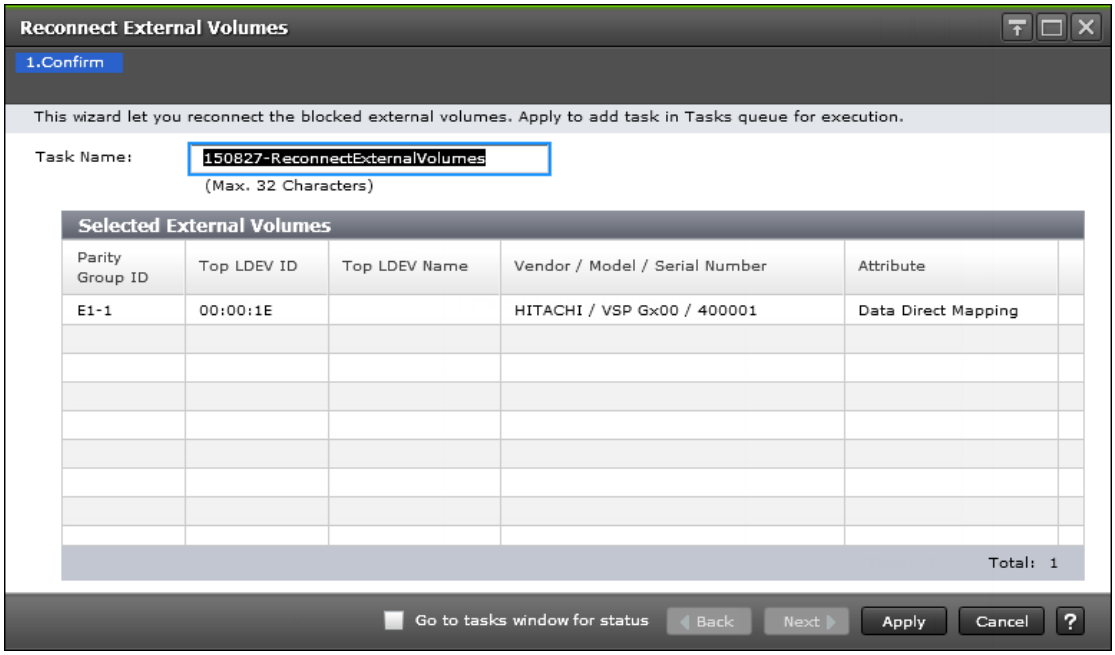
3. On the **External Path Groups** tab, click the link for a path group.



4. On the **Mapped Volumes** tab, select the external volume.

5. Click **More Actions** and select **Reconnect External Volumes**.

6. In the **Reconnect External Volumes** window, check the volume to be reconnected, accept or enter a new task name, and then click **Apply**.



7. Click **Apply** in the **Confirm** window.

When you finish the procedure, the external volume status displays as **Checking**, then **Normal**. If the volume cannot be resumed because the mapped settings and the external volume status are not in sync, the status becomes to **Blockade**.

Related Topics

- Reconnect External Volumes window on page D-59

Changing path mode to ALUA mode (Enable or Disable)

You can select whether ALUA mode is used as the path mode. See Supported external systems path mode for external volumes on page 4-7.

Prerequisites

- The external storage system must support ALUA. If **Enable** is set for **ALUA Settable** on the external volume, **Enable** is set for **Use ALUA as Path Mode** automatically. If **Disable** is set for **ALUA Settable**, **Disable** is set for **Use ALUA as Path Mode** automatically.
- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.

b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.

In Device Manager - Storage Navigator:

a. Click **Storage Systems**, and then expand the **Storage Systems** tree.

b. Click **External Storage**.

2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, click the link for a path group.
4. On the **Mapped Volumes** tab, select an external volume, and then click **Edit External Volumes**.
5. On the **Edit External Volumes** window, select **Enable** or **Disable** as the **Use ALUA as Path Mode** property.
6. Click **Finish** to display the **Confirm** window.
7. Confirm the settings and enter the task name in the **Task Name** box.
8. In the **Confirm** window, click **Apply**.

Changing I/O mode for external storage systems

With Load Balance Mode settings, you can change the I/O mode for external storage systems for each of the external volumes.

This section describes operations to change the Load Balance Mode of external volumes in the Edit External Volumes window. For more information, see Load Balance Mode on page 4-8.

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.

   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.

   In Device Manager - Storage Navigator:

   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.

   b. Click **External Storage**.

2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, click the link for a path group.

4. On the **Mapped Volumes** tab, select an external volume, and then click **Edit External Volumes**.
5. On the **Edit External Volumes** window, select the **Load Balance Mode** property, and then click **Extended Round-robin**, **Normal Round-robin**, or **Disable**.
6. Click **Finish** to display the **Confirm** window.
7. Confirm the settings and enter the task name in the **Task Name** box.
8. In the **Confirm** window, click **Apply**.

Changing the port setting of an external storage system

You can change the port setting of an external storage system from the **Edit External WWNs** window for Fibre Channel port and **Edit External iSCSI Targets** window for iSCSI port. However, it is important to note the following:

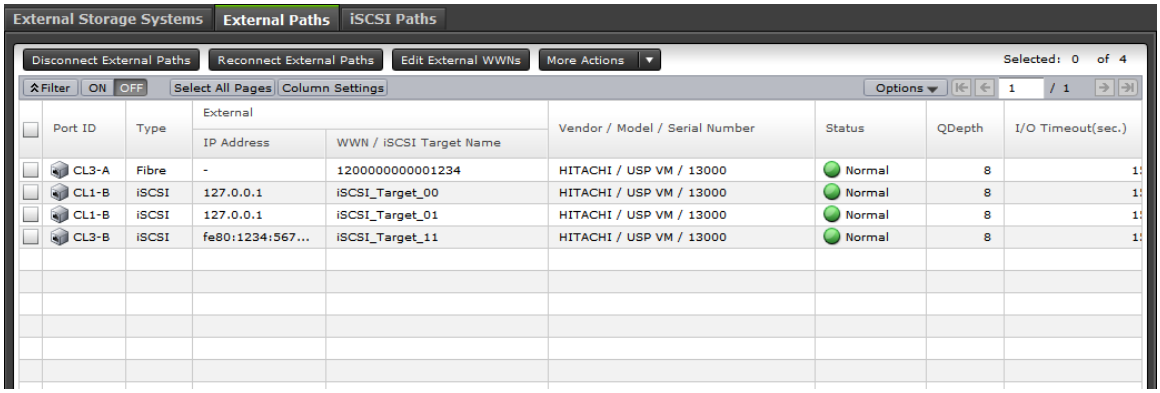
- If the current setting is error-free, it is best to continue using it.
- For an external volume with normal I/O, set **I/O Timeout** from 5 - 15 seconds.
- Use the external system's recommended values for other port settings.
- If you are going to change several parameters for the same external WWN or the same external iSCSI target, ensure that a task is completed before you perform the next task. If you perform a new task before the prior task is completed, the prior task might not be applied.

Prerequisites

- Storage Administrator (Provisioning) role

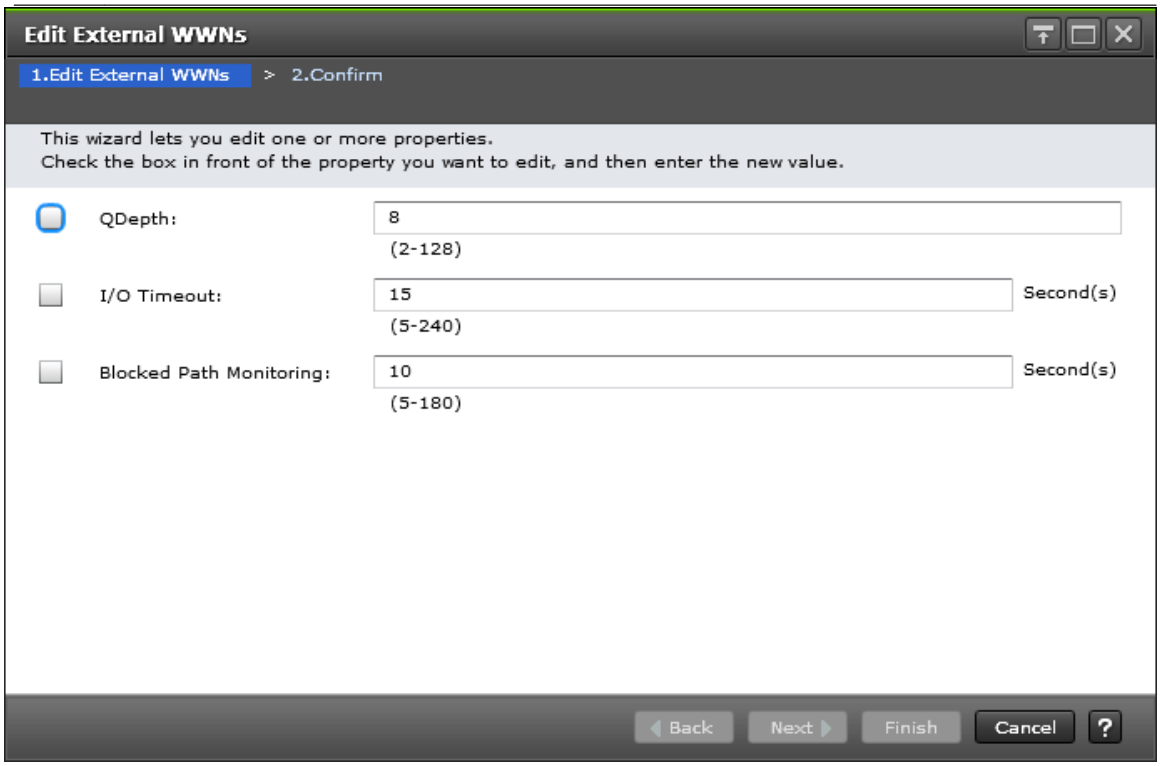
Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. Click the **External Paths** tab.
3. For a Fibre Channel port: On the **External Paths** tab, select **Edit External WWNs**.
   For an iSCSI port: On the **External Paths** tab, click **More Actions** then select **Edit External iSCSI Targets**.



4. In the **Edit External WWNs** window or the **Edit External iSCSI Targets** window, change the desired settings.

Note: The current values for the external WWN display unless you have selected multiple paths with different values. Then the fields are blank.



- **QDepth**. Enter the number of Read/Write commands that can be issued (queued) to the external volume at one time. The number can range from 2 to 128.
- **I/O Timeout**. Enter the number of seconds that should pass before I/O to the external volume times out. The range is 5 to 240 (seconds).
- **Blocked Path Monitoring**. Enter a time that should elapse from the time when the connection to the external volume goes down to the time when the external volume is blocked. Commands from the host are accepted until Blocked Path Monitoring passes, then the status of

the external volume and all paths to that volume becomes Blockade. The range is from 5 to 180 (seconds).

5. Click **Finish**.
6. In the **Confirm** window, check settings, accept or enter a new task name, and then click **Apply**.

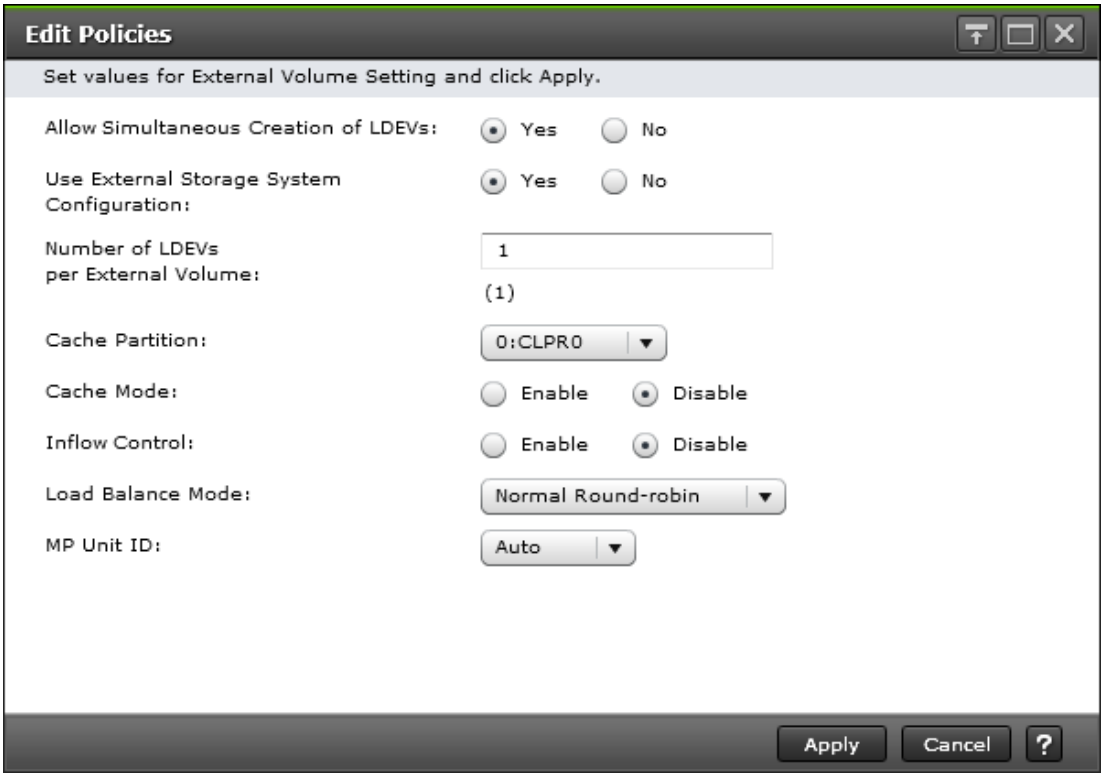
Editing mapping policies

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. In the **External Storage** window, click the **External Paths** tab.
3. On the **External Paths** tab, select a path group.
4. Click **More Actions** and select **Edit Policies**.
5. In the **Edit Policies** window, make whatever changes are required to the external volume settings.
6. Click **Apply**.



Note: You can also edit **Cache Mode** and **Inflow Control** for individual external volumes. In Device Manager - Storage Navigator, select an external volume in the **Mapped Volumes** tab. Then click **Edit External Volumes**.

Related Topics

- Edit Policies window on page D-29

Deleting external volume mapping

You can delete the mapping for an external volume. The data in the external volume is not deleted.

Prerequisites

- The external volume or volumes to be deleted must first be disconnected, which results in all data in cache memory being written to the external volume.

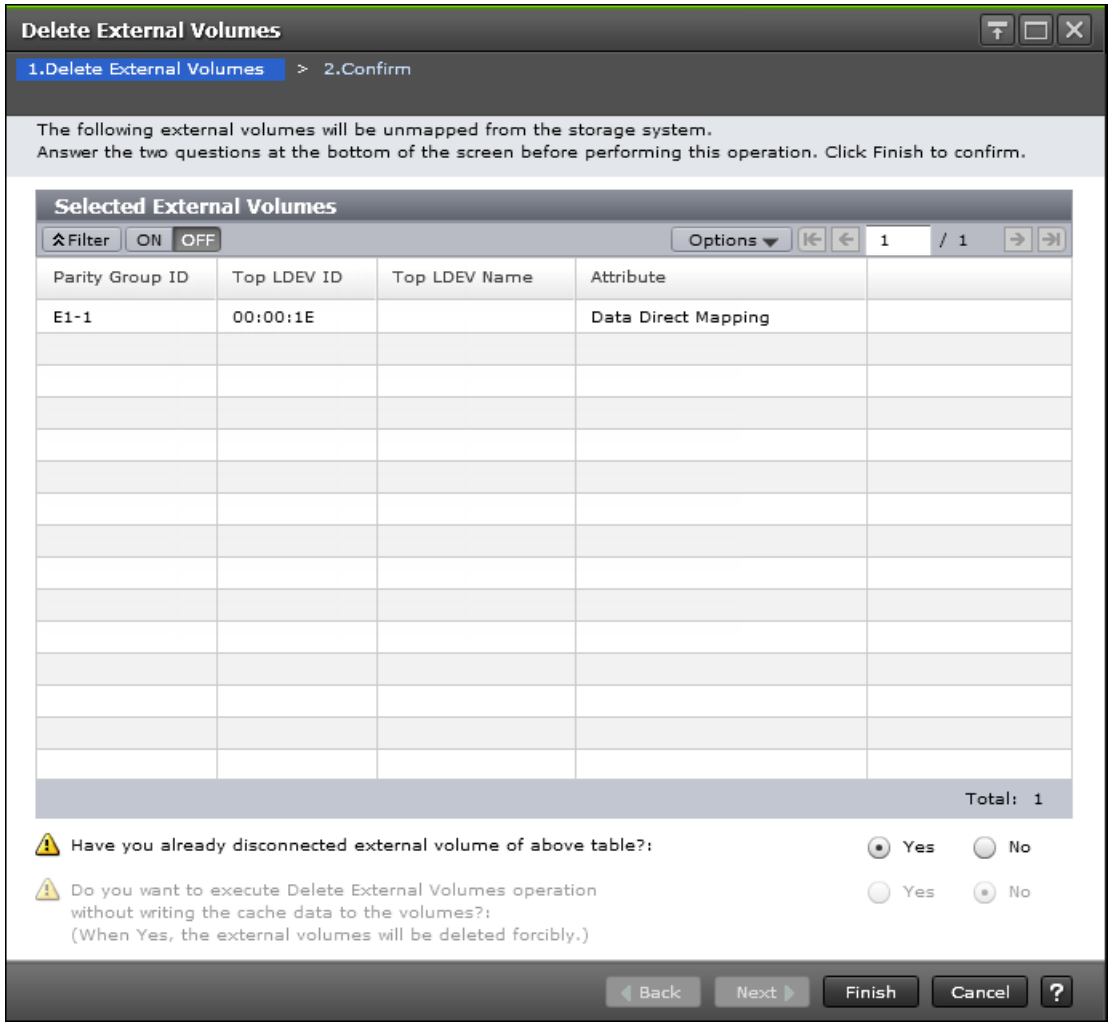
  However, you can delete a volume without disconnecting, meaning that data in cache is not destaged to the external volume.
- You cannot delete a mapping while the external volume is used in the following:
  - TrueCopy, Universal Replicator, ShadowImage, or Thin Image
  - A reserved volume for ShadowImage or Volume Migration.

- A pool-VOL

- For command devices, stop the application using the external volume as a command device.
- You must have Storage Administrator (Provisioning) role to perform this task.

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system
3. On the **External Path Groups** tab, click the link for a path group.
4. On the **Mapped Volumes** tab, select the external volume.
5. Click **More Actions** and select **Delete External Volumes**.
6. In the **Delete External Volumes** window, verify the external volumes you want to delete.



7. For **Have you already disconnected external volume of above table?**, click one of the following:
   - **Yes** if you have already disconnected the volumes.
   - **No** if you have not disconnected the volumes.
8. If you clicked **No** in the previous field, in the **Do you want to execute Delete External Volumes operation without writing the cache data to the volumes?**, click one of the following:
   - **Yes** to delete the external volumes without writing the data in cache memory into the volumes.

Note: When **Yes** is selected, the data remaining in cache is not guaranteed.

   - **Cancel** to disconnect the volume or volumes and then perform the delete operation again.

     You cannot continue the operation if **No** is selected.
9. Click **Finish**.

10. In the **Confirm** window, check settings and accept the task name shown or enter a new one. When satisfied click **Apply**.

Related Topics

- Delete External Volumes wizard on page D-42

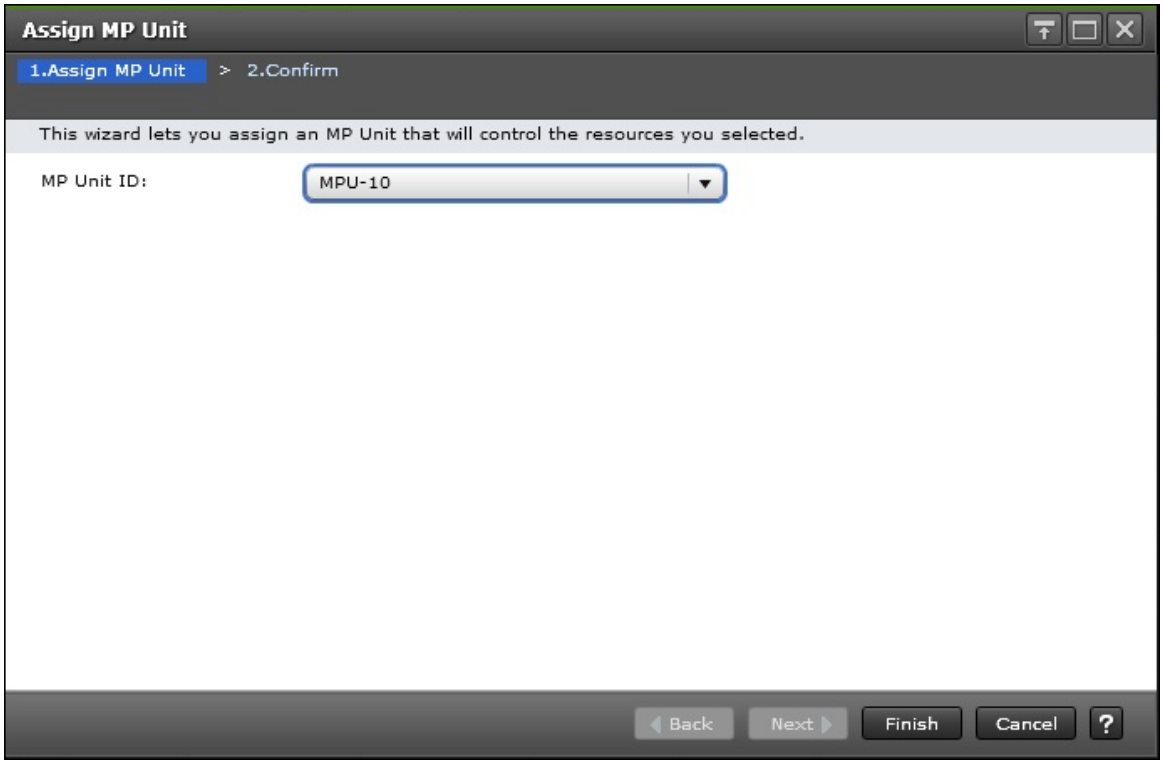
Changing the MP Unit of an external volume

Prerequisites

- Storage Administrator (Provisioning) role

Procedure

1. Open the **External Storage** window.
   In Hitachi Command Suite:
   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems**.
   b. Expand the target storage systems, right-click **External Storage**, and then select **System GUI**.
   In Device Manager - Storage Navigator:
   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **External Storage**.
2. On the **External Storage Systems** tab, click the link for an external system.
3. On the **External Path Groups** tab, click the link for a path group.
4. On the **Mapped Volumes** tab, select one or more external volumes, and then select **More Actions > Assign MP Unit.**
5. In the **Assign MP Unit** window, select the desired **MP Unit ID**.



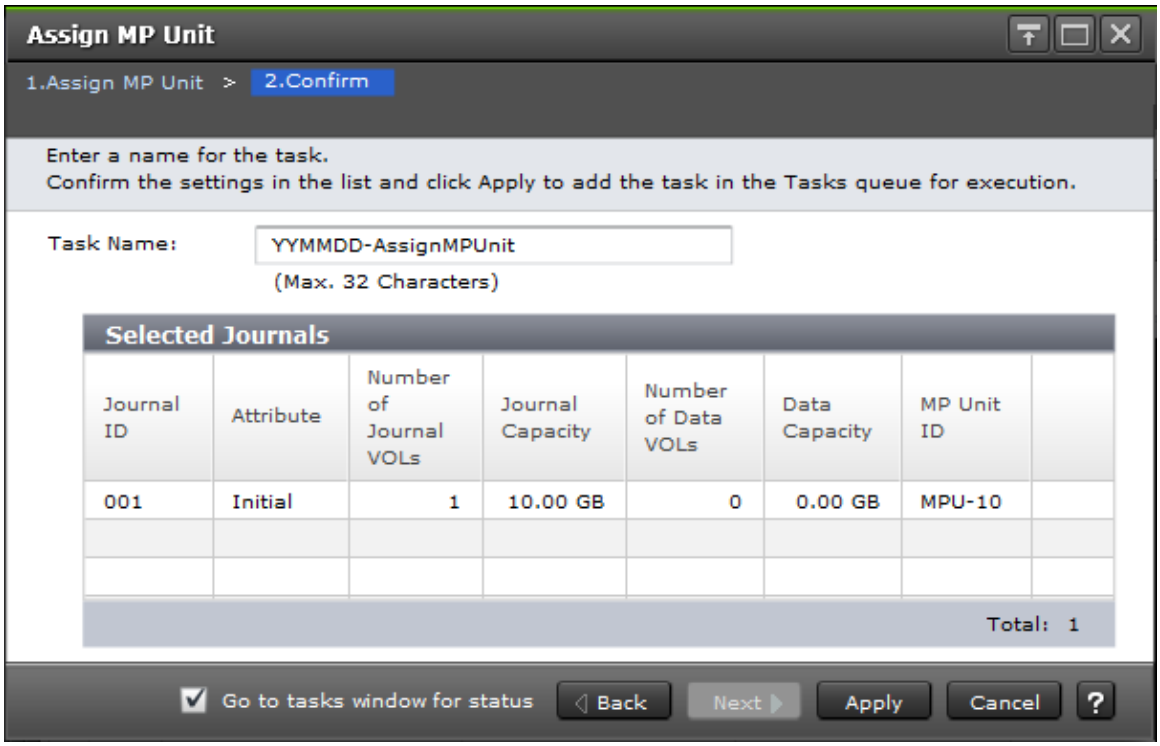
The current setting for the external volume displays, unless you have selected multiple external volumes with different values. Then the field is blank.

The choices you see are dependent on the configuration of the device.

Note: MP unit assignment should be set to evenly distribute work across all the available processors.

Selecting **Auto** allows the system to assign the blade.

6. Click **Finish**.
7. In the **Confirm** window, check settings, accept or enter a new task name, and then click **Apply**.


Assign MP Unit
1.Assign MP Unit > 2.Confirm
Enter a name for the task.
Confirm the settings in the list and click Apply to add the task in the Tasks queue for execution.
Task Name:
YYMMDD-AssignMPUnit
(Max. 32 Characters)
Selected Journals
Journal ID
Attribute
Number of Journal VOLs
Journal Capacity
Number of Data VOLs
Data Capacity
MP Unit ID
001
Initial
1
10.00 GB
0
0.00 GB
MPU-10
Total: 1
Go to tasks window for status
Back
Next
Apply
Cancel
?

6

Troubleshooting

This topic provides troubleshooting information.

Contacting Hitachi Data Systems customer support

If you need to contact the Hitachi Data Systems 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 on 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 HDS customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the HDS Support Portal for contact information: https://hdssupport.hds.com

General troubleshooting

Check the following table for the problem. After removing an error, retry the operation.

Problem	Possible causes
Storage Navigator cannot access the external volume.	• An error occurred in the switch, or the switch is off. • The cables are not properly connected. • The external volume was deleted in the external system. • An error occurred in the external volume. • The path is changed in the external system. • The port attribute in the local storage system is changed. • Topology information is not properly set.
The external volume cannot be mapped.	• The number of mapped volumes exceeds the following maximum number available for the local storage system: - VSP G200: 2,048 - VSP G400 and VSP G600: 4,096 - VSP G800: 14,080 • There are not enough LDKC:CU:LDEV numbers available for external volume mapping.
The external path is blocked.	• See the problem, Device Manager - Storage Navigator cannot access the external volume. If the problem persists after correcting any errors, continue to the next item.

Problem	Possible causes
	• Confirm that the cable between the local and external system is connected properly. • If the cable is properly connected, disconnect it and then reconnect. After 30 seconds, check the path status. If the path is not restored, call Hitachi Data Systems customer support.
Action is required for a path status in the **View External LUN Properties** dialog box.	See Troubleshooting external path status on page 6-4.
The volume in the external system cannot be found even after port discovery or volume discovery was performed.	Perform any required action in the message and then retry the operation. If the problem persists, see Troubleshooting port and volume discovery problems on page 6-11.
The external volume is blocked.	• All external paths are blocked (paths are not connected). • The external volume is not set to Read/ Write. • The external volume is blocked by an error.
The status of the external volume is blockade.	When errors occur in all external paths, the local storage system changes the status of the external volume to Blockade. • Reconnect the volume or storage system. • If the volume's status still does not change to Normal, restore the path as described in the problem above, "The external path is blocked", and then reconnect the volume again.
The ? sign displays in the **LUN ID (Highest Priority)** column of the **Discovered External Volumes** table (**Add External Volumes** window).	A corresponding external volume was not found for the external path with the highest priority. Confirm the connection with the external system that failed during volume discovery, correct the error, and perform the operation again.
External volume discovery was not completed because of failure.	Confirm the connection with the external system; also confirm that the external volume is correctly configured in the external system, then perform the operation again.
After reconnecting an external volume or system, 10 minutes have passed but the status has not change from **Checking**.	Click **Refresh** on the Device Manager - Storage Navigator main window. If the status remains **Checking**, perform the reconnect operation again. If the problem persists after a reasonable time, call Hitachi Data Systems customer support.
After disconnecting an external volume or system, the status does not change from **Cache Destage**.	Click **Refresh** on the Device Manager - Storage Navigator main window. Note that the time required for write processing from cache to the external volume depends on volume capacity. More time is required for larger volumes. Processing speed is about 20 MB/s.

Problem	Possible causes
	However, this also depends on the performance and status of the external system. If status does not change from **Cache Destage** after a reasonable time, call Hitachi Data Systems customer support.

Troubleshooting external path status

The following table shows path statuses in the **View External LUN Properties** window. Descriptions and corrective actions you can take are provided.

Also, see Troubleshooting path errors for specific storage systems on page 6-6.

Status	Description	Corrective action
Unknown	The path status cannot be determined.	Call Hitachi Data Systems customer support.
Blockade	The port connected to the external storage system is blocked.	The port is blocked because of firmware replacement, package replacement, or other factor. Check the status of the local storage system. If you cannot restore the path, call Hitachi Data Systems customer support.
External device setting changed	An external system setting has changed. For example, the path definition was deleted, or the external system itself was replaced by another device.	The port of the external system is recognized. See your device manufacturer's documentation to verify that the settings on the volumes in question have not changed.
LDEV size reduced	The external volume capacity was reduced.	Check the external volume capacity. Delete the external volume, and then remap to it.
Not ready	The reply of the external system was NOTREADY. Either the drive is spinning up or the system is being formatted.	The path cannot be used to access the external system. Check the status of the external system. If you cannot restore the path, call Hitachi Data Systems customer support.
Illegal request	The reply of the external system was ILLEGALREQUEST. The command cannot be executed to the external system. Data protection may be set on the external system.	The external system port is recognized. Check the external system settings. If you cannot restore the path, call Hitachi Data Systems customer support.
Command aborted	The reply of the external system was ABORTEDCOMMAND. An error may have occurred on the external system side.	The external system port is recognized. Check external system settings and the physical connection to the external system

Status	Description	Corrective action
		(cables and switches). If you cannot restore the path, call Hitachi Data Systems customer support.
Busy	The external system is in the BUSY status.	The external system port is recognized. Check whether the external system configuration causes excessive load on the system. If you cannot restore the path, call Hitachi Data Systems customer support.
Response error	The external system is in blocked status caused by an abnormal reply (Response). You may not be able to access the system, or data protection may be set.	The external system port is recognized. Check the setting and status of the external system. If you cannot restore the path, call Hitachi Data Systems customer support.
Initiator port	The port attribute of the external system has been changed to "initiator".	Set the port attribute of the external system to "target". If you cannot restore the path, call Hitachi Data Systems customer support.
Destage Failed	The writing of data from cache memory to the external volume failed.	Reconnect the external volume or system. When status is Normal, disconnect the volume or system. You may need to try this multiple times. If the problem remains, call Hitachi Data Systems customer support.
Unknown port	The port attribute of the external system is unknown.	The external system port is recognized. Check external system settings and the physical connection to the external system (cables and switches). If you cannot restore the path, call Hitachi Data Systems customer support.
Cannot detect port	The external path has been removed or the external system port cannot be found. Possible causes are: • The cable is not properly connected. • The topology does not match between the ports connected to the external storage system and target ports. • Because security is set on the port, the external system cannot be recognized from the local system.	If you cannot restore the path after checking the possible causes, call Hitachi Data Systems customer support.

Status	Description	Corrective action
	• If the external system is connected through switches, the switch setting may be incorrect.	
Internal error	A program error occurred, or there is a logical contradiction.	Call Hitachi Data Systems customer support.
Timeout	Processing was retried because of an abnormal reply; however, processing was stopped because of timeout.	The external system port is recognized. Check external system settings and the physical connection to the external system (cables and switches). If you cannot restore the path, call Hitachi Data Systems customer support.
Device check error	An external volume is mapped, but you cannot access the volume in the external system.	Check the volume's status in the external system and take any necessary corrective action. Format the volume if it is not formatted.
Medium error	The external volume has become inaccessible.	Check the volume's status in the external system and take any necessary corrective action. Format the volume if it is not formatted.

Troubleshooting path errors for specific storage systems

Storage system-specific recovery information is provided for the following errors:

- External device setting changed
- Illegal request
- Cannot detect port

Virtual Storage Platform G200, G400, G600, G800 Storage System

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete Volume and then Add Volume operations using Universal Volume Manager. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it may be protected because of the pair status. If this is the case, make sure the volume is not set to a pair such as TrueCopy, Universal Replicator, ShadowImage, or

Path Status	Description and corrective actions
	global-active device, then change the pair status or delete the pair. The access attribute of the volume might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Manager. If so, disable it.

Unified Storage VM, Virtual Storage Platform, and Universal Storage Platform V/VM

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete Volume and then Add Volume operations using Universal Volume Manager. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Manager. If so, disable it.

Universal Storage Platform / TagmaStore NSC

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Manager. If so, disable it.

Lightning 9900 V

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager. • The volume's access attribute might have been changed by Open LDEV Guard. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by Open LDEV Guard. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port

Path Status	Description and corrective actions
	might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Manager. If so, disable it.

Lightning 9900

Path Status	Description and corrective actions
External device setting changed	LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager.
Illegal request or Response error	If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Manager. If so, disable it.

Thunder 9500V

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Management. Either change the settings back to the values used when the volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager. • The volume's access attribute might have been changed by Open SDEV Guard. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by Open SDEV Guard. If the volume is protected by the access attribute, release the protection.

Path Status	Description and corrective actions
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • The host group LUN security might have been enabled by LUN Management. If so, disable it.

HUS/AMS/WMS

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Manager. Either change the settings back to the values used when the volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by Data Retention Utility. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • The host group LUN security might have been enabled by LUN Manager. If so, disable it.

SVS200

Path Status	Description and corrective actions
External device setting changed	• LU path settings might have been changed by LUN Management. Either change the settings back to the values used when the

Path Status	Description and corrective actions
	volume was mapped, or perform the Delete LU and then Add LU operations using Universal Volume Manager. • The volume's access attribute might have been changed by LUN Security XP Extension. If the volume is protected by the access attribute, release the protection.
Illegal request or Response error	• If the volume is a pair volume, it might be protected because of the pair status. If this is the case, change the pair status or delete the pair. • The volume's access attribute might have been changed by LUN Security XP Extension. If the volume is protected by the access attribute, release the protection.
Cannot detect port	• There is a problem with connection to the external storage system. The possible causes are: - Cable connection. Make sure the cable is connected correctly. - Fibre Channel port settings. The topology settings between the port connected to the external storage system and the target port might not match. Make sure that the Fibre Channel ports are set properly using LUN Manager. - Switch settings. If the external storage system is connected through switches, make sure that the switch settings are correct. • LUN security might have been enabled by LUN Management. If so, disable it.

Troubleshooting port and volume discovery problems

The following table shows corrective actions you can take for port and volume discovery problems.

Problem	Corrective action
The port on the local storage system and port on the external system are not connected.	Connect the port of the local system and the external system port.
The cable for the switch is not connected correctly, or the switch's port is blocked.	Connect the cable to the correct port on the switch. Or change the port status to the normal status.
Zoning for the switch is not set appropriately.	Make sure the zoning configuration is correct so that the port of the local system can communicate with the external system port.
External volume returned RESERVATION CONFLICT.	Release the reserved state of the external volume.
Port security is set on the external system.	Cancel the port security setting or change the security of the external system so that the local system can access the port of the external system.
No LU is configured on the external system port.	Configure an LU on the port.

Problem	Corrective action
External volume capacity is less than the supported capacity for Universal Volume Manager.	Perform one of the following: • Increase the external volume's capacity to be equal or larger than the supported capacity. • Use a security function or delete the LU setting from the external system port so that the local system cannot recognize a volume with insufficient capacity.
The external volume is configured as a management LU.	If a management LU, such as Universal Xport LU, is configured on the external system port, perform one of the following: • Make sure that at least one LU is used for data storage and has a smaller LUN than the management LU's LUN. Also make sure that the data storage LU is set to the port connected to the local system. • Delete the management LU from the port connected to the local system. • Use a security function and configure the access attribute of the management LU to prohibit read and write operations.
Remote command devices of the external system are cascaded.	Perform one of the following: • Change the configuration so that the remote command devices are not cascaded. • Use a security function or delete the LU setting from the port of the connected external system so that the local system cannot recognize the remote command devices.
External system information retrieved by port discovery is not found in the profile information.	Perform one of the following: • Connect an external system supported by Universal Volume Manager. • Call Hitachi Data Systems customer support to ask if the external system is supported by Universal Volume Manager. If the system is supported, install the firmware version that supports the external system or install the profile information of the external system.
Login to the external system failed.	Perform one of the following: • Make sure that the port of the external system is in Normal status. • Register the WWN to the external system to allow login from the local system.
The external volume is not in Normal status, or a failure or error occurred in retrieving information from the external system.	Make sure that the external system or the external volume is in the Normal status.

If none of the actions suggested in the table provide volume discovery, remove the cable connection between the local and external storage systems,

and then reconnect the storage systems. After 30 seconds, retry the operation.

A

Supported external storage systems

This topic provides required configuration settings for many of the supported external storage systems.

- Sun StorageTek FlexLine 380
- Sun StorageTek 2540
- Sun StorageTek V2X2
- EMC CLARiiON CX series
- EMC VNX series
- EMC Symmetrix series
- IBM DS3000/DS4000/DS5000 series
- IBM V7000 series
- IBM SVC series
- IBM XIV series
- Fujitsu FibreCAT CX series
- Fujitsu DX60/80/90 S2 and Fujitsu DX400 S2
- SGI IS4600 series
- 3Par T800, F400, V800, V400 series
- Connecting with a storage system other than Hitachi
- Storage system with a product name displayed as (generic)

External systems

The storage systems in the following sections can be connected to Virtual Storage Platform G200, G400, G600, G800 as external storage systems.

Note: Not all information on supported systems is provided here. If you do not find your storage system, refer to http://www.hds.com/products/storage-systems/specifications/supported-external-storage.html for a complete listing.

HUS VM Storage System

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.
- If the external HUS VM Storage System uses Open LDEV Guard, set System Option Mode (SOM) 701 to **ON** on the local Virtual Storage Platform G200, G400, G600, G800 system.

Virtual Storage Platform

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.
- If the external VSP Storage System uses Open LDEV Guard, set System Option Mode (SOM) 701 to ON on the local Virtual Storage Platform G200, G400, G600, G800 system.

Virtual Storage Platform G1000

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.
- If the external Virtual Storage Platform G200, G400, G600, G800 system uses Open LDEV Guard, set System Option Mode (SOM) 701 to **ON** on the local Virtual Storage Platform G200, G400, G600, G800 system.

Universal Storage Platform V/VM

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.
- If the external USP V/VM system uses Open LDEV Guard, set SOM 701 to **ON** on the local Virtual Storage Platform G200, G400, G600, G800 system.

Universal Storage Platform/TagmaStore NSC

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.
- If the external USP system uses Open LDEV Guard, set SOM 701 to **ON** on the local Virtual Storage Platform G200, G400, G600, G800 system.

Host mode option for a volume larger than 2 TB

If a volume's capacity is more than 2 TB, host mode option No. 24 must be enabled before mapping it as an external volume. For instructions, see the *LUN Manager User's Guide* for the Universal Storage Platform / TagmaStore NSC storage system.

Lightning 9900 V

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.

Lightning 9900

Use the following settings on the external system:

- The port's host mode must be set to PC Server (0C).
- The port attribute must be set to **Target port** or **RCU target port**.

Thunder 9500V

The following versions are recommended. If you use an earlier version, the SATA drive information may not display correctly.

- For Thunder 9530V, Thunder 9520V, Thunder 9570V: Firmware version 0658 or later.

- For Thunder 9580V, Thunder 9585V: Firmware version 1658 or later.

The following table shows the system parameters that must be specified for ports on the Thunder 9500V storage system.

Window Names	Parameters	Parameter Settings
System Startup Settings	Start Attribute	
	Single Mode	Use when the Thunder 9500V is in a one-controller configuration.
	Dual Active Mode	Use when the Thunder 9500V is in a two-controller configuration. Be sure to specify that Data Share Mode will be used.
	Hot Stand-By Mode	Do not specify this parameter.
Common 1	Delay Planned Shutdown	Optional
OPTION 1	SCSI Fibre Channel Common Options	Optional
OPTION 2	SCSI Fibre Channel Common Options	Optional
Data Striping	Operation if the processor failure occurs	**Reset of occurred**
Inquiry Setting	Command Queuing Mode	**ON**
	Vendor ID	**HITACHI** (default)
	Product ID	**DF600F** (default)
	ROM Firmware Version	Optional
	RAM Firmware Version	Optional
	WEB Title	Optional
Port Type	Reset/LIP Mode	
	Reset/LIP Mode (Signal)	Optional
	Reset/LIP Mode (Process)	Optional
	LIP Reset Mode	Optional
Controller Option	RS232C Error Information Outflow Mode	Optional
	Write and verify mode	**ON**
Host Connection Mode	Host Connection Mode 1	**Standard Mode**
	Host Connection Mode 2	**HISUP Mode** (do not specify any other parameter).

Identifying the 9500 V model using the serial number

You can identify the storage system model from the serial number displayed in the **Vendor / Model / Serial Number** column in the **External Storage System** tab.

The following table shows the relationship between the number in the **Serial Number** column and the storage system model.

Displayed Serial Number	Model
D600XXXX	9570V, 9520V
D60JXXXX	9530V
D60HXXXX	9580V, 9585V
Note: In serial numbers, "X" is an arbitrary number or character.	

Identifying the controller using the port WWN

You can identify the controller (controller 0 or controller 1) from the WWN of the port.

The following table describes the relationship between the port WWN and the controller.

Model	Controller	WWN of Port
9570V 9530V 9520V	Controller 0	XXXXXXXXXXXXXXX0 XXXXXXXXXXXXXXX1
	Controller 1	XXXXXXXXXXXXXXX2 XXXXXXXXXXXXXXX3
9580V 9585V	Controller 0	XXXXXXXXXXXXXXX0 XXXXXXXXXXXXXXX1 XXXXXXXXXXXXXXX2 XXXXXXXXXXXXXXX3
	Controller 1	XXXXXXXXXXXXXXX4 XXXXXXXXXXXXXXX5 XXXXXXXXXXXXXXX6 XXXXXXXXXXXXXXX7
Note: In WWNs, "X" is an arbitrary number or character. The ports in the same physical storage system have the identical value.		

Virtual Storage Platform G200, G400, G600, G800 storage systems

If the Virtual Storage Platform G200, G400, G600, G800 storage system is connected as external storage, set host mode 0C (Windows) or 2C (Windows Extension) for the port.

HUS/AMS/WMS

The table below shows the system parameters that must be specified for ports on HUS, AMS, and WMS storage systems when used with Universal Volume Manager. You can specify or omit any other parameters.

Also, ensure the following two settings *using Storage Navigator Modular or Storage Navigator Modular2*:

- Set the data transfer speed of the port connected to the external storage system to a fixed value other than Auto.
- Set the data transfer speed of the target port of the HUS/AMS/WMS storage system to a fixed value consistent with the data transfer speed of the port connected to the external storage system.

Window Names	Parameters	Parameter Settings
Boot Options	Start Attribute	
	Single Mode	Specify when HUS/AMS/WMS is in a one-controller configuration.
	Dual Active Mode	Specify when HUS/AMS/WMS is a two-controller configuration.
	Delay Planned Shutdown	Optional
	Drive blocking mode	Optional
	Vendor ID	**HITACHI** (default-do not change)
	Product ID	**DF600F** (default-do not change)
	ROM Firmware Version	Optional
	RAM Firmware Version	Optional
System Parameter	Option	Optional
	Operation if the processor failure occurs	**Reset of occurred**.
	WEB Title	Optional
	Write and verify mode	For AMS 1000, AMS 500, AMS 200 and WMS 100: **ON** For HUS 150, HUS 130, HUS 110, AMS 2500, AMS 2300, AMS 2100, and AMS 2010: **OFF**

Window Names	Parameters	Parameter Settings
Port Options	Port Option	Optional
Host Connection Mode	Host Connection Mode 1	Set AMS common setting to **Standard Mode**.
	Host Connection Mode 2	Do not specify any parameters for AMS additional settings. For AMS 1000, AMS 500, AMS 200 and WMS 100, do not specify HISUP OFF mode.

Identifying the HUS/AMS/WMS model using the serial number

When the external storage system is HUS, AMS, or WMS, you can identify the storage system model from the serial number displayed in the **Serial Number** column in the **Volume Operation** window.

The following table describes the relationship between the number in the Serial Number column and the storage system model.

Storage System	Displayed Serial Number	Model
HUS	95XXXXXX	HUS 150
	93XXXXXX	HUS 130
	91XXXXXX	HUS 110
AMS	87XXXXXX	AMS 2500
	85XXXXXX	AMS 2300
	83XXXXXX	AMS 2100, AMS 2010
	77XXXXXX	AMS 1000
	75XXXXXX	AMS 500
	73XXXXXX	AMS 200
WMS	71XXXXXX	WMS 100
In serial numbers, "X" is an arbitrary number or character.		

When the model of HUS/AMS/WMS storage system is changed, the **Serial Number** is changed as well. If the HUS/AMS/WMS storage system is used as an external storage system, the mapped external volume may be blocked. To correct this problem, you can delete the mapping of the external volume and remap it to use the blocked external volume. See Considerations for external storage system maintenance (remapping) on page 2-6 for detailed information on remapping.

Identifying the controller using the port WWN (HUS/AMS/WMS)

When the external storage system is HUS, AMS, or WMS, you can identify the controller (controller 0 or controller 1) from the port WWN.

The following table describes the relationship between the port WWN and the controller.

Model	Controller	WWN of Port
AMS 200 WMS 100	Controller 0	XXXXXXXXXXXXXXX0
	Controller 1	XXXXXXXXXXXXXXX1
AMS 2100 AMS 2010 AMS 500	Controller 0	XXXXXXXXXXXXXXX0 XXXXXXXXXXXXXXX1
	Controller 1	XXXXXXXXXXXXXXX2 XXXXXXXXXXXXXXX3
HUS 110 HUS 130 AMS 2300 AMS 1000	Controller 0	XXXXXXXXXXXXXXX0 XXXXXXXXXXXXXXX1 XXXXXXXXXXXXXXX2 XXXXXXXXXXXXXXX3
	Controller 1	XXXXXXXXXXXXXXX4 XXXXXXXXXXXXXXX5 XXXXXXXXXXXXXXX6 XXXXXXXXXXXXXXX7
HUS 150 AMS 2500	Controller 0	XXXXXXXXXXXXXXX0 XXXXXXXXXXXXXXX1 XXXXXXXXXXXXXXX2 XXXXXXXXXXXXXXX3 XXXXXXXXXXXXXXX4 XXXXXXXXXXXXXXX5 XXXXXXXXXXXXXXX6 XXXXXXXXXXXXXXX7
	Controller 1	XXXXXXXXXXXXXXX8 XXXXXXXXXXXXXXX9 XXXXXXXXXXXXXXXA XXXXXXXXXXXXXXXB XXXXXXXXXXXXXXXC XXXXXXXXXXXXXXXD XXXXXXXXXXXXXXXE XXXXXXXXXXXXXXXF
Note: In WWNs, "X" is an arbitrary number or character. The ports in a physical storage system have the identical value.		

When the model of HUS/AMS/WMS storage system is changed, the WWN of the port is changed as well. If the HUS/AMS/WMS storage system is used as

an external storage system, the mapped external path may be blocked. To correct this problem, you can delete the mapping of the external path and remap it to use the blocked external path. See Considerations for external storage system maintenance (remapping) on page 2-6 for detailed information on remapping.

Identifying logical volumes using Volume Properties

The Volume Properties value is the internal LUN number of the LUNS from the AMS/WMS.

Caution on using the power savings option

When an HUS 150, HUS 130, HUS 110, AMS 2500, AMS 2300, AMS 2100, or AMS 2010 storage system is connected as an external system with the Power Savings option is enabled, do not access external volumes from a host if the external volumes are spinning down. This prevents the external volume status from changing to **Blockade**.

If external volume status changes to **Blockade**, the volume is automatically restored in several hours. You can also manually restore the external volumes by reconnecting the external volume.

HUS and AMS 2000 series guidelines

- If a failure occurs in an HUS or AMS 2000 series system, responses from local storage systems to the HUS or AMS 2000 series system might be delayed. To prevent requests from external storage systems from timing out, configure the local storage systems as follows:
  - Set the I/O timeout value of the local storage system to 35 seconds.
  - Set the timeout value of the external storage system to *(I/O-timeout-value* x 2) + *margin*. For example:

    (35 seconds x 2) + 10 seconds = 80 seconds
- Avoid unnecessary load to the external storage system. Path mode between storage systems is Multi mode; therefore, when many external paths and mapping volumes are mapped, the load to the external system is high; some commands from host to Virtual Storage Platform G200, G400, G600, G800 or from Virtual Storage Platform G200, G400, G600, G800 to the external system may time out. To keep the proper load, the following is recommended.
  - Specify two external paths. Set the paths to the ports of each controller of the AMS 2000 series system.
  - Set the queue to 500 or fewer commands issued at the same time from a AMS 2000 series system. The formula to calculate the number of queue commands per system is as follows.

    (number of queues) x (number of external paths) x (number of concurrent external volume commands) < 500

For more information about command queue settings, see Changing the port setting of an external storage system on page 5-27.

- When using external volumes for replication, the copy operation needs to be distributed to two or more RAID groups.

  There is an upper bound to the number of pairs that can be used for initial copy or resynchronization. Therefore, the copy operation may focus on a specific RAID group according to the order of the operation when it is performed to two or more external volumes.

  If the copy operation focuses on a specific RAID group, then the AMS 2000 drive could bottleneck.

SVS200 storage system

Use the following settings on the external system:

- The port must be set to the host group for the Windows hosts (host mode 0C: Windows, host mode 2C: Windows Extension).
- The port attribute must be set to **Target port** or **RCU target port**.

EVA storage system

Use the following settings on the external system:

- The port must be configured as a target attached to a Windows host.
- EVA storage systems with firmware version 4.000 or later can be connected as an external system.
- On the local Virtual Storage Platform G200, G400, G600, G800 storage system, set SOM 720 to **ON** for active path load-balancing support.

Set EVA system parameters in the following table. For parameters not shown, refer to the EVA system documentation for connection parameters.

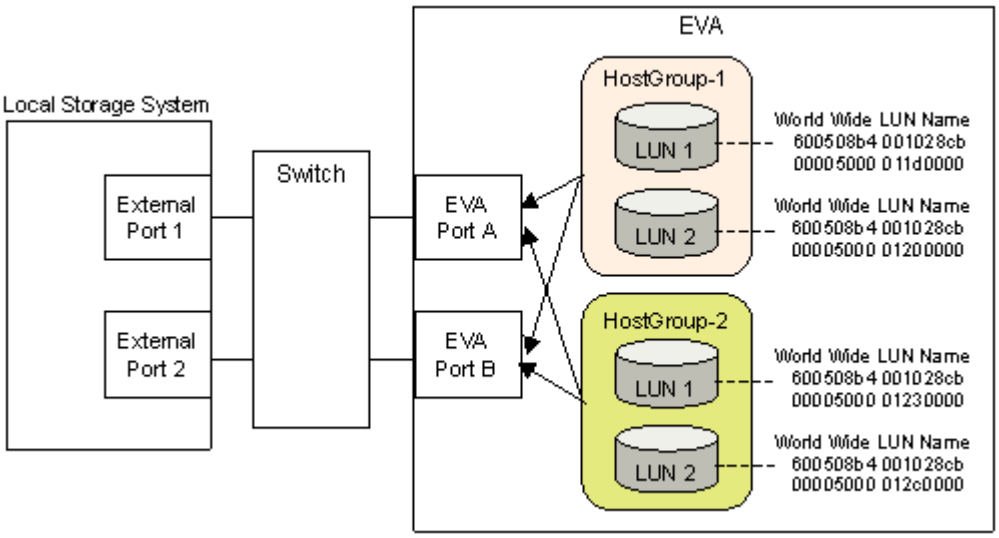
Parameter		Parameter Setting
Add a Host	Host OS	**Windows**

The WWN of each Virtual Storage Platform G200, G400, G600, G800 port connected to an EVA storage system must be registered to the EVA system. See EVA storage system documentation for details on registering WWNs

Identifying logical volumes using Device ID

With an EVA external storage system, LUNs appear as Volume Properties in Device Manager - Storage Navigator windows.

If you search for the logical volumes by specifying the WWN for EVA Port A as illustrated in the following figure, logical volumes LUN 1 and LUN 2 are found for each of HostGroup-1 and HostGroup-2.



In this case, two different logical volumes with the same name (LUN 1 and LUN 2) are found that can be connected from EVA Port A. But you cannot determine which LUN 1 and LUN 2 belong to HostGroup-1 or HostGroup-2 only by Volume Properties.

However, in Device Manager - Storage Navigator, you can identify the logical volumes referring to Device ID. The first 32 characters of Device ID indicate the World Wide LUN Name. Identify the logical volume of the EVA storage system by this World Wide LUN Name.

Sun StorEdge 6120/6320

System Option Mode for connecting Sun StorEdge 6120/6320

When you connect Sun StorEdge 6120/6320 as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when performing maintenance tasks such as rebooting the controller of the external storage system before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

System option parameters for connecting Sun StorEdge 6120/6320

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to the Sun StorEdge 6120/6320 system documentation.

On the local Virtual Storage Platform G200, G400, G600, G800 storage system, set system option mode 725 to **ON** for support of Sun online maintenance operation.

Parameter	Parameter Setting
port host	SUN

Sun StorageTek FlexLine 380

System Option Mode for connecting Sun StorageTek FlexLine 380

When you connect Sun StorageTek FlexLine 380 as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when performing maintenance tasks such as rebooting the controller of the external storage system before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

System option parameters for connecting Sun StorageTek FlexLine 380

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to the Sun StorageTek FlexLine 380 documentation.

Parameter	Parameter Setting
host type	Windows Non-clustered (DMP Support)

Sun StorageTek 2540

System Option Mode for connecting Sun StorageTek 2540

When you connect Sun StorageTek 2540 as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when performing maintenance tasks such as rebooting the controller of the external storage system before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

System option parameters for connecting Sun StorageTek 2540

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to Sun StorageTek 2540 documentation.

Parameter	Parameter Setting
host type	Windows 2K non Clustered DMP

Sun StorageTek V2X2

The port must be configured as a target attached to a Windows host.

Important: Use only one external path when you mapping external volumes. Do not add alternate paths after you finish mapping external volumes.

EMC CLARiiON CX series

The port must be configured as a target attached to a Windows host.

System option mode for connecting EMC CLARiiON CX series

When you connect an EMC CLARiiON CX series as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when performing maintenance tasks such as rebooting the controller of the external storage system before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

System parameters for connecting EMC CLARiiON CX series

When you connect an EMC CLARiiON CX series as an external storage system, set the system parameters according to the following table.

Parameter	Setting
Initiator Type	CLARiiON Open
Failover Mode	2
ArrayCommPath	Disabled

For system parameters not shown in the table, see the EMC CLARiiON CX series documentation.

Note: Volumes created with RAID0 level or Individual Disk Units (JBOD disks) of EMC CLARiiON CX series are not supported. Make sure to define LUN 0 for each port in the EMC CLARiiON CX side.

EMC VNX series

System option mode for connecting EMC VNX series

When you connect an EMC VNX series as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when performing maintenance tasks such as rebooting the controller of the external storage system before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

System parameters for connecting EMC VNX series

When you connect an EMC VNX series as an external storage system, set the system parameters of the EMC VNX series according to the following table:

Parameter	Setting
Initiator Type	CLARiiON Open
Failover Mode	2
ArrayCommPath	Disable

For system parameters not shown in the table, see the EMC VNX series documentation.

Note: Volumes created with RAID0 level or Individual Disk Units (JBOD disks) of EMC VNX series are not supported. Make sure to define LUN 0 for each port in the EMC VNX side.

EMC Symmetrix series

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to EMC Symmetrix series documentation

Parameter	Parameter Setting
SC3 flag	Enable
SPC2 flag	Disable

On the local Virtual Storage Platform G200, G400, G600, G800 system, system option mode 745 needs to be **ON**.

IBM DS3000/DS4000/DS5000 series

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to IBM DS3000/DS4000/DS5000 series documentation.

Parameter	Parameter Setting
host type	When alternate paths are connected to different clusters on the DS3000/DS4000/DS5000 series side: Linux

IBM V7000 series

Set system parameters according to the following table. For connection parameters not shown, refer to the IBM V7000 series documentation.

Table A-1 System parameters for connecting IBM V7000 series

Parameter	Parameter setting
host type	Generic

The model name of the IBM V7000 series is displayed as "SVC" on the Device Manager - Storage Navigator window.

IBM SVC series

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to IBM SVC series documentation.

Parameter	Parameter Setting
host type	Generic

IBM XIV series

The port must be configured as a target attached to a Windows host.

Device serial number differs between IBM XIV series and Virtual Storage Platform G200, G400, G600, G800, as shown in the following table.

Display in Virtual Storage Platform G200, G400, G600, G800		Display in IBM XIV	
Item	**Type**	**Item**	**Type**
First 2 digits of Serial Number	Decimal value	First 2 digits of (System) Serial number	Decimal value
Last 5 digits of Serial Number	Hexadecimal value	Last 5 digits of (System) Serial number	Decimal value
Volume Properties	Hexadecimal value	Device serial number	Decimal value

Fujitsu FibreCAT CX series

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to Fujitsu FibreCAT CX series documentation.

Parameter	Parameter Setting
Initiator Type	CLARiiON Open
Failover Mode	2

Volumes created with the RAID0 level or Individual Disk Units (JBOD disks) of Fujitsu FibreCAT CX series are not supported.

System option mode for connecting Fujitsu FibreCAT CX series

When you connect the Fujitsu FibreCAT CX series as an external storage system, you must set SOM 725 of the local storage system to ON. If SOM 725 is not set to ON, the external storage system might be blocked when a maintenance task such as rebooting the controller of the external storage system is performed before the firmware update.

For more information about using SOM 725, log on to the Hitachi Data Systems Support Portal: https://Portal.HDS.com.

Fujitsu DX60/80/90 S2 and Fujitsu DX400 S2

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to Fujitsu DX60/80/90 S2 or Fujitsu DX 400 S2 documentation.

Parameter	Parameter Setting
Inquiry VPD ID Type in Setup Host Response screen	Type1 + Type3
Load Balance Response in Setup Host Response screen	Busy

SGI IS4600 series

The port must be configured as a target attached to a Windows host.

Set system parameters according to the following table. For connection parameters not shown, refer to SGI IS4600 series documentation.

Parameter	Parameter Setting
host type	When alternate paths are connected to different clusters on the SGI IS4600 series side: Linux

3Par T800, F400, V800, V400 series

The port must be configured as a target attached to a windows host.

Set system parameters according to the following tables. For connection parameters not shown, refer to 3Par T800, F400, V800 or V400 series documentation.

For 3Par T800 and F400 series

Parameter	Parameter Setting
host mode	generic-legacy (or generic)

For 3Par V800 and V400 series

Parameter	Parameter Setting
host mode	generic-legacy

The volumes in which "Dynamic optimization" or "Adaptive optimization" is applied must not be used as the external volume of Virtual Storage Platform G200, G400, G600, G800; otherwise the performance of the external volume may possibly be degraded and the operation cannot be guaranteed.

Connecting with a storage system other than Hitachi

If connecting with storage system other than Hitachi as an external storage system, port needs to be configured as Target port connected to Windows host. For detailed information, please contact the third party vendor.

Storage system with a product name displayed as (generic)

The generic Universal Volume Manager profile provides support for connecting external storage systems that are attached using Fibre Channel, without testing them individually. It will automatically support storage systems that conform to a subset of the standard SCSI Primary Commands. (If you need further information, contact Hitachi Data Systems customer support). An HDS representative can perform a step-wise process to install and connect external storage. These steps (defined below) follow a standard process to ensure that no obvious problems exist in the virtualization.

Support conditions when product name displays as (generic)

When an external storage system is connected to a VSP G200, G400, G600, G800 and is supported with the generic UVM profile, the following support conditions exist.

- **Vendor name** that corresponds to the external storage system is displayed.
- **Product name** is displayed as (generic).

Note: If multiple generic storage systems of the same vendor are connected, they are displayed as a single storage system. As a result, if **Disconnect External Storage Systems** or **Reconnect External Storage Systems** is run for generic storage systems, all the generic storage system volumes are disconnected or reconnected. For disconnecting or reconnecting a particular generic storage system volume, the best practice is to run the command in the external volume unit rather than the external storage system unit.

- **Serial number** is not displayed.
- **Volume Properties (device information)**. LUN assigned to the path with the highest priority is displayed.
- **Path Mode and Load Balance Mode**. Load Balance Mode is set to **Disable** by default. Three Path Mode settings are available:

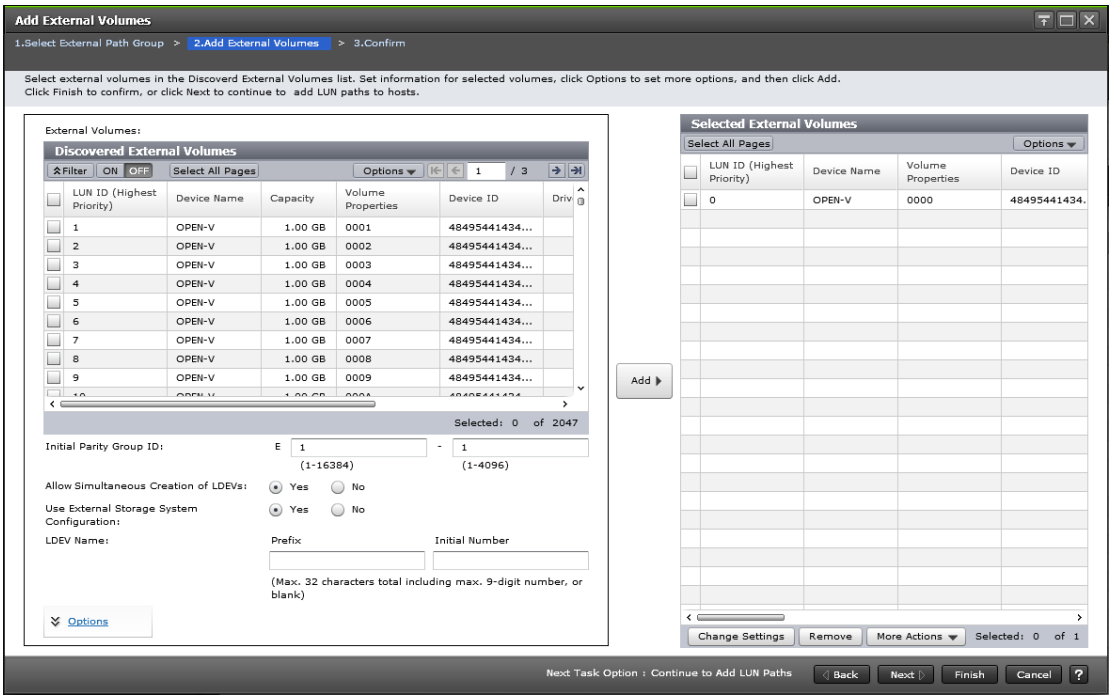
  a. **Normal Round-robin** (For Multi Path)

  b. **Extended Round-robin** (For Multi Path)

  c. **Disable** (For Single Path and ALUA)

  By default, Load Balance Mode is set to **Disable** for the generic UVM profile. As a result, UVM uses Single Mode (Active/Passive). If the attached external storage supports Multi pathing (Active/Active), the Load Balance Mode setting must be changed to **Extended Round-robin** or **Normal Round-robin**.

The Load Balance Mode can be changed in the Add External Volumes window of Device Manager - Storage Navigator.



Note: If you need a profile that models your specific storage system, contact Hitachi Data Systems customer support. HDS will gather the required information and might provide the requested profile in a microcode update. Upgrading to the new microcode will allow the Universal Volume Manager to display the vendor name, product name, serial number, and path mode of the external volumes.

Virtualization support requirements

- The external storage system conforms to SCSI Primary commands (SPC-3).
- Inquiry page 0x83 contains device identifier 2h (EUI-64-based) or 3h (NAA).
- The alternate path mode is not Active/Standby. (Active/Standby is a Single Mode much like Active/Passive, but it does not failover automatically.)
- A profile specific to the storage system does not exist.
- A special device driver or path manager is not required to control the external storage system.
- All other restrictions referenced in this guide apply to virtualization specifications.

Suggested virtualization procedure

Procedure

1. Set up VSP G200, G400, G600, G800 External ports.
2. Connect the external storage FC ports to the VSP G200, G400, G600, G800 External ports.
3. Virtualize at least four LUNs from the external storage.
   - If virtualization fails, contact Hitachi Data Systems customer support.
4. Connect two FC ports of the VSP G200, G400, G600, G800 to two HBAs of the server.
5. Provision the ELUNs mapped to the LUNs (step 3) on the ES to the UVM FC ports.
6. Run an I/O generator to the virtualized LUNs. IOMETER or VDBENCH can be used.
   a. Delete the external path of the highest priority during the I/O.
   b. Add the external path as the highest priority during the I/O.
7. Stop the I/O.

Note: The collection of information is optional but recommended. HDS asks that if new branded storage is attached that the local HDS representative collect the required data to send to Hitachi. After reviewing the data, Hitachi will add the External Storage Model to a listing of supported models on the HDS website. Hitachi might also provide a profile that models your specific storage system. You have the option of continuing to use the external storage system or waiting for your customized profile. If the required data is not provided, HDS support might be limited until the data is sent to Hitachi.

B

Remote command devices

This topic provides information for mapping to command devices in external storage systems.

Overview of remote command devices

You can map to a volume used as a command device in an external system. From the local system, the mapped command device volume becomes a remote command device.

A license is not required for a remote command device mapping operation.

From a host connected to the local system, you can issue ShadowImage or TrueCopy commands from Command Control Interface (CCI) to the remote command device. The commands are relayed from the remote command device to the external system where they are executed for ShadowImage and TrueCopy pairs. This process is outlined in the following figure.

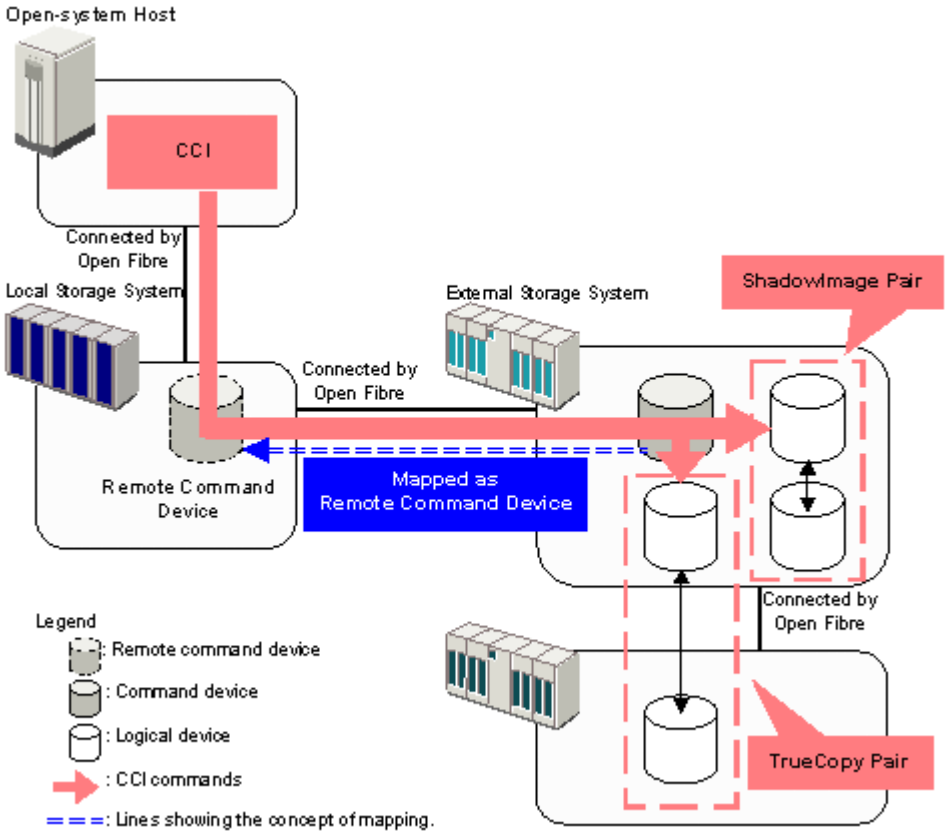


Figure B-1 Outline of remote command device

Requirements

The following table shows requirements for mapping a command device as a remote command device.

Table B-1 Restrictions on remote command device

Item	Requirement
Number of LDEVs in an external volume	1
Cache mode	Disable
Minimum capacity	96,000 Blocks (about 47 MB)
Maximum capacity	4TB
Maximum number of the available CCI instances per remote command device	16*
* Maximum number of available CCI instances may be less than 16, dependent upon the number of paths between a local storage system and an external storage system.	

Restrictions and other information

Before mapping a command device as a remote command device, note the following information.

- The remote command device cannot be identified by port discovery or volume discovery process that takes place during the mapping operation.
- When an external storage system (A) has a remote command device (B) (that is, when a command device in another external storage system (C) is mapped to this external storage system (A)), make sure that the remote command device (B) does not have the smallest LUN on the port in the external storage system (A).
- You cannot execute I/O to the remote command device.
- You cannot set command device disable on the remote command device.
- You cannot set command device security on the remote command device.
- Do not set the command device security on the external storage system side for the command device that is mapped as a remote command device.
- You cannot create CVs using the VLL function in the remote command device.
- Command device information reported to the local host by the remote command device includes the following:
  - Serial number
  - Vendor
  - Device name. The name displayed for many individual storage system is listed in Supported external systems path mode for external volumes on page 4-7.
- Errors can occur when operations are performed on the remote command device, even though the status of the remote command device is normal. In this case, check the status of the command device on the external storage system where the error actually exists.

Mapping a command device

To map a command device, select a command device that can be mapped and follow the procedure in Mapping an external volume on page 4-8.

When mapped, the remote command device appears in the Device Manager - Storage Navigator **Mapped Volumes** window, **Device Name** column as follows:

Storage system	Displayed information in Device Name column
VSP G200, G400, G600, G800 Virtual Storage Platform G1000 Unified Storage VM Virtual Storage Platform Universal Storage Platform V Universal Storage Platform VM SANRISE Universal Storage Platform SANRISE Network Storage Controller SANRISE9900V series TagmaStore Universal Storage Platform TagmaStore Network Storage Controller Lightning 9900V series Virtual Storage Platform VX7 VP9500 H24000 H20000 SANRISE H12000 SANRISE H10000 SANRISE H1024/H128 HP XP7 Storage XP24000 P9500 XP24000 XP20000 XP12000 XP10000 XP1024/XP128	Format: "Emulation Type" + "-CM" Example: OPEN V-CM
Unified Storage Adaptable Modular Storage Workgroup Modular Storage SANRISE9500V series Thunder 9500V series	DF600F-CM

C

Command Control Interface command reference

This topic lists Command Control Interface (CCI) commands that correspond to the Actions you select in Device Manager - Storage Navigator.

- Device Manager - Storage Navigator action names and CCI commands

Device Manager - Storage Navigator action names and CCI commands

The following table compares Actions you take in Device Manager - Storage Navigator and corresponding CCI commands.

SN location	SN Action name	CCI command
External Storage	Add External Volumes	raidcom add external_grp
	Delete External Volumes	raidcom delete external_grp
	Disconnect External Storage Systems	raidcom disconnect external_grp
	Reconnect External Storage Systems	raidcom check_ext_storage external_grp
	Edit External Volumes	raidcom modify external_grp
	Assign MP Unit	raidcom modify external_grp
	Disconnect External Volumes	raidcom disconnect external_grp
	Reconnect External Volumes	raidcom check_ext_storage external_grp
	Disconnect External Paths	raidcom disconnect path
	Reconnect External Paths	raidcom check_ext_storage path
	Edit External Path Configuration	raidcom add path raidcom delete path

D

Universal Volume Manager GUI reference

This appendix describes Device Manager - Storage Navigator windows, dialog boxes, and fields related to Universal Volume Manager.

- Create External Path Group window
- Change Settings window
- View External LUN Properties window
- Reconnect External Storage Systems window
- Reconnect External Volumes window
- Disconnect External Storage Systems window
- Disconnect External Volumes window
- Assign MP Unit wizard
- External LDEV Properties window
- Discovery Result Detail window
- Add iSCSI Paths wizard
- Delete iSCSI Paths window
- Edit iSCSI Targets wizard

External Storage window

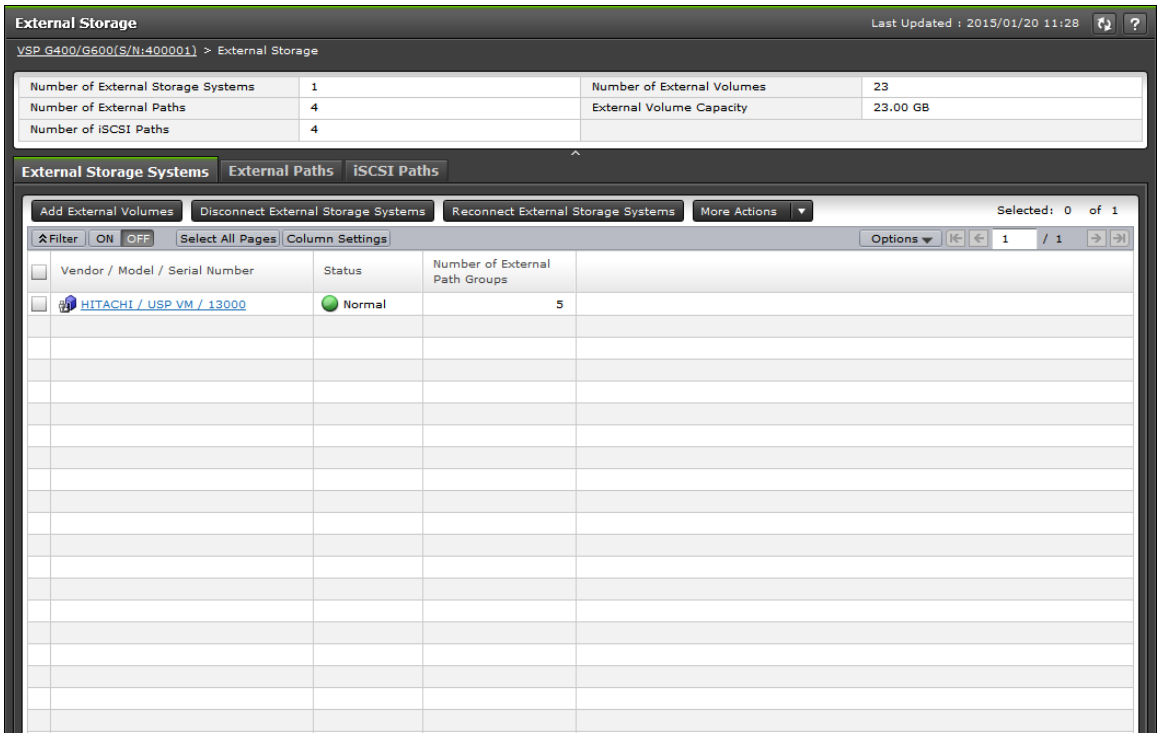
Use this window to view external storage systems.

You can perform these operations from the window:

- Mapping an external volume on page 4-8
- Editing mapping policies on page 5-29
- Disconnecting an external path on page 5-8
- Reconnecting an external path on page 5-9

Information areas in this window:

- Summary on page D-3
- External Storage Systems tab on page D-4
- External Paths tab on page D-5
- iSCSI Paths tab on page D-6



Summary

Displays summary information for external storage.

Item	Description
Number of External Storage Systems	Number of external storage systems in which mapped external volumes reside.
Number of External Paths	Number of external paths.
Number of iSCSI Paths	Number of local storage system's iSCSI paths set for external storage system.

Item	Description
Number of External Volumes	Number of mapped external volumes.
External Volume Capacity	Total capacity of mapped external volumes.

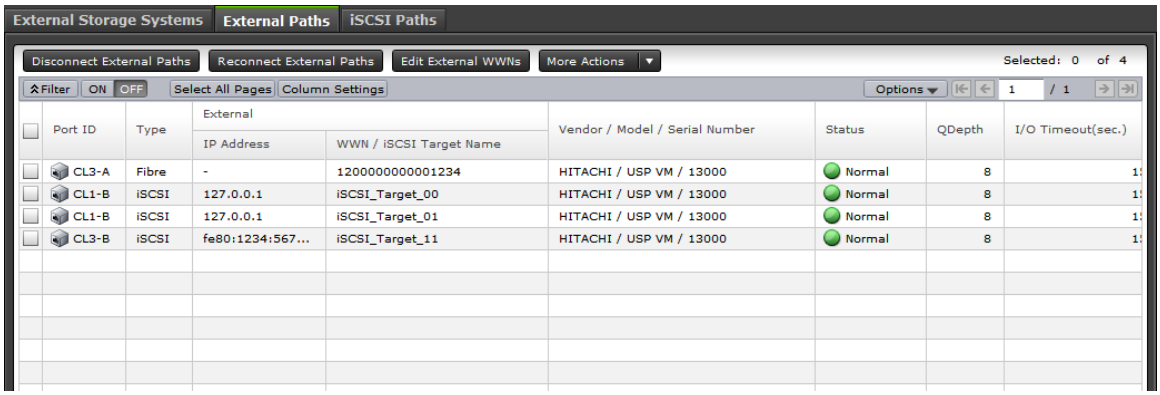
External Storage Systems tab

Displays the external storage systems in which mapped external volumes reside.

Item	Description
Vendor / Model / Serial Number	Identifying information for the selected external storage system. When the link is clicked, more information for the system is shown.
Status	Any of the following statuses can display for the external system. • **Normal**: There are no problems, the system is usable. • **Disconnect**: The external system or one of its mapped volumes has been intentionally disconnected. • **Checking**: The system is checking the mapping path status. • **Unknown**: The status of the mapping path is not known. • **Cache Destage**: Writing of data from cache memory to the volume is in progress. • **Warning**: There are mapping paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The mapping path is blocked. • **Destage Failed**: The writing of data from cache memory to the volume failed.
Number of External Path Groups	Number of external path groups in the external system.
Add External Volumes	When clicked, launches the **Add External Volumes** window.
Disconnect External Storage Systems	When clicked, launches the **Disconnect External Storage Systems** window.
Reconnect External Storage Systems	When clicked, launches the **Reconnect External Storage Systems** window.
Edit Policies*	When clicked, launches the **Edit Policies** window.
Export*	When clicked, allows you to save table information to a file.
Notes: * Appears when you click **More Actions**.	

External Paths tab

Displays the paths connecting mapped external volumes in the external system to Virtual Storage Platform G200, G400, G600, G800.



Item	Description
Port ID	Port connected to the external storage system of the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about the target port of the external storage system. • IP Address: Displays the target port IP address when the port type is an iSCSI port. • TCP Port Number[1]: Displays the target TCP port number when the port type is an iSCSI port. • WWN/iSCSI Target Name: Displays the WWN to show the target port when the port type is a Fibre Channel port. If the port type is iSCSI port, the iSCSI target name is displayed.
Vendor / Model / Serial Number	Identifying information for the external system.
Status	Status of external paths. • **Normal**: There are no problems, the system is usable. • **Disconnect**: The path has been intentionally disconnected. • **Checking**: The system is checking the external path status. • **Unknown**: The status of the external path is not known. • **Warning**: There are external paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The external path is blocked.
QDepth	Number of Read/Write commands that can be queued to the external volume. 8 is set by default.

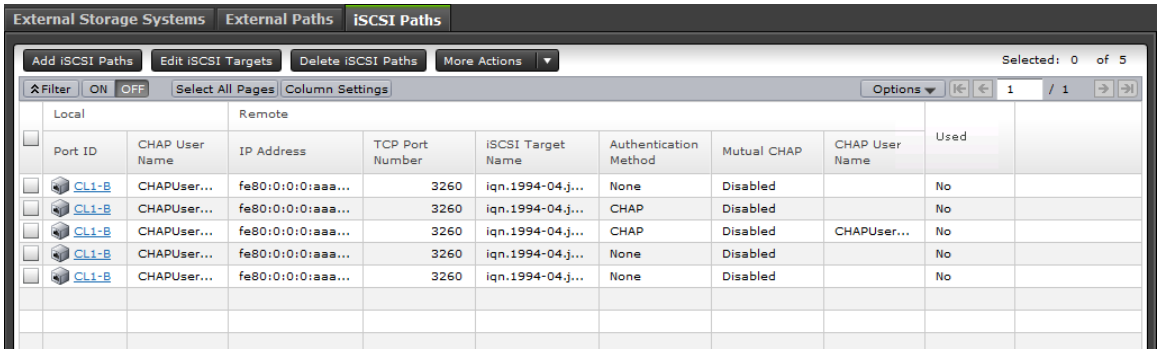
Item	Description
	When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are sequential, the number of Read/Write commands that can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out. 15 seconds is the default.
Blocked Path Monitoring (sec.)	Time that will elapse from the time that a path goes down to the time when the external volume is blocked. 10 seconds is the default.
Disconnect External Paths	When clicked, launches the **Disconnect External Paths** window.
Reconnect External Paths	When clicked, launches the **Reconnect External Paths** window.
Edit External WWNs	When clicked, launches the **Edit External WWNs** window.
Edit External iSCSI Targets[2]	When clicked, the **Edit External iSCSI Targets** window launches.
Edit Policies[2]	When clicked, launches the **Edit Policies** window.
Export[2]	When clicked, allows you to save table information to a file.

Notes:

1. Does not appear by default. To display the item, change the settings in the **Column Settings** window. See the *System Administrator Guide* for the details of the window.
2. Appears when you click **More Actions**.

iSCSI Paths tab

Displays the iSCSI paths connecting mapped external volumes in the external system to Virtual Storage Platform G200, G400, G600.



Item	Description
Local	Displays the local storage system port information. Port ID: Displays the port ID. CHAP User Name: Displays the CHAP user name.

Item	Description
Remote	Displays the remote storage system port information. IP Address: Displays the IP address. TCP Port Number: Displays the TCP port number. iSCSI Target Name: Displays the iSCSI target name. Authentication Method: Displays the method for authentication. Mutual CHAP: Displays the mutual CHAP setting when CHAP is set for authentication method. CHAP User Name: Displays the CHAP user name when CHAP is set for authentication method.
Used	Displays whether volume is mapped as an external volume. • Yes: Used as an external path. • No: Not used as an external path.
Add iSCSI Paths button	Displays Add iSCSI Paths window.
Edit iSCSI Targets button	Displays Edit iSCSI Targets window.
Delete iSCSI Paths button	Displays Delete iSCSI Paths window.
Test Login iSCSI Target*	Executes login test for the iSCSI target.
Export*	Displays the window to save table information to a file.
Notes: * Appears when you click **More Actions**.	

Selected external storage system window

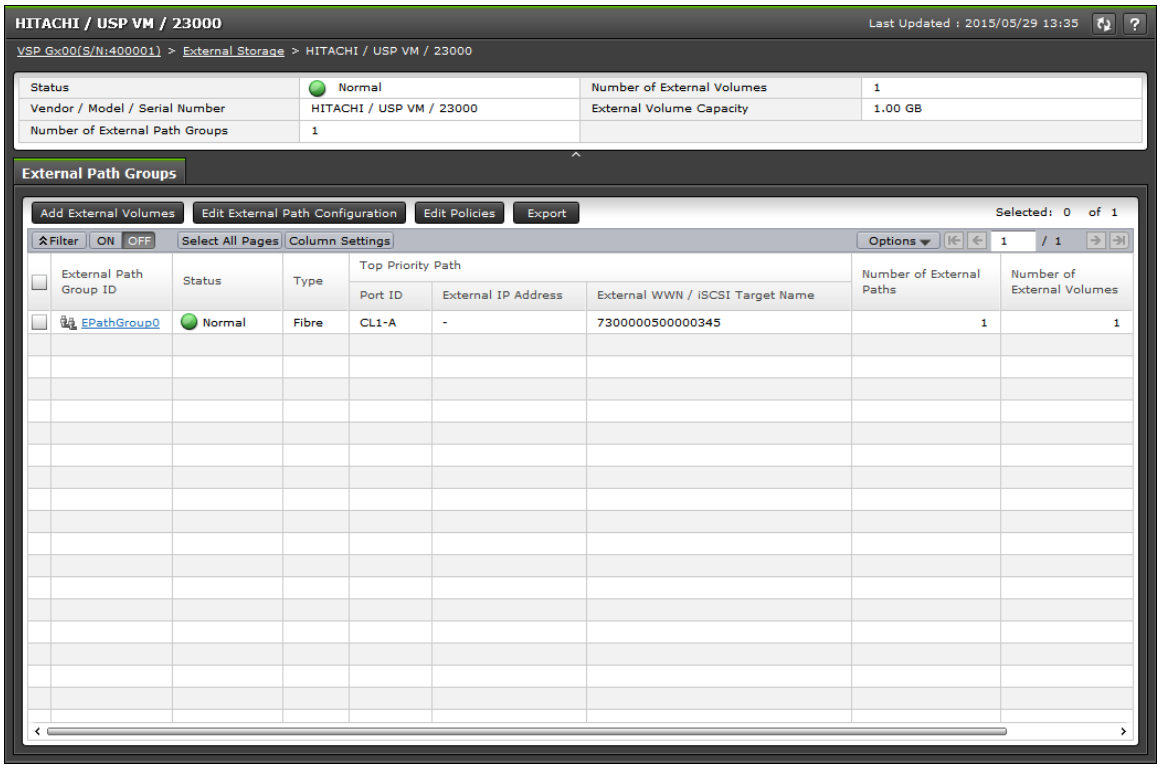
Use this window to view information about the selected external storage system.

You can perform these operations from the window:

- Mapping an external volume on page 4-8
- Adding an external path to an existing path group on page 5-3
- Changing external path priority on page 5-6
- Removing and replacing an external path on page 5-12
- Editing mapping policies on page 5-29
- Export table information to a file.

Information areas in this window:

- Summary on page D-8
- External Path Groups tab on page D-9



Summary

Displays summary information about the selected external storage.

Item	Description
Status	Status of external storage systems. • **Normal**: There are no problems, the system is usable. • **Disconnect**: The external system or one of its mapped volumes has been intentionally disconnected. • **Checking**: The system is checking the mapping path status. • **Unknown**: The status of the mapping path is not known. • **Cache Destage**: Writing of data from cache memory to the volume is in progress. • **Warning**: There are mapping paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The mapping path is blocked. • **Destage Failed**: The writing of data from cache memory to the volume failed.
Vendor / Model / Serial Number	Identifying information for the external system.
Number of External Path Groups	Number of external path groups in the external system.

Item	Description
Number of External Volumes	Number of mapped external volumes.
External Volume Capacity	Total capacity of mapped external volumes.

External Path Groups tab

Displays the external path groups in which external paths are grouped.

Item	Description
External Path Group ID	Name of the external path group. When the link is clicked, the list of the group's external paths displays.
Status	Status of external path groups. • **Normal**: There are no problems, the path group is usable. • **Disconnect**: The path group has been intentionally disconnected. • **Checking**: The system is checking the mapping path status. • **Unknown**: The status of the mapping path is not known. • **Cache Destage**: The writing of data from cache memory to the external volume is in progress. • **Warning**: There are mapping paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The mapping path is blocked. • **Destage Failed**: The writing of data from cache memory to the volume is failed.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port • Mixed: Configuration with Fibre Channel port and iSCSI port
Top Priority Path	Displays the external path which has the highest priority. • Port ID: Displays the port which local storage system is connected to the external storage system. • External IP Address: Displays the target port IP address when port type is iSCSI port. • External TCP Port Number*: Displays the target TCP port number when port type is iSCSI port. • External WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.

Item	Description
Number of External Paths	Number of external paths in the path group.
Number of External Volumes	Number of external volumes using the external path group.
Add External Volumes	When clicked, launches the **Add External Volumes** window.
Edit External Path Configuration	When clicked, launches the **Edit External Path Configuration** window.
Edit Policies	When clicked, launches the **Edit Policies** window.
Export	When clicked, allows you to save table information to a file.
Notes: * Does not appear by default. To display the item, change the settings in the **Column Settings** window. See the *System Administrator Guide* for the details of the window.	

Selected external path group window

Use this window to view the mapped external volumes using the external path, and view the external paths in the path group.

You can perform these operations from the window.

- Mapping an external volume on page 4-8
- Edit Cache Mode and Inflow Control settings for individual mapped volumes (see Editing mapping policies on page 5-29)
- View path status and external LUN information (see the Status description in the External Storage Systems tab on page D-4 section.)
- Deleting external volume mapping on page 5-30
- Disconnecting a single mapped volume on page 5-21
- Reconnecting a single mapped volume on page 5-23
- Changing the MP Unit of an external volume on page 5-33
- Editing mapping policies on page 5-29
- Export table information to a file (see the Export button description in External Storage Systems tab on page D-4 section.)

Information areas in this window:

- Summary on page D-10
- Mapped Volumes tab on page D-11
- External Paths tab on page D-15

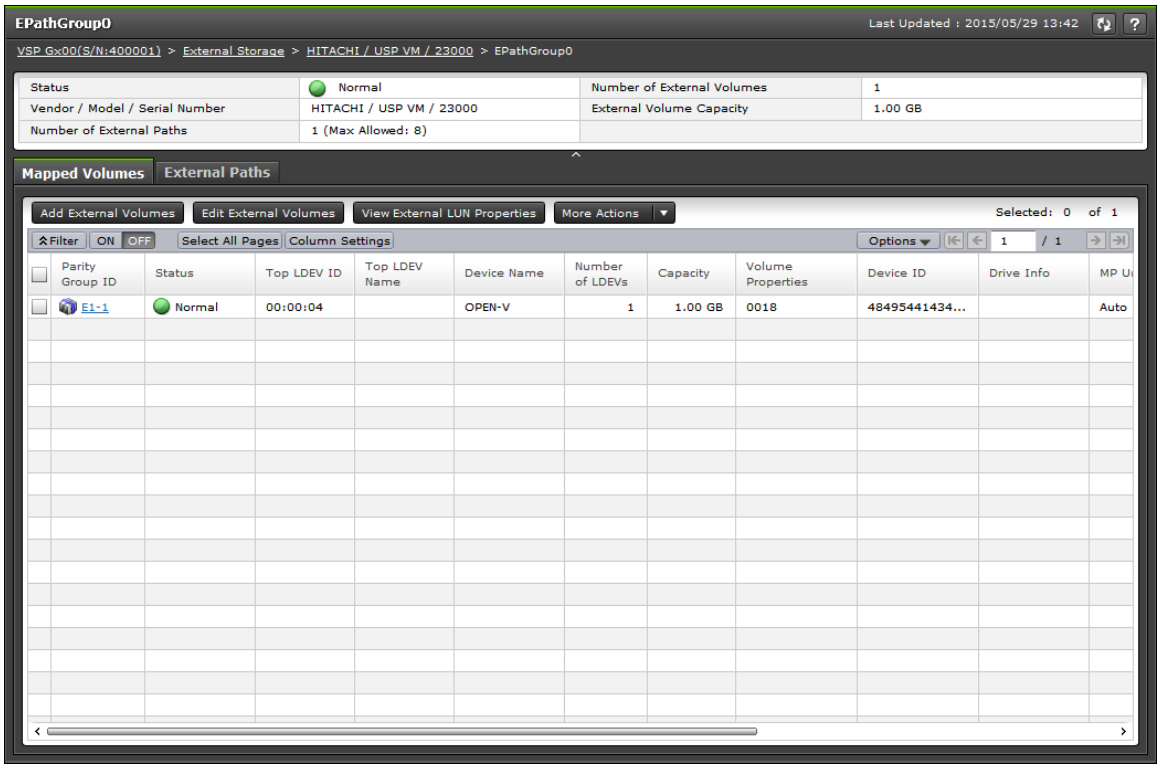
Summary

Displays summary information about the selected external path group.

Item	Description
Status	Status of path groups. • **Normal**: There are no problems, the path group is usable. • **Disconnect**: The path group has been intentionally disconnected. • **Checking**: The system is checking the mapping path status. • **Unknown**: The status of the mapping path is not known. • **Cache Destage**: The writing of data from cache memory to the external volume is in progress. • **Warning**: There are mapping paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The mapping path is blocked. • **Destage Failed**: The writing of data from cache memory to the volume is failed.
Vendor / Model / Serial Number	Identifying information for the external system.
Number of External Paths	Number of external paths in the external path group.
Number of External Volumes	Number of mapped external volumes using the external path group.
External Volume Capacity	Total capacity of mapped external volumes using the path group.

Mapped Volumes tab

Displays the external volumes mapped to the Virtual Storage Platform G200, G400, G600, G800 using the selected path group.



Item	Description
Parity Group ID	Displays parity group numbers for the mapped external volumes. When the link is clicked, a list of LDEVs in the mapped volume and parity group displays. When the link is clicked, a list of LDEVs in the mapped volume and parity group displays.
Status	Status of the external volume • **Normal**: There are no problems, the volume is usable. • **Disconnect**: The external system or one of its mapped volumes has been intentionally disconnected. • **Checking**: The system is checking the mapping path status • **Unknown**: The status of the mapping path is not known. • **Cache Destage**: Writing of data from cache memory to the volume is in progress. • **Warning**: There are mapping paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The mapping path is blocked. • **Destage Failed**: The writing of data from cache memory to the volume failed.
Top LDEV ID	External volume's top LDEV ID.
Top LDEV Name	External volume's top LDEV name.

Item	Description
Device Name	Product ID of Standard Inquiry. This is the name defined by the standard body that controls SCSI. This name varies according to the storage system vendor. For example, for Hitachi enterprise storage, this field displays the emulation type.
Number of LDEVs	Number of LDEVs created in the external volume.
Capacity	Capacity of the external volume.
Volume Properties	Identification number of the external volume. The value is used by UVM to identify the LUN across multiple paths. The value is provided by the external system and may reflect internal numbering.
Device ID	Identification number of the external volume.
Drive Info	Information about the external volume's drive type. **SATA** displays when the external volume is a SATA drive of following storage systems. • Virtual Storage Platform • Universal Storage Platform V/VM • HUS/AMS/WMS • SMS • Thunder 9500V **SSD** displays when the external volume is the SSD of following storage systems. • Virtual Storage Platform G200, G400, G600, G800 • Virtual Storage Platform G1000 • HUS VM Storage Platform • Virtual Storage Platform • Universal Storage Platform V/VM
MP Unit ID[3]	MP unit IDs allocated to the external volume.
Path Mode	Path mode for the external volume's external path. • **Single**: Ordinarily, only one external path is used even if alternate paths are set. Alternate paths are available in case of failure. • **Multi**: Multiple paths are used at the same time. • **ALUA**: Like Multi, all paths are used; however, they are not used when connected to ports in Passive status. See External paths on page 4-5 for more information.
Path Mode on Profile[1]	Displays the path mode on the profile information of the external storage system. • **Single**: Ordinarily, only one external path is used even if alternate paths are set. • **Multi**: When alternate paths are set, external paths from several ports are used simultaneously with load balancing.

Item	Description
ALUA Settable[1]	Displays whether ALUA can be set as the Path Mode in the external storage system. • **Enable**: Enables ALUA Mode. • **Disable**: Disables ALUA Mode.
ALUA Permitted[1]	Displays whether ALUA can be set as the Path Mode in the local storage system. • **Enable**: ALUA Mode is used. **Disable**: ALUA Mode is not used.
Load Balance Mode	Displays I/O load balance system for external storage system. • **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance.
Cache Mode	Write data from the host to the external system is propagated synchronously (**Disable**) or asynchronously (**Enable**). When nondisruptive migration is specified as the Attribute, the cache modes are displayed. • Through: Transfers write and read requests from the host to the external storage system. The local system's cache is not used. • Write Sync: Reflects write data from the host to the external storage system synchronously. If read or write is performed while data is being written to the external storage system, the read or write operation waits until the ongoing write operation is completed. While cache mode operations are in progress, status is reported for cache mode changes. • (Changing): Transition to the displayed cache mode is in progress. • (Error): Transition to the displayed cache mode has failed and maintenance work is required.
Inflow Control	Write operation to cache memory is limited (**Enable**) or continued (**Disable**) when the write operation to the external volume cannot be performed.
Attribute	Displays the attribute of the parity group.
Data Direct Mapped LDEV[1]	Displays the LDEV ID of the mapped DP-VOL. • If the Data Direct Mapping attribute is disabled, a hyphen is displayed. • If a V-VOL that has the Data Direct Mapping attribute is not set to the pool that has the Data Direct Mapping attribute, a blank is displayed. When clicked, launches the LDEV Properties window.

Item	Description
Add External Volumes	Displays the Add External Volumes window.
Edit External Volumes	Displays the Edit External Volumes window.
View External LUN Properties	View external system LUN information for the external volume, as well as external and mapping path information in the **Displays the View External LUN Properties** window.
Delete External Volumes[2]	When clicked, launches the **Delete External Volumes** window.
Disconnect External Volumes[2]	When clicked, launches the **Disconnect External Volumes** window.
Reconnect External Volumes[2]	When clicked, launches the **Reconnect External Volumes** window.
Assign MP Unit[2]	When clicked, launches the **Assign MP Unit** window.
Edit Policies[2]	When clicked, launches the **Edit Policies** window.
Export[2]	When clicked, allows you to save table information to a file.

Notes:

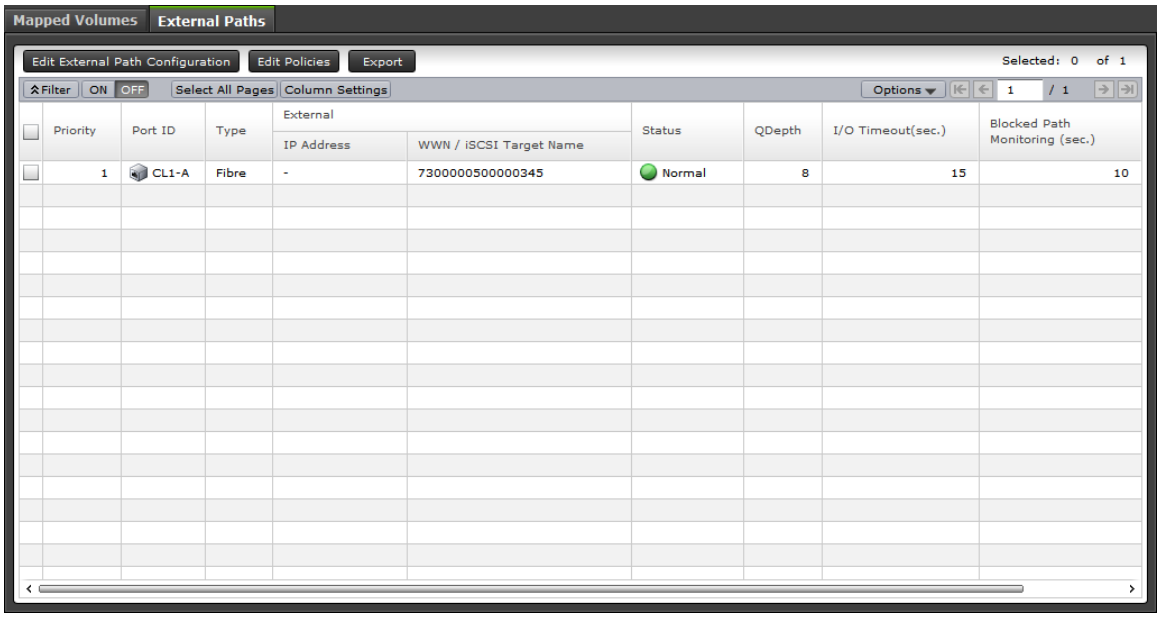
1. Does not appear in the table by default. To display this item, click **Column Settings** window. See the *System Administrator Guide* for the details of the window.
2. Appears when you click **More Actions**.
3. If an MP unit is blocked due to a failure, the processing to be performed by the MP unit where the failure occurred is taken over by another MP unit. See MP unit priorities after takeover on page D-15 for priorities assumed by MP unit after takeover.

MP unit priorities after takeover

Failed MP unit	Priorities assumed by MP units after takeover		
	1st	2nd	3rd
MPU10	MPU11	MPU21	MPU20
MPU11	MPU10	MPU20	MPU21
MPU20	MPU21	MPU11	MPU10
MPU21	MPU20	MPU10	MPU11

External Paths tab

Displays the external paths within the selected path group.



Item	Description
Priority	Priority of external paths.
Port ID	Port connected to the external storage system of the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port. • TCP Port Number*: Displays the target TCP port number when port type is iSCSI port. • WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
Status	Status of external paths. • **Normal**: There are no problems, the system is usable. • **Disconnect**: The path has been intentionally disconnected. • **Checking**: The system is checking the external path status. • **Unknown**: The status of the external path is not known. • **Warning**: There are external paths whose status is not normal. You can check their status in the **View External LUN Properties** window. • **Blockade**: The external path is blocked.

Item	Description
QDepth	Number of Read/Write commands that can be queued to the external volume. 8 is set by default. When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are sequential, the number of Read/Write commands that can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out. 15 seconds is the default.
Blocked Path Monitoring (sec.)	Time that will elapse from the time that a path goes down to the time when the external volume is blocked. 10 seconds is the default.
Edit External Path Configuration	When clicked, launches the **Edit External Path Configuration** window.
Edit Policies	When clicked, launches the **Edit Policies** window.
Export	When clicked, allows you to save table information to a file.
Notes: * Does not appear by default. To display the item, change the settings in the **Column Settings** window. See the *Hitachi Virtual Storage Platform G200, G400, G600, G800 System Administrator Guide* for the details of the window.	

Add External Volumes wizard

Use this wizard to connect external volumes to Virtual Storage Platform G200, G400, G600, G800.

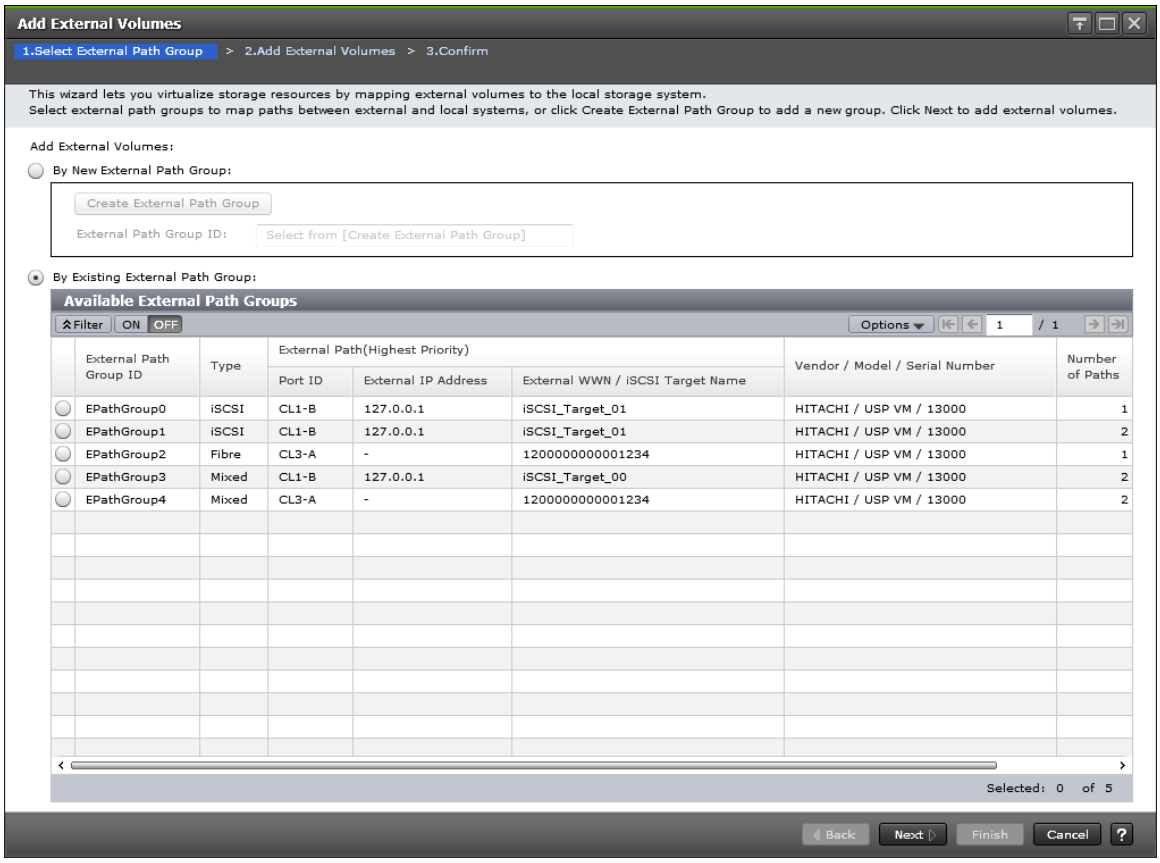
See Mapping an external volume on page 4-8 for instructions.

Each window in the wizard is identified below the wizard title. The windows are:

- Select External Path Group window on page D-17
- Add External Volumes window on page D-19
- Add External Volumes confirmation window on page D-27

Select External Path Group window

Part of the Add External Volumes wizard, use this window to select and set parameters for an external path group.



Item	Description
By New External Path Group.	Option for setting up a new external path group.
Create External Path Group	When clicked, launches the **Create External Path Group** window.
External Path Group ID	Number in the range that identifies the new external path group for each model. • VSP G200: 0 to 2,047 • VSP G400, VSP G600: 0 to 4,095 • VSP G800: 0 to 14,079 Default is blank.
By Existing External Path Group.	Option for using an existing external path group.

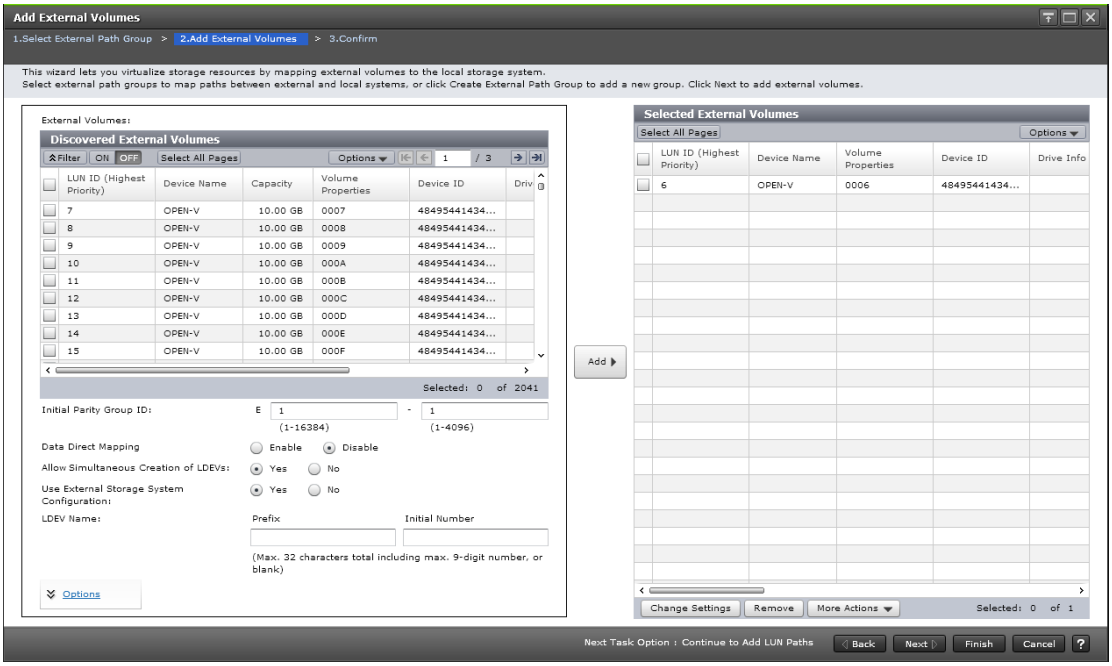
Available External Path Groups table

Item	Description
Available External Path Groups	External path groups for the ports assigned to the user.
External Path Group ID	Name of the external path group.

Item	Description
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port • Mixed: Configuration with Fibre Channel port and iSCSI port
External Path (Highest Priority)	Displays the external path which has the highest priority. • Port ID: Displays the port which local storage system is connected to external storage system. • External IP Address: Displays the target port IP address when port type is iSCSI port. • External TCP Port Number*: Displays the target TCP port number when port type is iSCSI port. • External WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
Vendor / Model / Serial Number	Identifying information for the external system.
Number of Paths	Number of external paths in the path group.

Add External Volumes window

Part of the **Add External Volumes** wizard, use this window to display discovered external volumes and to make related selections.



Discovered External Volumes

Item	Description
LUN ID(Highest Priority)	The external LUN with the highest priority. "?" indicates that an external volume is not found. In this case, confirm the connection with the external system, and then perform the operation again.
Device Name	Name of the storage system reported to the host by the external volume. The displayed name differs by vendor. For some Hitachi enterprise storage, this field displays emulation type.
Capacity	External volume capacity.
Volume Properties	Identification number of the external volume. The value is used by UVM to identify the LUN across multiple paths. The value is provided by the external system and may reflect internal numbering.
Device ID	Identification number of the external volume.
Drive Info	Information about the external volume's drive type. **SATA** displays when the external volume is a SATA drive of following storage systems. • Virtual Storage Platform • Universal Storage Platform V/VM • HUS/AMS/WMS • SMS • Thunder 9500V **SSD** displays when the external volume is the SSD of following storage systems. • Virtual Storage Platform G200, G400, G600, G800 • Virtual Storage Platform G1000 • HUS VM Storage Platform • Virtual Storage Platform • Universal Storage Platform V/VM
Path Mode	Displays operation mode of the external path. • **Single**: Ordinarily, only one external path is used even if alternate paths are set, In Single mode, alternate paths are used only in case of maintenance work failure. • **Multi**: When alternate paths are set, external paths from several ports are simultaneously used with load balancing.
ALUA Settable	Displays whether ALUA can be set as the Path Mode in the external storage system. • **Enable**: Enables ALUA Mode. • **Disable**: Disables ALUA Mode.
Discovery Result	Displays one of the following: • Normal

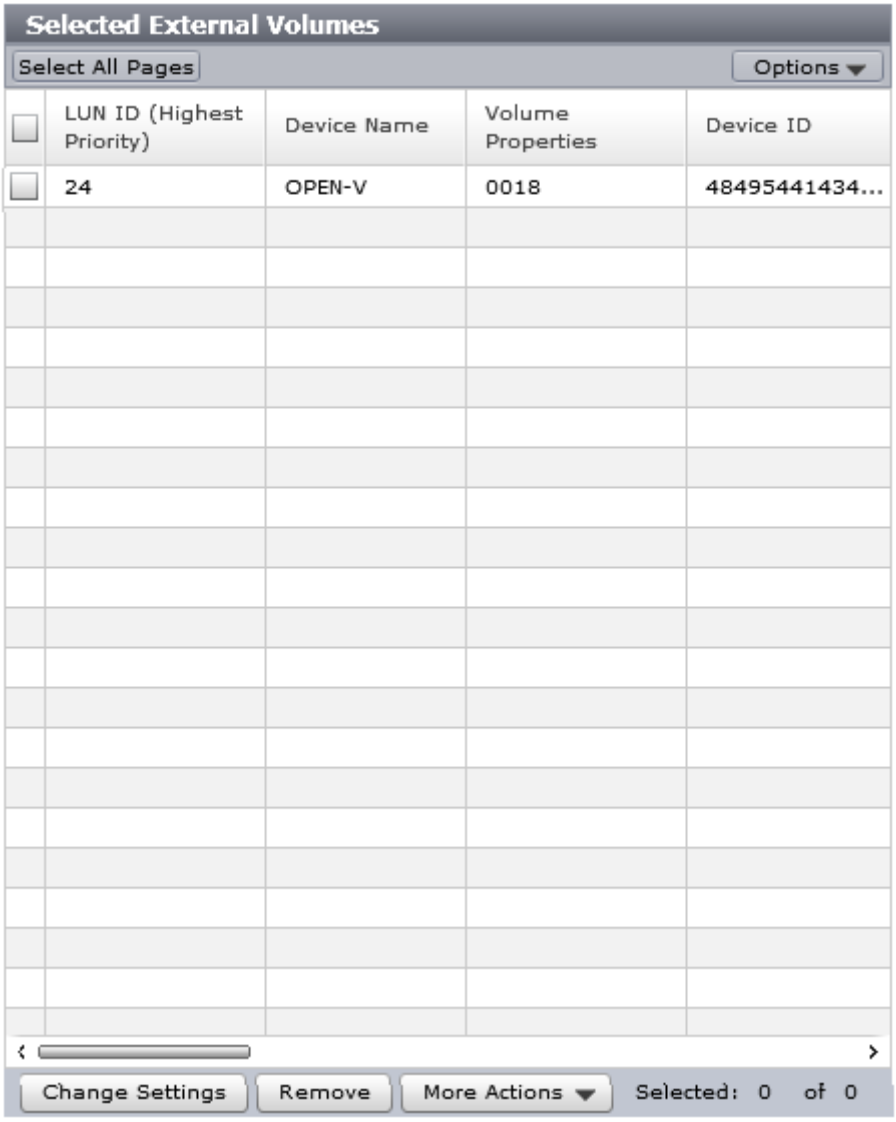
Item	Description
	• An error code When clicked, the link displays the Discovery Result Detail window with details of the search.
Initial Parity Group ID	An external volume group number and sequence number. Values range from 1 - 1 (default) to 16384 - 4096.
Data Direct Mapping	Specify whether to enable the Data Direct Mapping attribute. • Enable: Enables the Data Direct Mapping attribute. • Disable: Disables the Data Direct Mapping attribute (Default).
Allow Simultaneous Creation of LDEVs	LDEVs are automatically created in the external volume when Yes is selected. If No is selected, you must create LDEV's manually. By default, the value set in the **Edit Policies** window is set. If Enable is specified for Data Direct Mapping, Yes is selected automatically.
Use External Storage System Configuration	If Yes is specified in "Allow Simultaneous Creation of LDEVs", the external volume's configuration for the LDEVs is used when Yes is selected. If No is selected, you must configure LDEV's manually. By default, Yes is selected. If Enable is specified for Data Direct Mapping, Yes is selected automatically.
LDEV Name	Requires a prefix character and initial number, 32 characters maximum (including the initial number). Numbering rule for Initial Number: 1: total 9 numbers (1,2,3,…9) 08: total 92 numbers (08,09,10,…99) 23: total 77 numbers (23,24,25,…99) 098: total 902 numbers (098,099,100…999)
Options	Optional default settings for the external volume. Options can be affected by values entered in previous fields.
Initial LDEV ID	Virtual Storage Platform G200, G400, G600, G800 searches from this number in ascending order and allocates the next available LDEV ID to the external volume. Ranges for each item: • **LDKC**: 00 • **CU**: From 00 (default) to FE. • **DEV**: The LDEV ID. From 00 (default) to FF. • **Interval**: Interval between LDEV IDs. From 0 (default) to 255.
LDKC	LDKC number. 00 can be set for the value.
CU	CU number. Possible values for each model: • VSP G200: 00 to 07

Item	Description
	• VSP G400, VSP G600: 00 to 0F • VSP G800: 00 to 3F Default is 00.
DEV	LDEV identifier. Value between 00 and FF can be set. Default is 00.
Interval	Interval between each LDEV can be selected. The specified interval will be kept and the LDEV ID will be set to each LDEV in external volume.
View LDEV IDs	Shows used, available, and disabled LDEV IDs.
Number of LDEVs per External Volume	Maximum number of LDEVs to be created in the external volume when the volume is mapped. Depends on external volume capacity. If Enable is specified for Data Direct Mapping, 1 is selected automatically.
Cache Partition	CLPR for accessing the external volume. A value between CLPR0 and CLPR31 can be specified. The default is the value set in **Edit Policies** window. See Editing mapping policies on page 5-29 for more information.
Cache Mode	• Enable: Write data from the host is propagated asynchronously • Disable: Write data from the host is propagated synchronously See Cache use and external storage performance on page 2-8 for more information.
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed. See Editing mapping policies on page 5-29 for more information.
Use ALUA as Path Mode	Select whether ALUA is used as the Path Mode. The default is **Enable** if ALUA mode can be set as the Path Mode. Otherwise, the default is **Disable**. • **Enable**: Enables ALUA mode. • **Disable**: Disables ALUA mode.
Load Balance Mode	Select I/O load balance system for external storage system. • **Depend on the selected external volume(s)**: If **Enable** is set for **ALUA Settable** on the external volume, **Normal Round-robin** is set for Load Balance Mode automatically. If **Disable** is set for **ALUA Settable**, **Disable** is set for Load Balance Mode automatically. • **Normal Round-robin**: Performs load balance in round-robin system.

Item	Description
	• **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance. The default is the value set in the **Edit Policies** window. If the product name of an external storage system is displayed as "(generic)", **Depend on the selected external volume(s)** is used by default. This item cannot be selected when the path mode of the external volume is **Single** or **Disable** is selected for **Use ALUA as Path Mode**.
MP Unit ID	MP unit ID for the external volume. • You can select MPU-10, MPU-11, MPU-20 or MPU-21. • Auto (default if it can be selected): Unit is automatically selected by the system. • Unit with lowest number is the default when Auto cannot be selected.
Add	When clicked, moves selected volumes to the Selected External Volumes list.

Selected External Volumes

Displays selected external volumes.

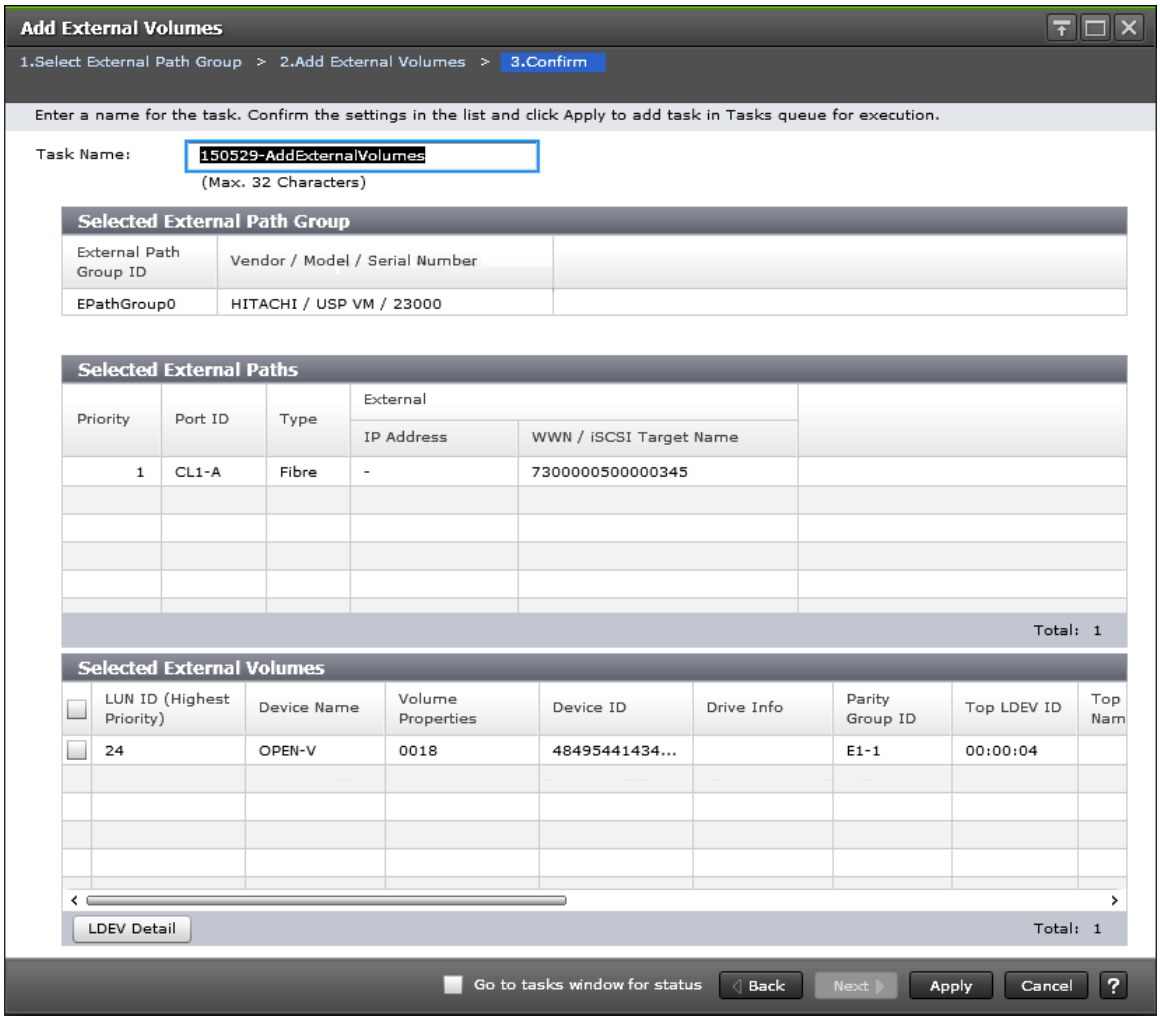


Item	Description
LUN ID(Highest Priority)	External volume's LUN with the highest priority.
Device Name	Name of the storage system reported to the host by the external volume. The displayed name differs by vendor. For some Hitachi enterprise storage, this field displays emulation type.
Volume Properties	Identification number of the external volume. The value is used by UVM to identify the LUN across multiple paths. The value is provided by the external system and may reflect internal numbering.
Device ID	External volume's identification number.
Drive Info	Information about the external volume's drive type. **SATA** displays when the external volume is a SATA drive of following storage systems.

Item	Description
	• Virtual Storage Platform • Universal Storage Platform V/VM • HUS/AMS/WMS • SMS • Thunder 9500V **SSD** displays when the external volume is the SSD of following storage systems. • VSP G200, G400, G600, G800 • Virtual Storage Platform G1000 • HUS VM Storage Platform • Virtual Storage Platform • Universal Storage Platform V/VM
Parity Group ID	Parity group numbers
Top LDEV ID	External volume's top LDEV ID
Top LDEV Name	External volume's top LDEV name
Number of LDEVs	External volume's number of LDEVs
Capacity	External volume's capacity
CLPR	CLPR used for accessing to the mapped external volume
Cache Mode	• Enable: Write data from the host is propagated asynchronously • Disable: Write data from the host is propagated synchronously See Cache use and external storage performance on page 2-8 for more information.
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed. See Editing mapping policies on page 5-29 for more information.
Path Mode	Displays operation mode of the external path. • **Single**: Ordinarily, only one external path is used even if alternate paths are set, In Single mode, alternate paths are used only in case of maintenance work failure. • **Multi**: When alternate paths are set, external paths from several ports are simultaneously used with load balancing. • **ALUA**: When alternate paths are set, external paths from several ports are simultaneously used with load balancing. External paths connected to ports in Passive status are not used.

Item	Description
ALUA Permitted	Displays whether ALUA can be set as the Path Mode in the local storage system. • Enable: ALUA Mode is used. • Disable: ALUA Mode is not used.
Load Balance Mode	Displays I/O load balance system for external storage system. • **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance.
MP Unit ID	External volume's MP unit IDs.
Attribute	External volume's attribute.
Change Settings	When clicked, the Change Setting dialog box opens.
Remove	When clicked, removes external volumes from the Selected External Volumes table.
Path Detail*	When clicked, the External LUN Properties window opens and you can check the path details of the selected external volume.
LDEV Detail*	When clicked, the External LDEV Properties window opens and you can check the details of the LDEV to be created from the selected external volume.
Notes: * Appears when you click **More Actions**.	

Add External Volumes confirmation window



Item	Description
Task Name	Identifies the operation within the system when Apply is clicked. Allows you to track the status of the operation.
External Path Group ID	Name of the external path group.
Vendor / Model / Serial Number	Identifying information for the external system.
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port.

Item	Description
	• WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
LUN ID(Highest Priority)	The LUN which is connected to the external path with the highest priority.
Device Name	Name of the storage system reported to the host by the external volume. The displayed name differs by vendor. For some Hitachi enterprise storage, this field displays emulation type.
Volume Properties	Identification number of the external volume. The value is used by UVM to identify the LUN across multiple paths. The value is provided by the external system and may reflect internal numbering.
Device ID	Identification number of the external volume.
Drive Info	Information about the external volume's drive type. **SATA** displays when the external volume is a SATA drive of following storage systems. • Virtual Storage Platform • Universal Storage Platform V/VM • HUS/AMS/WMS • SMS • Thunder 9500V **SSD** displays when the external volume is the SSD of following storage systems. • VSP G200, G400, G600, G800 • Virtual Storage Platform G1000 • HUS VM Storage Platform • Virtual Storage Platform • Universal Storage Platform V/VM
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID.
Top LDEV Name	External volume's top LDEV name.
Number of LDEVs	External volume's number of LDEVs.
Capacity	External volume capacity.
CLPR	CLPR used for accessing to the mapped external volume.
Cache Mode	• Enable: Write data from the host is propagated asynchronously • Disable: Write data from the host is propagated synchronously See Cache use and external storage performance on page 2-8 for more information.

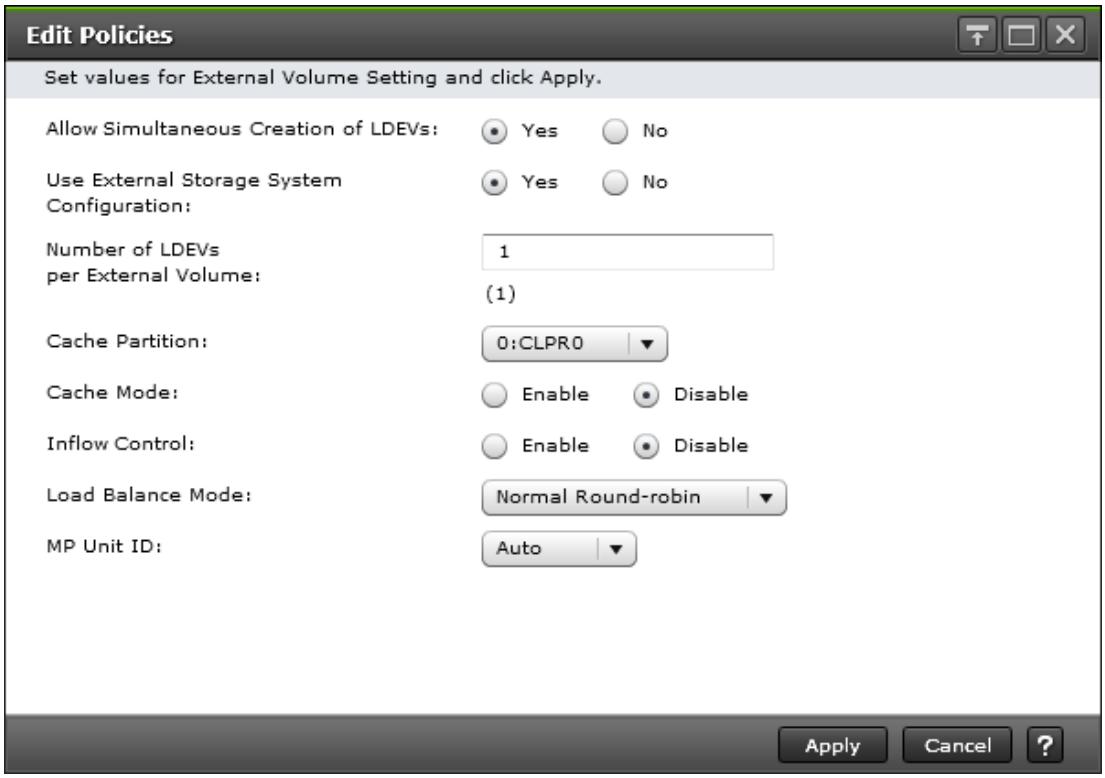
Item	Description
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed. See Editing mapping policies on page 5-29 for more information.
Path Mode	Displays operation mode of the external path. • **Single**: Ordinarily, only one external port is used even if alternate paths are set. In Single mode, alternate paths are used only in case of maintenance work failure. • **Multi**: When alternate paths are set, external paths from several ports are simultaneously used with load balancing. • **ALUA**: When alternate paths are set, external paths from several ports are simultaneously used with load balancing. External paths connected to ports in Passive status are not used.
ALUA Permitted	Displays whether ALUA can be set as the Path Mode in the local storage system. • Enable: ALUA Mode is used. • Disable: ALUA Mode is not used.
Load Balance Mode	Displays I/O load balance system for external storage system. • **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance.
MP Unit ID	External volume's MP unit IDs.
Attribute	External volume's attribute.
LDEV Detail	Displays the External LDEV Properties window and you can check the selected external volume's details.

Note: Information in this **Confirm** window assumes only a single task is executed. If multiple tasks are executed, the window displays all configuration items. For information on these items, return to the configuration window by clicking **Back** and refer to the topic on each configuration window by clicking **Help**.

Edit Policies window

Use this window to change settings for mapped external volumes.

See Editing mapping policies on page 5-29 for information.



Item	Description
Allow Simultaneous Creation of LDEVs	LDEVs are automatically created in the internal volume when Yes is selected. If No is selected, you must create LDEV's manually.
Use External Storage System Configuration	If Yes is specified in "Allow Simultaneous Creation of LDEVs", the external volume's configuration for the LDEVs is used when Yes is selected. If No is selected, you must configure LDEV's manually.
Number of LDEVs per External Volume	Number of LDEVs to be created in the local system when the volume is mapped. Depends on external volume capacity.
Cache Partition	CLPR for accessing the external volume. See Editing mapping policies on page 5-29 for more information.
Cache Mode	• Enable: Write data from the host is propagated asynchronously • Disable: Write data from the host is propagated synchronously See Cache use and external storage performance on page 2-8for more information.
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed.

Item	Description
	See Editing mapping policies on page 5-29 for more information.
Load Balance Mode	Select I/O load balance system for external storage system. • **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance. The default is **Normal Round-robin**.
MP Unit ID	MP unit ID for the external volume. • You can select MPU-10, MPU-11, MPU-20 or MPU-21. • Auto (default if it can be selected): Unit is automatically selected by the system. • Unit with lowest number is the default when Auto cannot be selected.

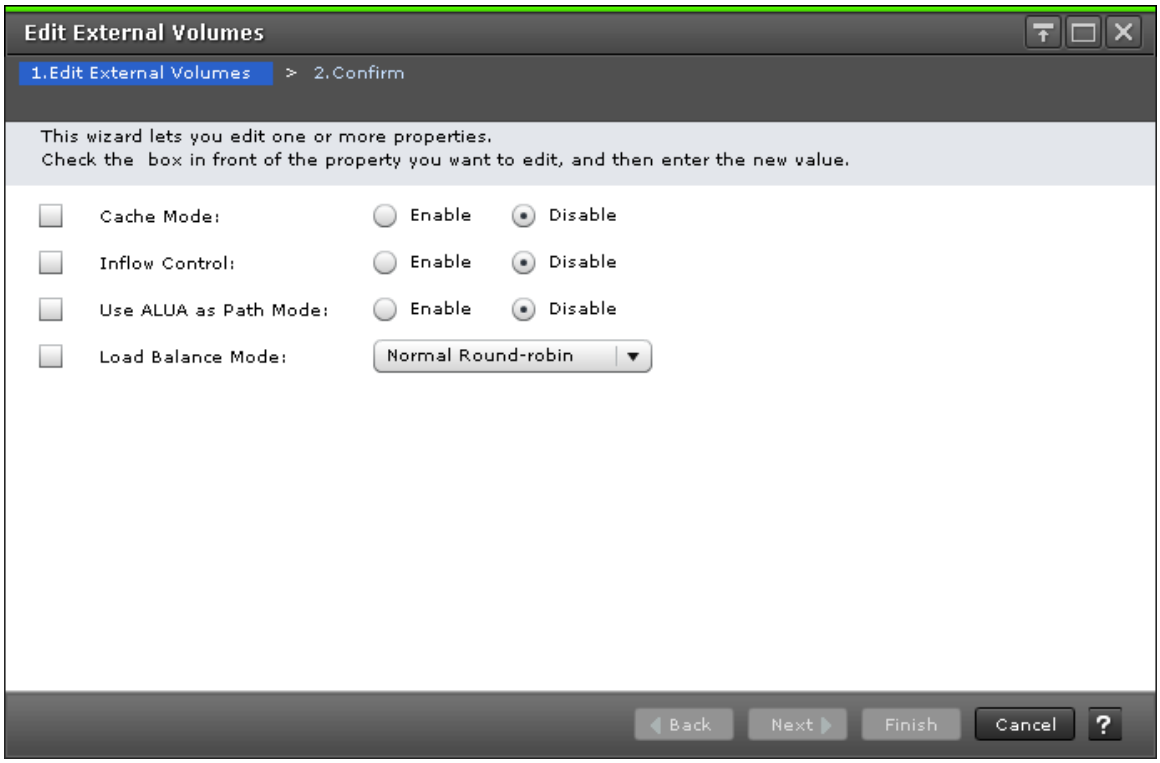
Edit External Volumes wizard

Use this wizard to change settings for a mapped external volume.

The windows in the wizard are:

- Edit External Volumes window on page D-32
- Edit External Volumes confirmation window on page D-33

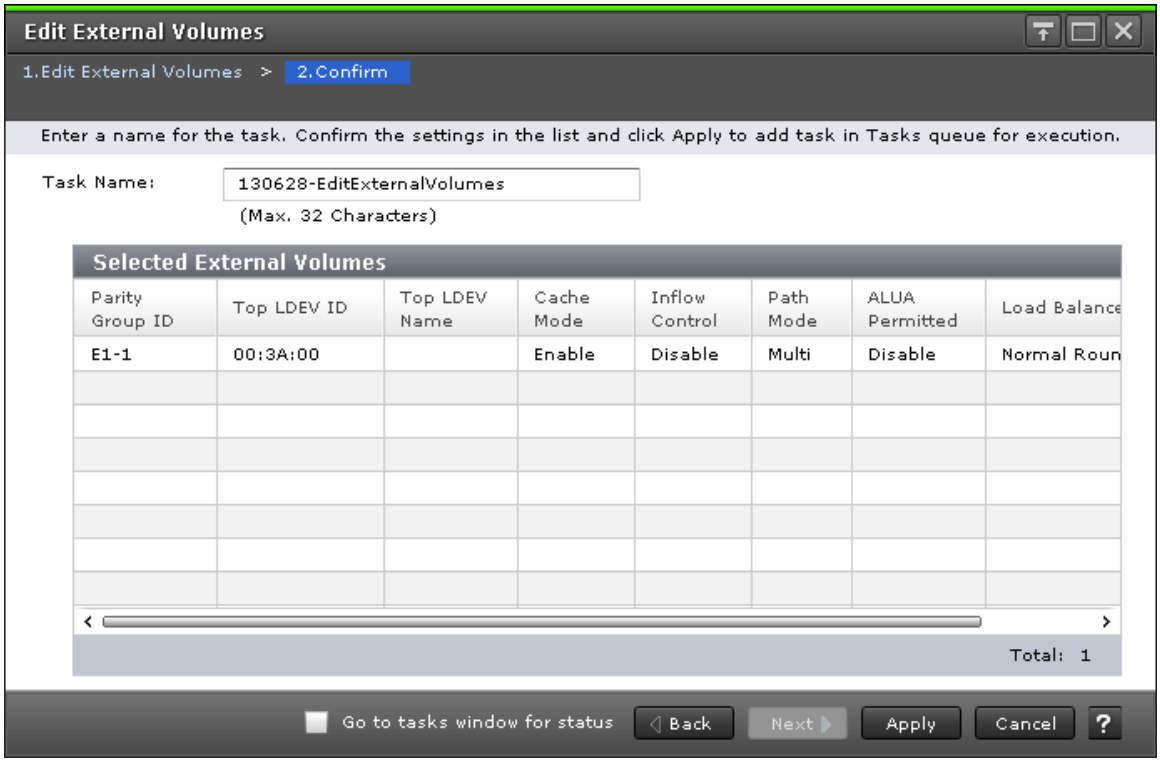
Edit External Volumes window



Item	Description
Cache Mode	• Enable: Write data from the host is propagated asynchronously. • Disable: Write data from the host is propagated synchronously. See Cache use and external storage performance on page 2-8 for more information.
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed. See Editing mapping policies on page 5-29 for more information.
Use ALUA as Path Mode	Select whether ALUA is used as the Path Mode.. • **Enable**: Enables ALUA mode. • **Disable**: Disables ALUA mode. The value that is set for the selected external volume is used as the default. If two or more external volumes with different values are selected, the item is placed in non-selected status. If the ALUA mode cannot be set for the selected external volume, **Enable** cannot be selected.
Load Balance Mode	Select I/O load balance system for external storage system.

Item	Description
	• **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance. The value that is set for the selected external volume is used as the default. If two or more external volumes with different values are selected, the item is placed in non-selected status.

Edit External Volumes confirmation window



Item	Description
Parity Group ID	Displays parity group numbers.
Top LDEV ID	External volume's top LDEV ID.
Top LDEV Name	External volume's top LDEV name.
Cache Mode	• Enable: Write data from the host is propagated asynchronously • Disable: Write data from the host is propagated synchronously When nondisruptive migration is specified as the Attribute, the cache modes are displayed.

Item	Description
	• Through: Transfers write and read requests from the host to the external storage system. The local system's cache is not used. • Write Sync: Reflects write data from the host to the external storage system synchronously. If read or write is performed while data is being written to the external storage system, the read or write operation waits until the ongoing write operation is completed. While cache mode operations are in progress, status is reported for cache mode changes. • (Changing): Transition to the displayed cache mode is in progress. • (Error): Transition to the displayed cache mode has failed and maintenance work is required. See Cache use and external storage performance on page 2-8for more information.
Inflow Control	• Enable: Limits or prevents write data from being written to cache memory when the write operation cannot be performed. • Disable: Allows write data to be written to cache when the write operation cannot be performed. See Editing mapping policies on page 5-29 for more information.
Path Mode	Displays the external path of the external volume. • **Single**: One external path is used, with alternate paths available in case of failure. • **Multi**: Multiple paths are used at the same time. • **ALUA**: Like Multi, all paths are used; however, they are not used when connected to ports in Passive status. For more information, see External paths on page 4-5.
ALUA Permitted	Displays whether ALUA can be set as the Path Mode in the local storage system. • Enable: ALUA Mode is used. • Disable: ALUA Mode is not used.
Load Balance Mode	Displays I/O load balance system for external storage system. • **Normal Round-robin**: Performs load balance in round-robin system. • **Extended Round-robin**: Load balance system is automatically switched for sequential I/O and random I/O. • **Disable**: Performs I/O operation with a single path, without load balance.

Edit External Path Configuration wizard

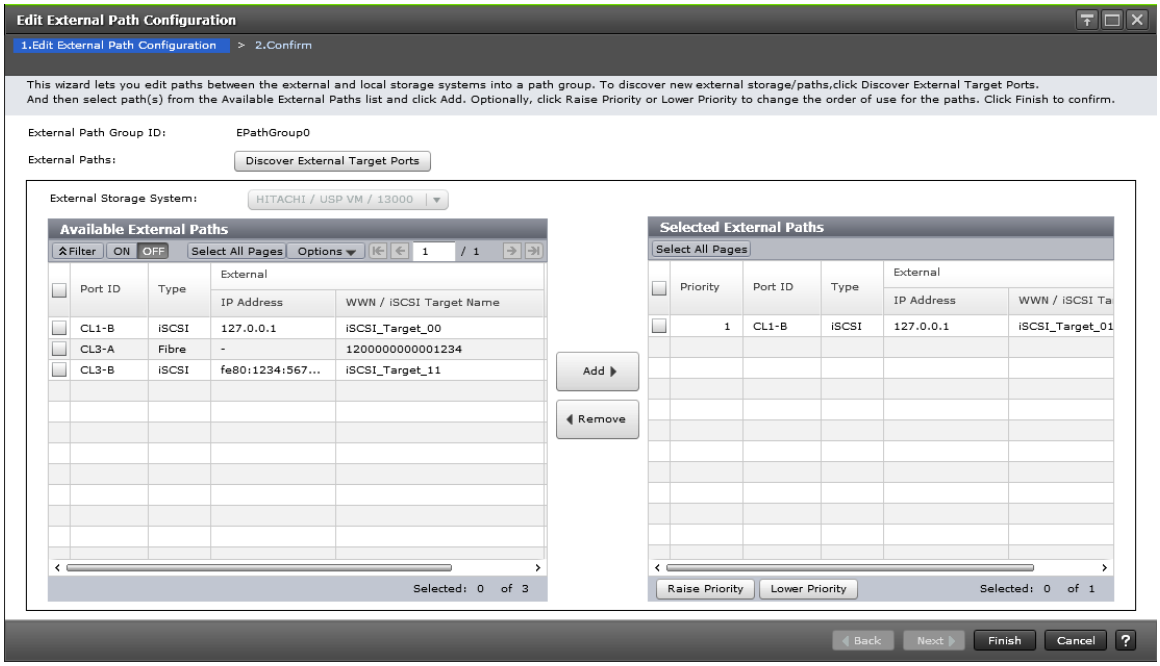
Use this wizard to add and remove external paths to a path group, and to raise and lower path priority.

See Adding an external path to an existing path group on page 5-3 for instructions.

The windows in the wizard are:

- Edit External Path Configuration window on page D-35
- Edit External Path Configuration confirmation window on page D-37

Edit External Path Configuration window



Only the external paths that are connected with the port assigned to the user are displayed.

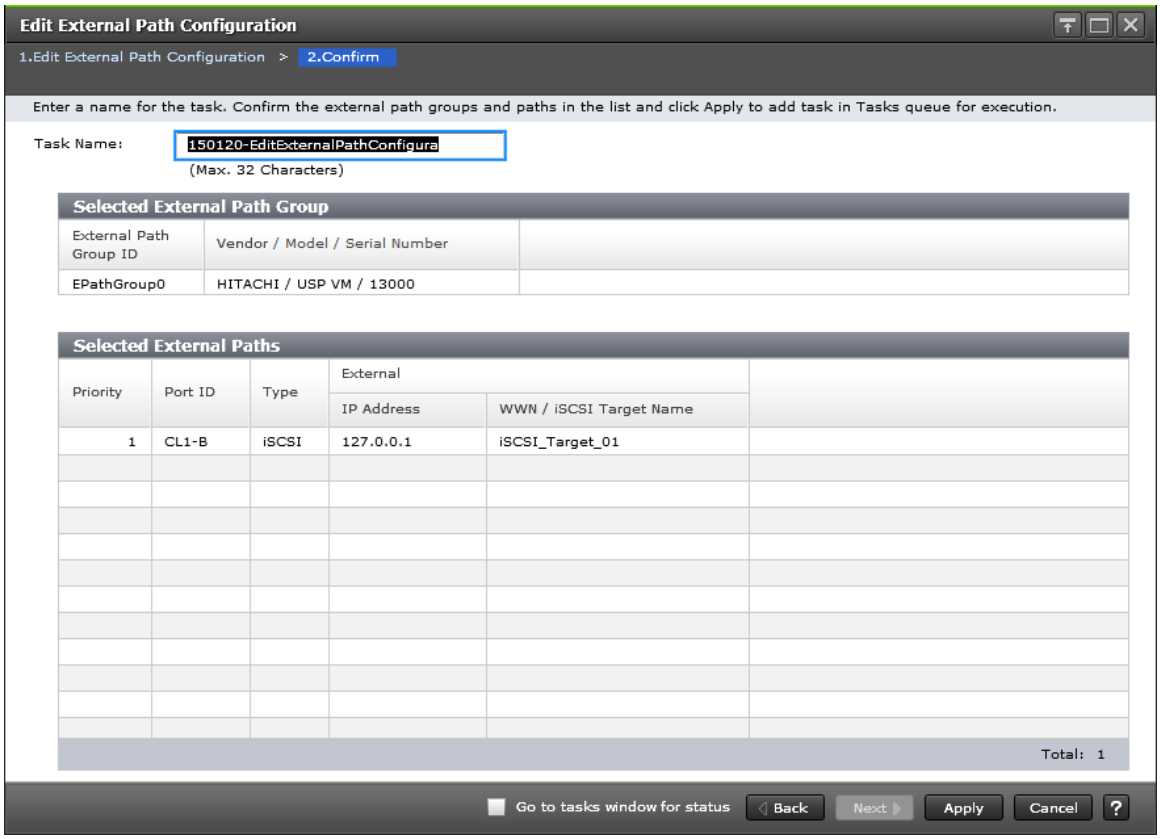
Item	Description
External Path Group ID	Name of the external path group.
External Paths	External path information.
Discover External Target Ports	When clicked, opens the Discover External Target Ports window, which lists available external ports.
External Storage System	The external system selected (greyed out). If no system was selected, allows you to select the system from a list.
Available External Paths	
Port ID	Port connected to the external storage system for the local storage system.

Item	Description
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about the target port of the external storage system. • IP Address: Displays the target port IP address when the port type is an iSCSI port. • WWN/iSCSI Target Name: Displays the WWN to show the target port when the port type is a Fibre Channel port. If the port type is iSCSI port, the iSCSI target name is displayed.
Add	When clicked, moves selected paths to the **Selected External Paths** list.
Remove	External path which is selected from the **Selected External Paths** table will be removed from the **Selected External Paths** table.

Selected External Paths

Item	Description
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about the target port of the external storage system. • IP Address: Displays the target port IP address when the port type is an iSCSI port. • WWN/iSCSI Target Name: Displays the WWN to show the target port when the port type is a Fibre Channel port. If the port type is iSCSI port, the iSCSI target name is displayed.
Raise Priority	Raise the priority of the selected external path.
Lower Priority	Lower the priority of the selected external path.

Edit External Path Configuration confirmation window



Item	Description
Task Name	Identifies the operation within the system when Apply is clicked. Allows you to track the status of the operation.
External Path Group ID	Displays the name of the external path group.
Vendor / Model / Serial Number	Identifying information for the external system.
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about the target port of the external storage system. • IP Address: Displays the target port IP address when the port type is an iSCSI port. • WWN/iSCSI Target Name: Displays the WWN to show the target port when the port type is a Fibre Channel port. If the port type is iSCSI port, the iSCSI target name is displayed.

Edit External WWNs wizard

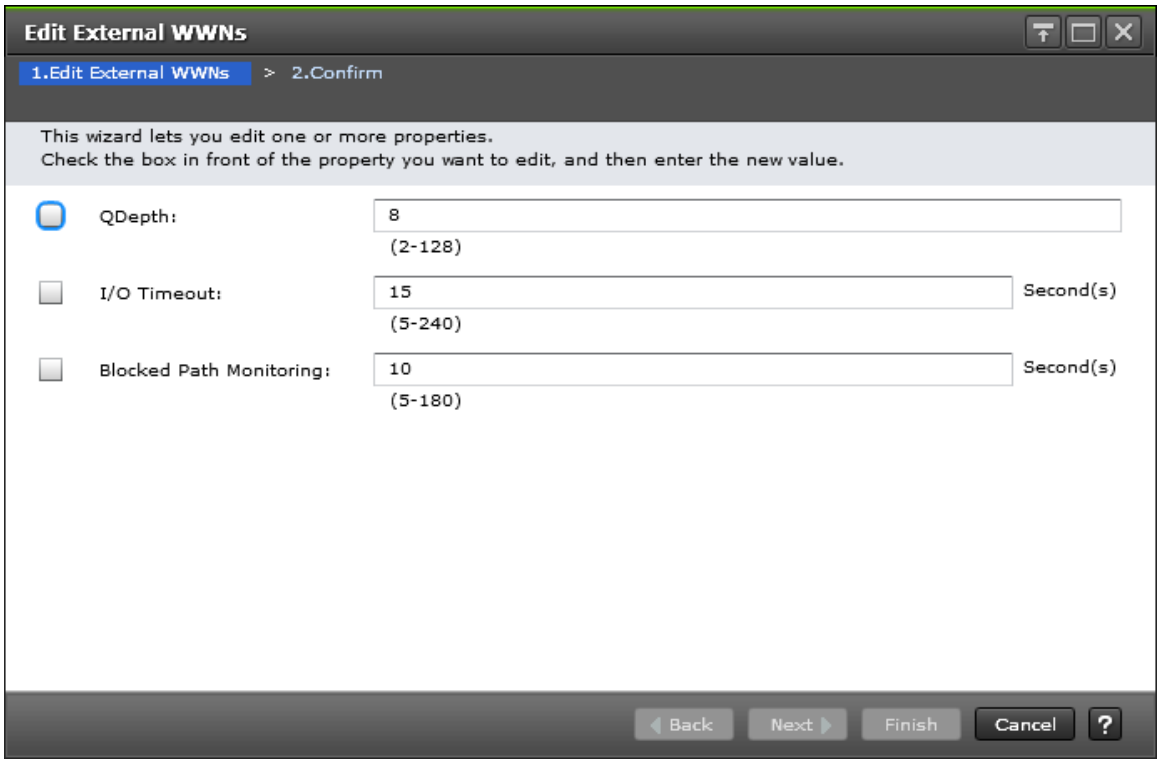
Use this wizard to change the external system's WWN port setting.

See Changing the port setting of an external storage system on page 5-27 for instructions.

The windows in the wizard are:

- Edit External WWNs window on page D-38
- Edit External WWNs confirmation window on page D-39

Edit External WWNs window

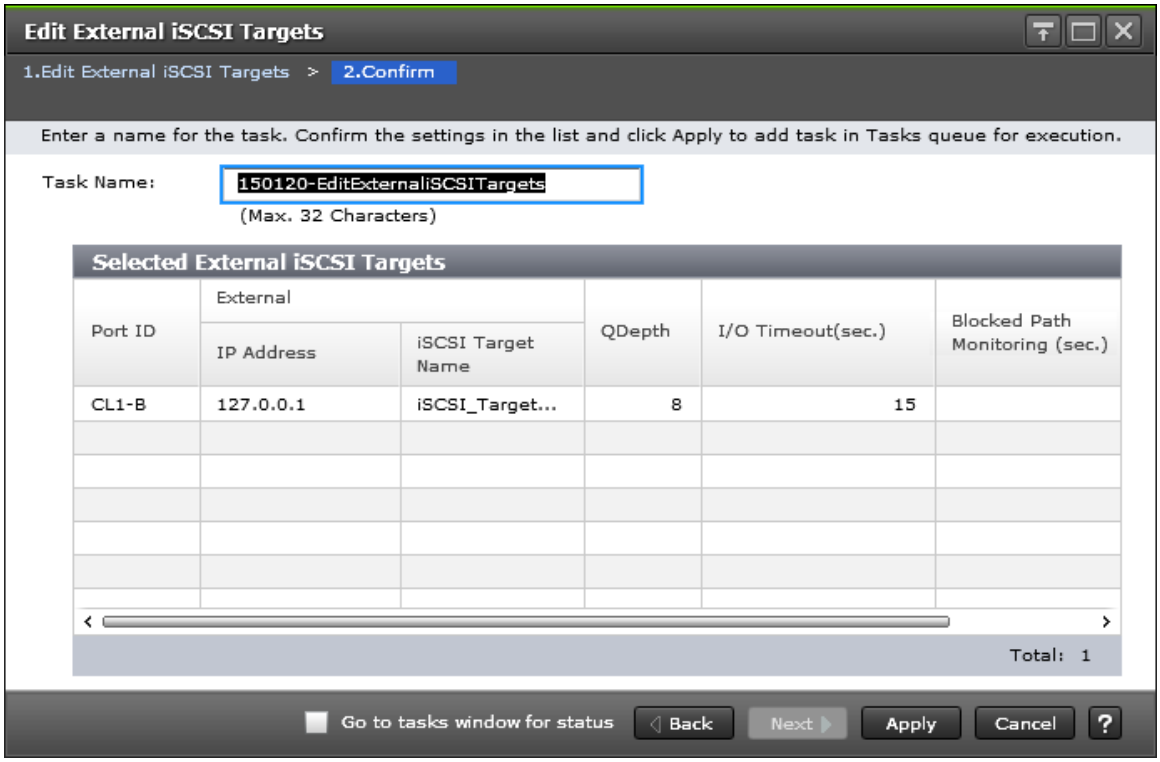


Item	Description
QDepth	Number of Read/Write commands that can be queued to the external volume. The numbers 2 through 128 can be entered. When two or more external paths with different values are selected, the field is blank. When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are sequential, the number of Read/Write commands that can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out. The numbers 5 through 240 can be entered. When two or more external paths with different values are selected, the field is blank.

Item	Description
Blocked Path Monitoring (sec.)	Time that elapses from the time that a path goes down to the time when the external volume is blocked. The numbers 5 through 180 can be entered. When two or more external paths with different values are selected, the field is blank.

Caution: If you want to change multiple parameters for an external WWN more than once, wait until the currently applied task finishes, and then perform the next setting change.
If you make a setting change for the next task before completing the last, the setting will be applied to the next task only. The result might be different from what you expected.

Edit External WWNs confirmation window



Item	Description
Port ID	Port connected to the external storage system for the local storage system.
External WWN	External system port identification number.
QDepth	Number of Read/Write commands that can be queued to the external volume. When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are sequential, the number of Read/Write commands that

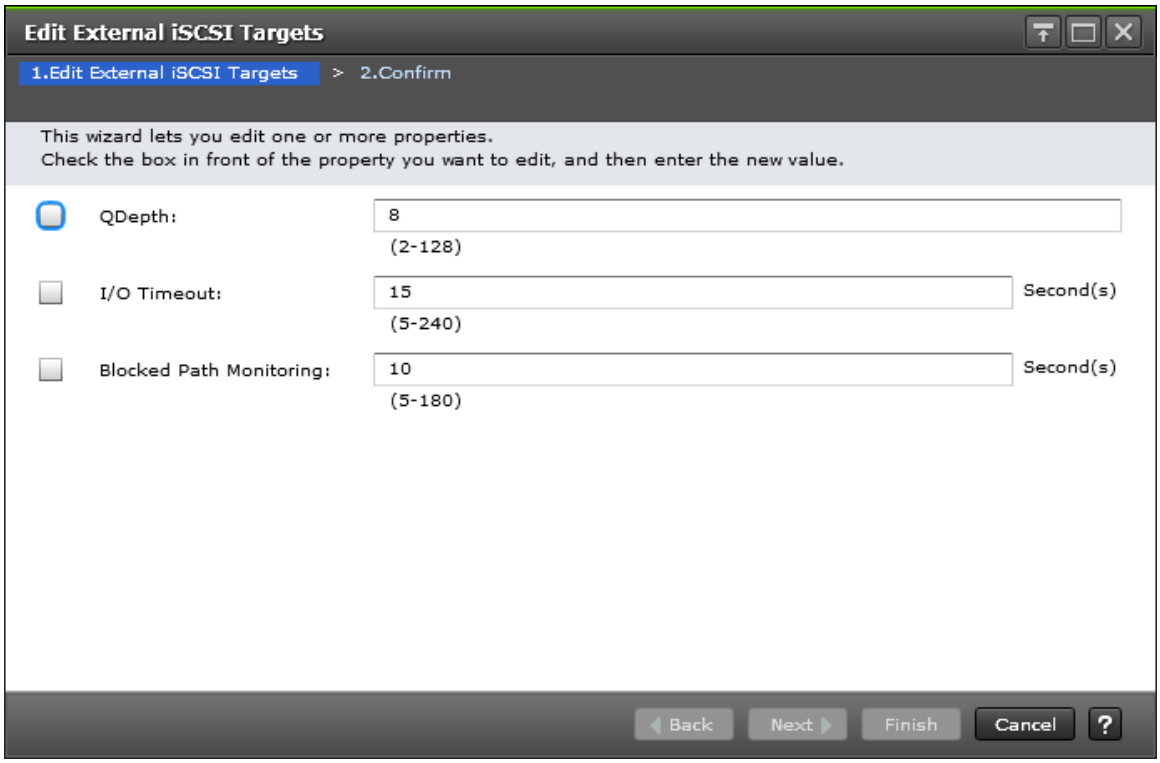
Item	Description
	can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out.
Blocked Path Monitoring (sec.)	Time that will elapse from the time that a path goes down to the time when the external volume is blocked.

Edit External iSCSI Targets wizard

Use this wizard to change the external iSCSI targets.

See Changing the port setting of an external storage system on page 5-27 for instructions.

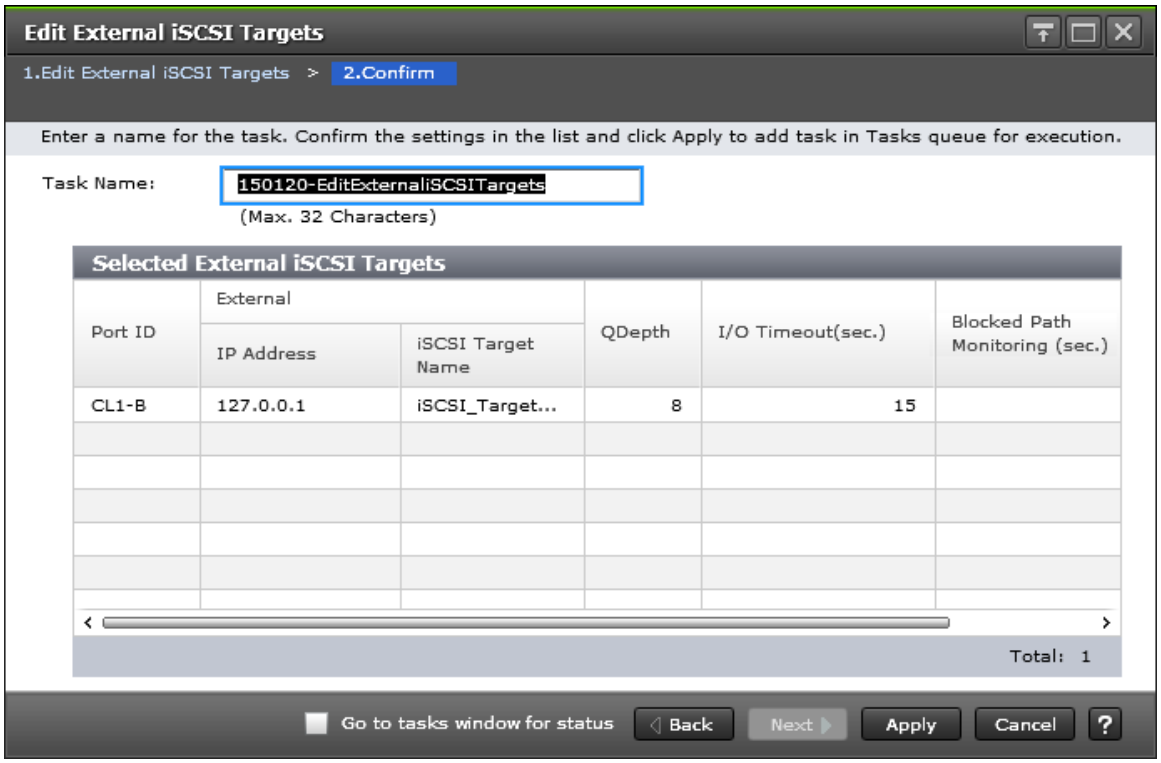
Edit External iSCSI Targets window



Item	Description
QDepth	Number of Read/Write commands that can be queued to the external volume. The numbers 2 through 128 can be entered. When two or more external paths with different values are selected, the field is blank. When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are

Item	Description
	sequential, the number of Read/Write commands that can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out. The numbers 5 through 240 can be entered. When two or more external paths with different values are selected, the field is blank.
Blocked Path Monitoring (sec.)	Time that elapses from the time that a path goes down to the time when the external volume is blocked. The numbers 5 through 180 can be entered. When two or more external paths with different values are selected, the field is blank.

Edit External iSCSI Targets confirmation window



Item	Description
Port ID	Displays the port connected to the external storage system for the local storage system.
External	Displays the target port information for the external storage system. • IP Address: Displays the IP address of the target port. • iSCSI Target Name: Displays the iSCSI target name of the target port.

Item	Description
QDepth	Number of Read/Write commands that can be queued to the external volume. When **Load Balance Mode** is **Extended Round-robin** and the I/Os issued to the external volume are sequential, the number of Read/Write commands that can be queued at one time is the total of the QDepth values of all the external paths.
I/O Timeout (sec.)	Number of seconds that should pass before I/O to the external volume times out.
Blocked Path Monitoring (sec.)	Time that will elapse from the time that a path goes down to the time when the external volume is blocked.

Delete External Volumes wizard

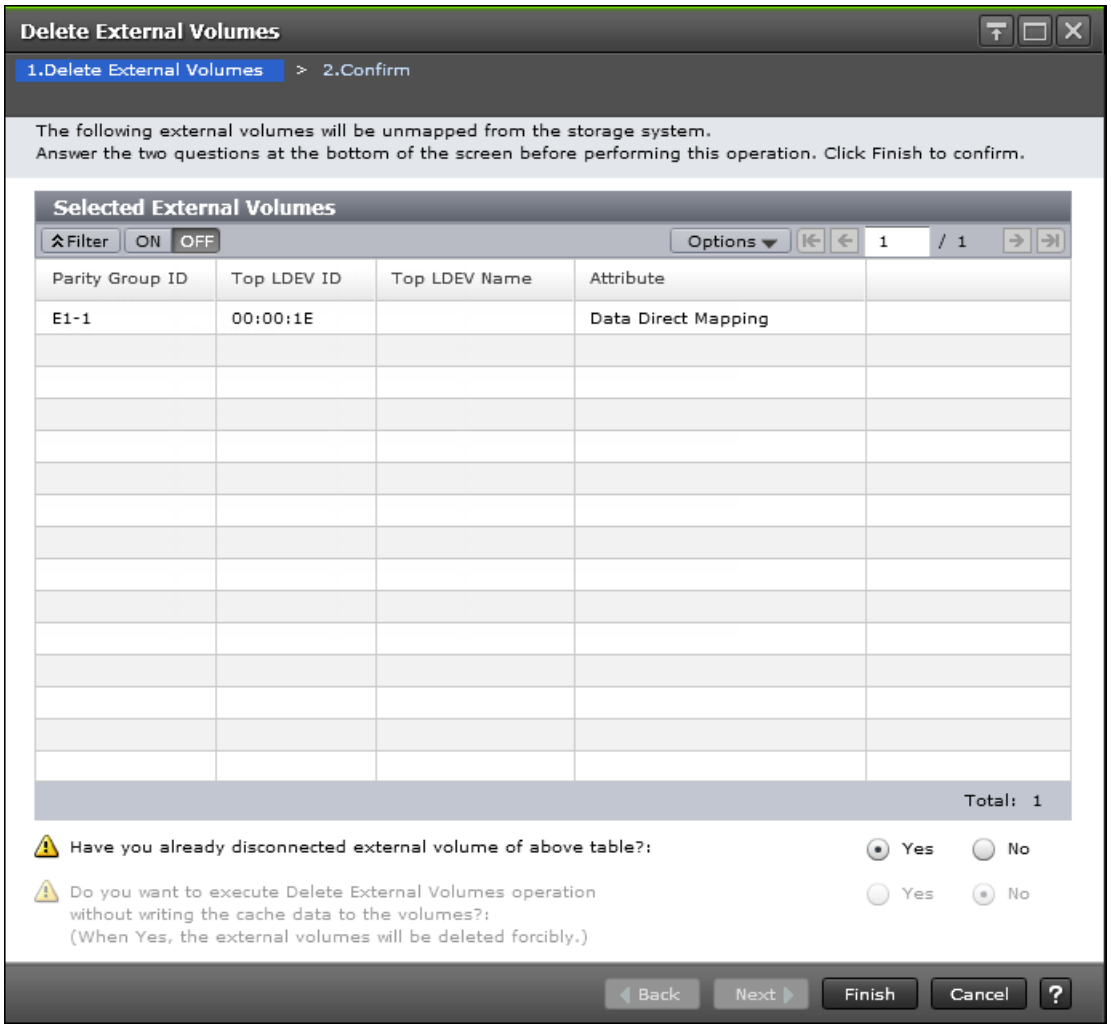
Use this wizard to delete external volume mapping.

See Deleting external volume mapping on page 5-30 for instructions.

The windows in the wizard are:

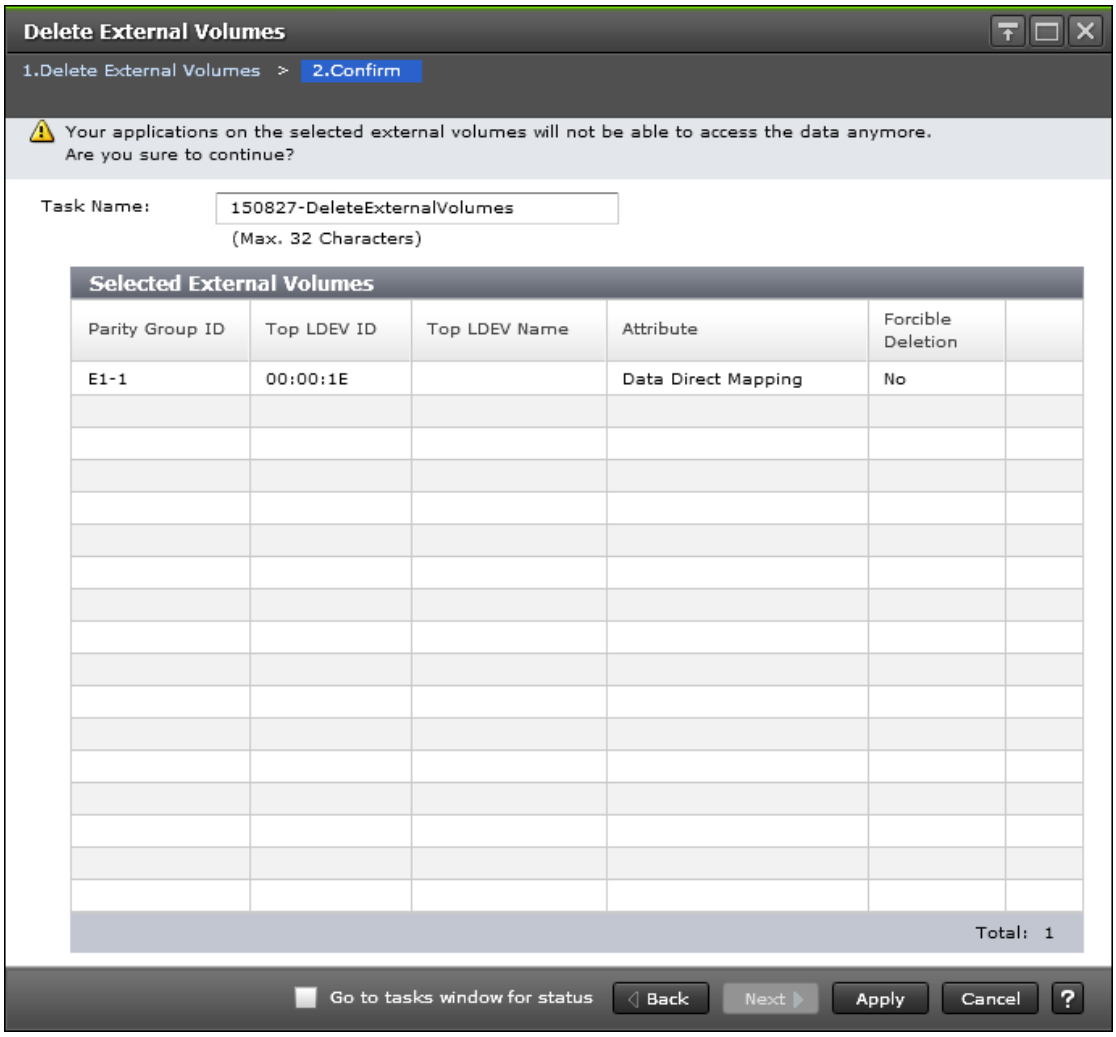
- Delete External Volumes window on page D-43
- Delete External Volumes confirmation window on page D-44

Delete External Volumes window



Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID.
Top LDEV Name	External volume's top LDEV name.
Attribute	External volume's attribute.
Have you already disconnected the external volume of the above table?	• Yes (default) if you have disconnected the external volume you want to delete. • No if you have not disconnected the external volume you want to delete.
Do you want to execute the Delete External Volumes operation without writing the cache data to the volumes?	• Yes to delete the external volumes without writing the data in cache memory into the volumes. • No (default). If selected, the operation cannot be completed.

Delete External Volumes confirmation window



Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID.
Top LDEV Name	External volume's top LDEV name.
Attribute	External volume's attribute.
Forcible Deletion	Yes: The external volume will be forcibly deleted even if the connection to the external volume has not been disconnected. No: The external volume will be deleted after confirming that the connection to the external volume is disconnected.

Disconnect External Paths wizard

Use this wizard to disconnect external paths.

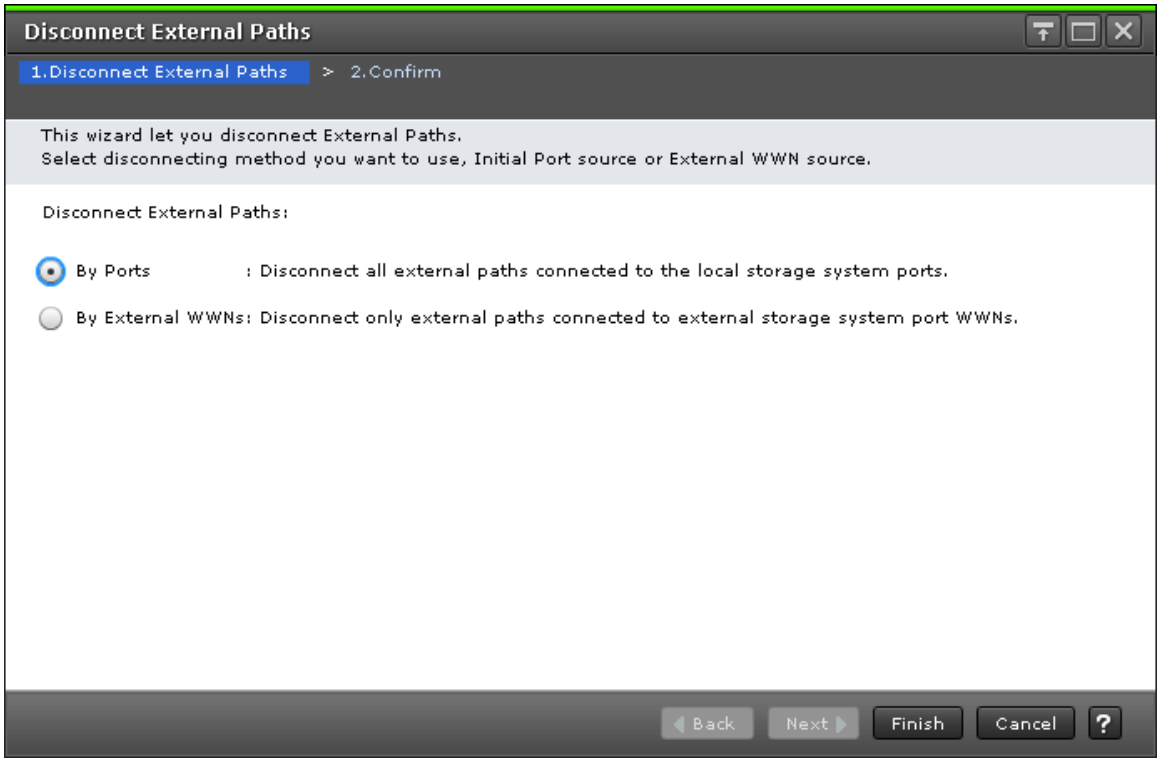
See Disconnecting an external path on page 5-8 for instructions.

The windows in the wizard are:

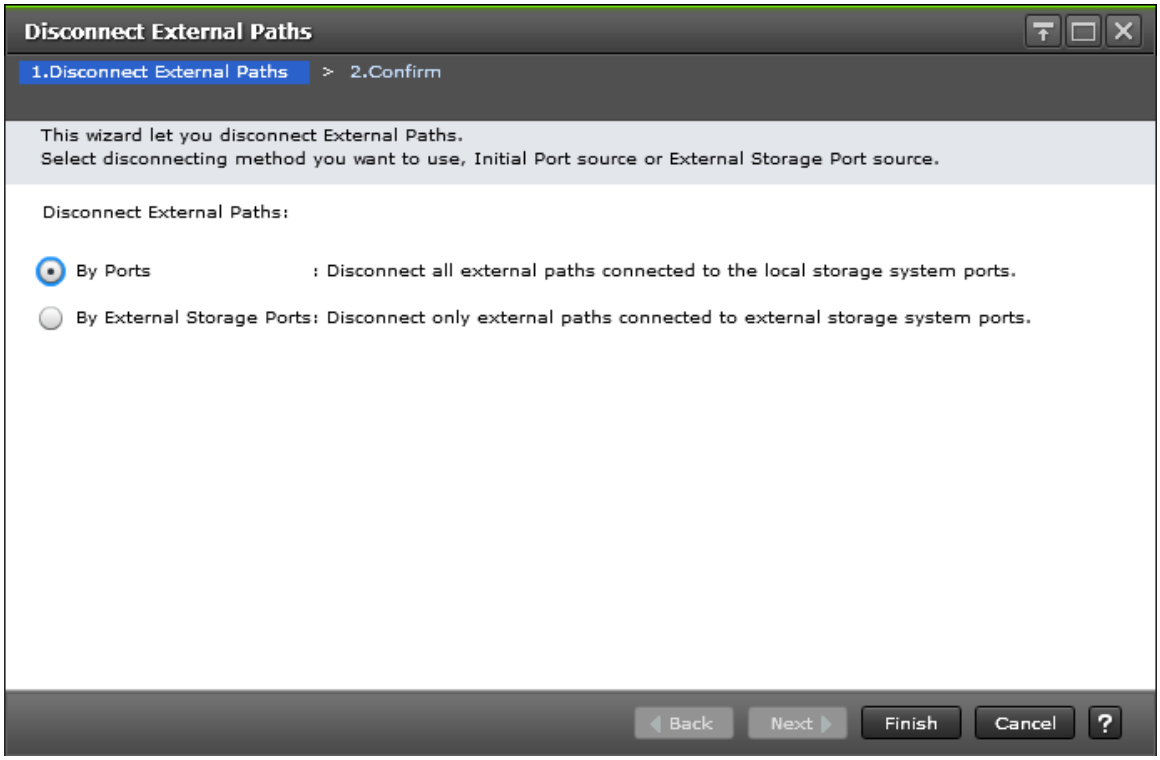
- Disconnect External Paths window on page D-45
- Disconnect External Paths confirmation window on page D-47

Disconnect External Paths window

For Fibre Channel port



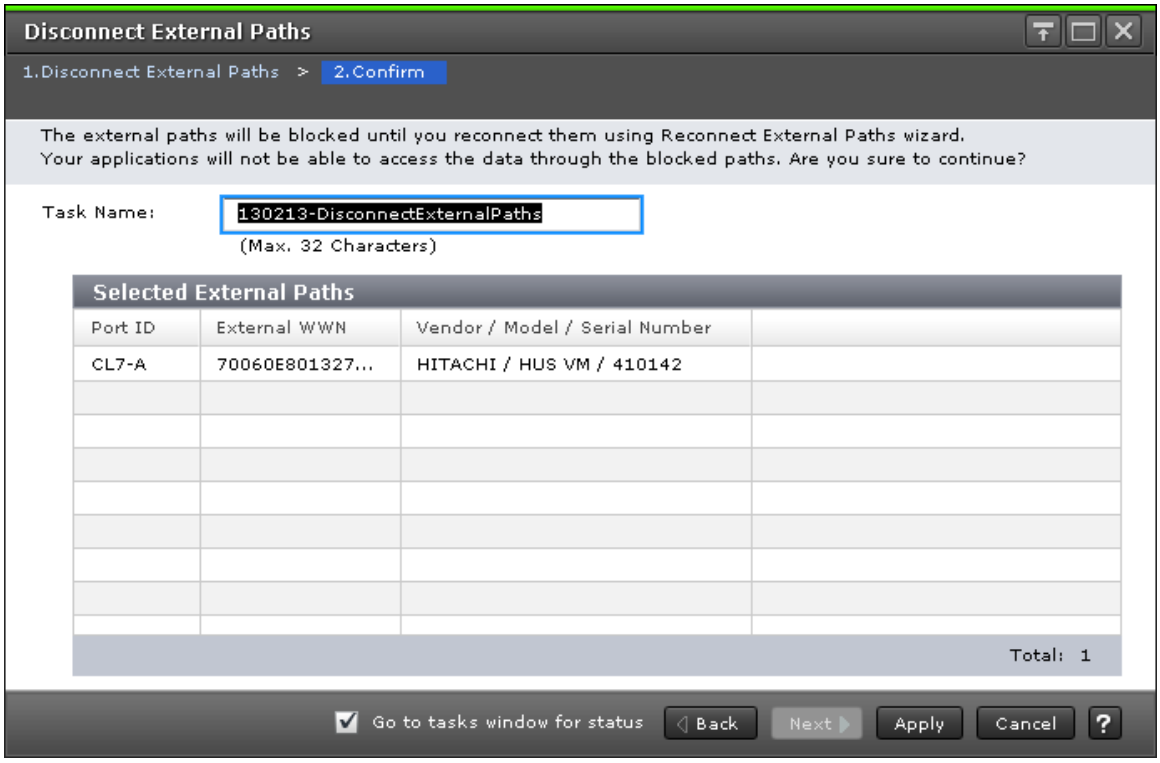
For iSCSI port



Item	Description
Disconnect External Paths	• By Ports (default): Stops use of all the external paths connected to the specified port in the local system. • By External WWNs or External Storage Ports: Stops use of all the external paths connected to the external system.

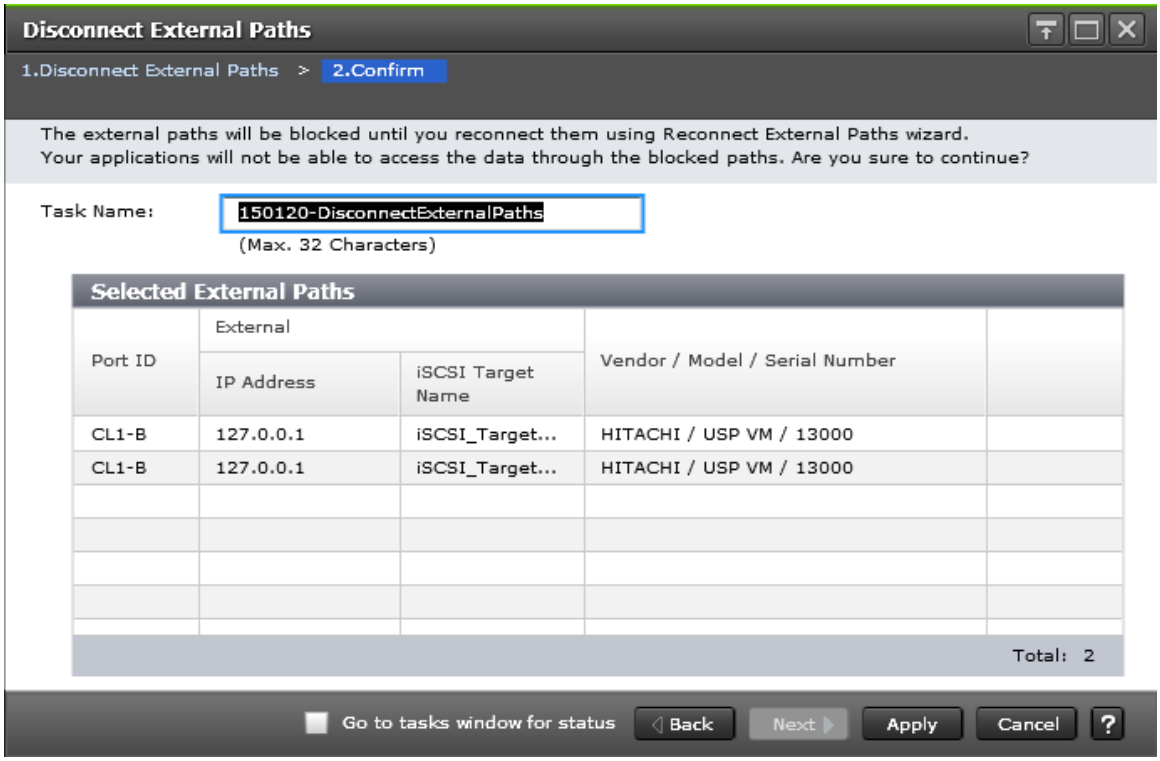
Disconnect External Paths confirmation window

For Fibre Channel port



Item	Description
Port ID	Port connected to the external storage system for the local storage system.
External WWN	External system port identification number.
Vendor / Model / Serial Number	Identifying information for the external system.

For iSCSI port



Item	Description
Port ID	Displays the port connected to the external storage system for the local storage system.
External	Displays the target port information for the external storage system. • IP Address: Displays the IP address of the target port. • iSCSI Target Name: Displays the iSCSI target name of the target port.
Vendor / Model / Serial Number	Identifying information for the external system.

Reconnect External Paths wizard

Use this wizard to reconnect external paths.

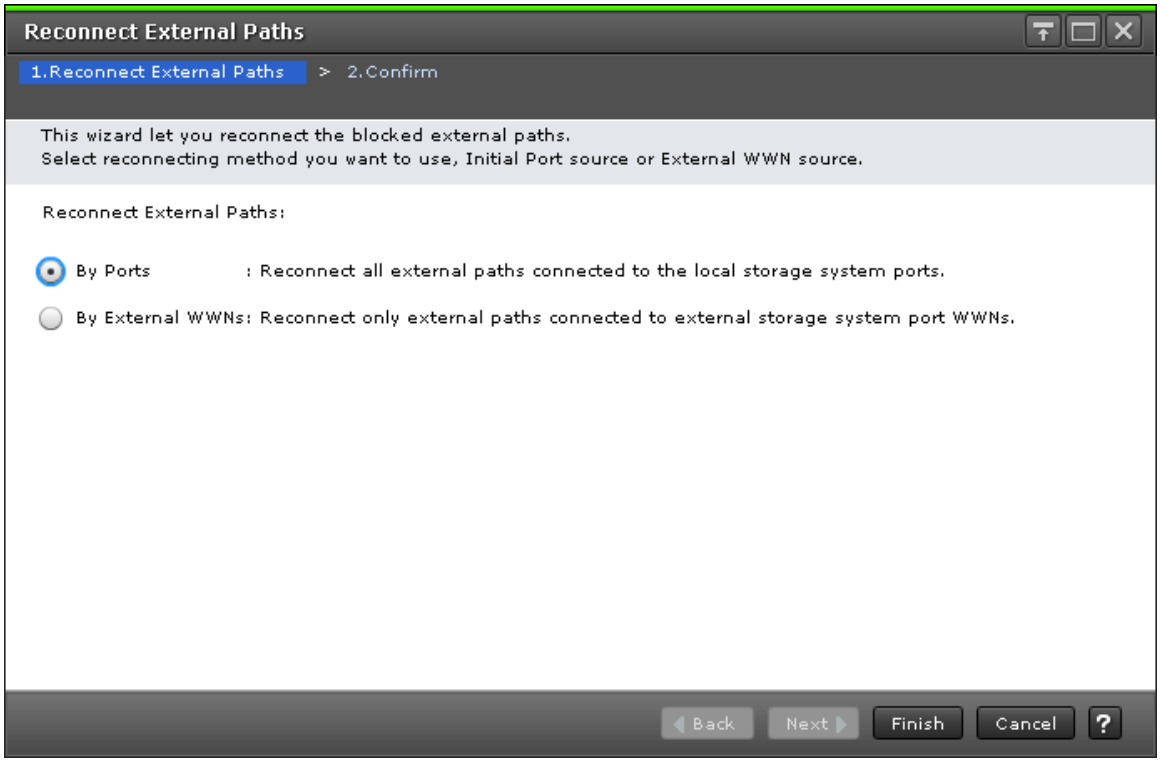
See Reconnecting an external path on page 5-9 for instructions.

The windows in the wizard are:

- Reconnect External Paths window on page D-49
- Reconnect External Paths confirmation window on page D-50

Reconnect External Paths window

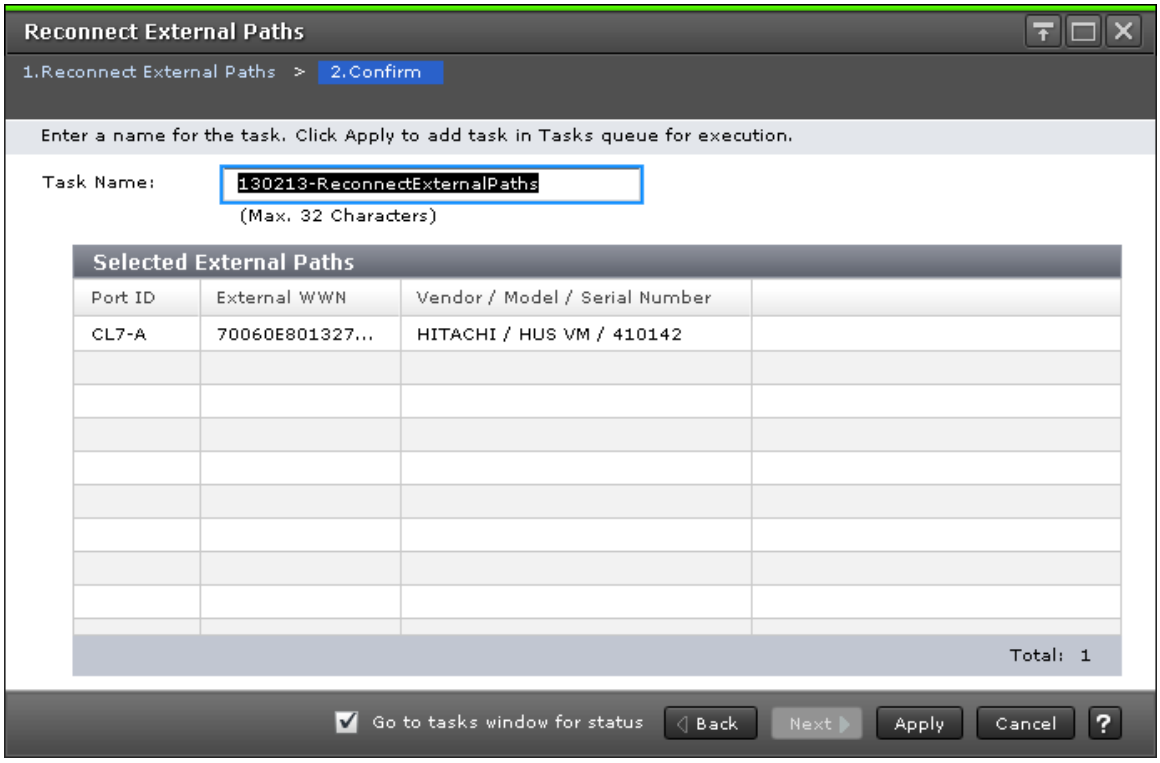
For Fibre Channel port and iSCSI port



Item	Description
Reconnect External Paths	• By Ports (default): Reconnects all external paths connected to the specified port in the local system. • By External WWNs or External Storage Ports: Reconnects all external paths connected to the external system.

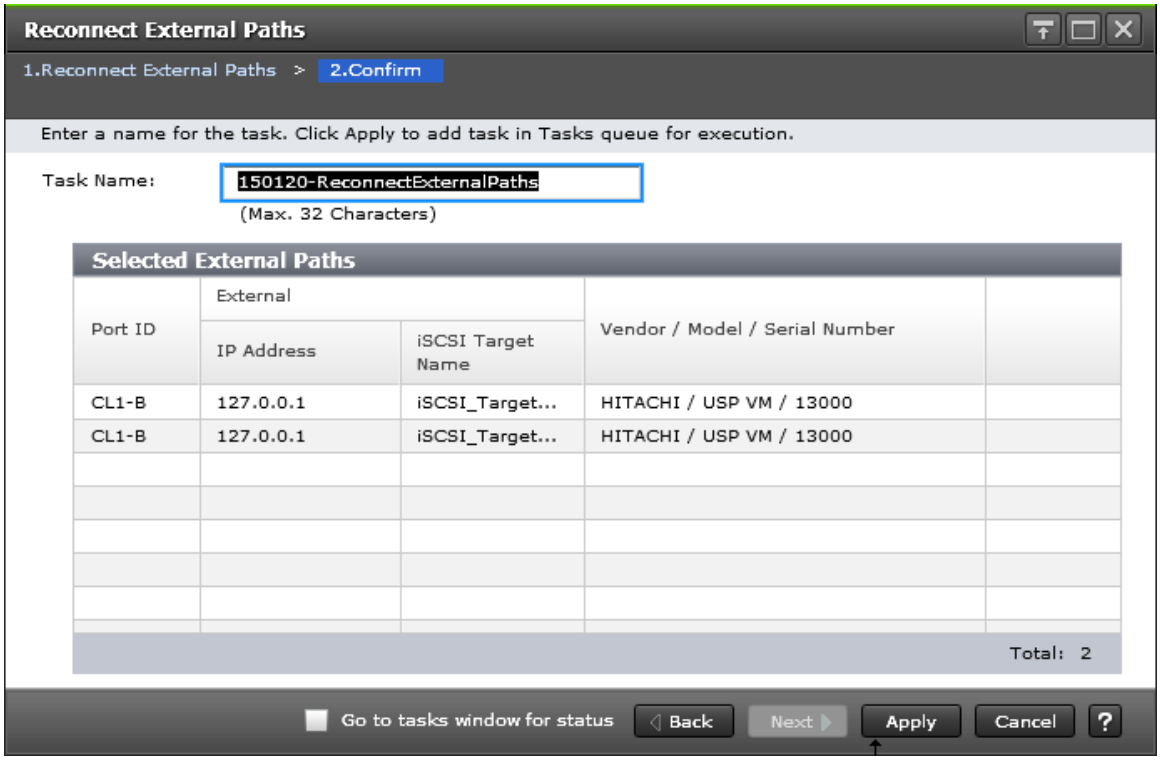
Reconnect External Paths confirmation window

For Fibre Channel port



Item	Description
Port ID	Port connected to the external storage system for the local storage system.
External WWN	External system port identification number.
Vendor / Model / Serial Number	Identifying information for the external system.

For iSCSI port



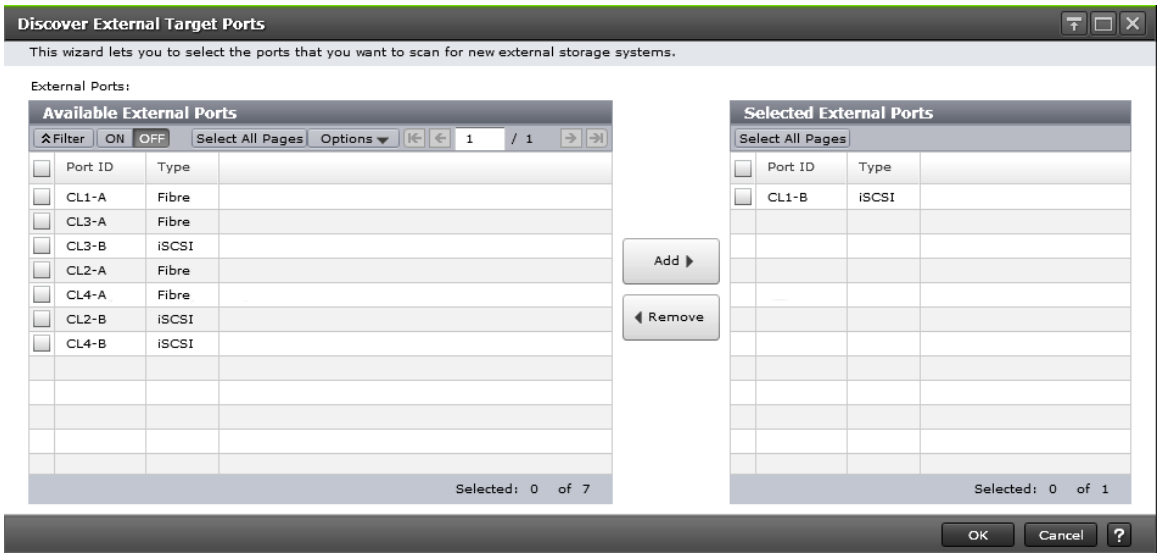
Item	Description
Port ID	Displays the port connected to external storage system of the local storage system.
External	Displays the target port information for the external storage system. • IP Address: Displays the IP address of the target port. • iSCSI Target Name: Displays the iSCSI target name of the target port.
Vendor/Model/Serial Number	Identifying information for the external system.

Discover External Target Ports window

Use this window to add or remove external ports for the external path.

This window is used in the following operations:

- Mapping an external volume on page 4-8
- Adding an external path to an existing path group on page 5-3



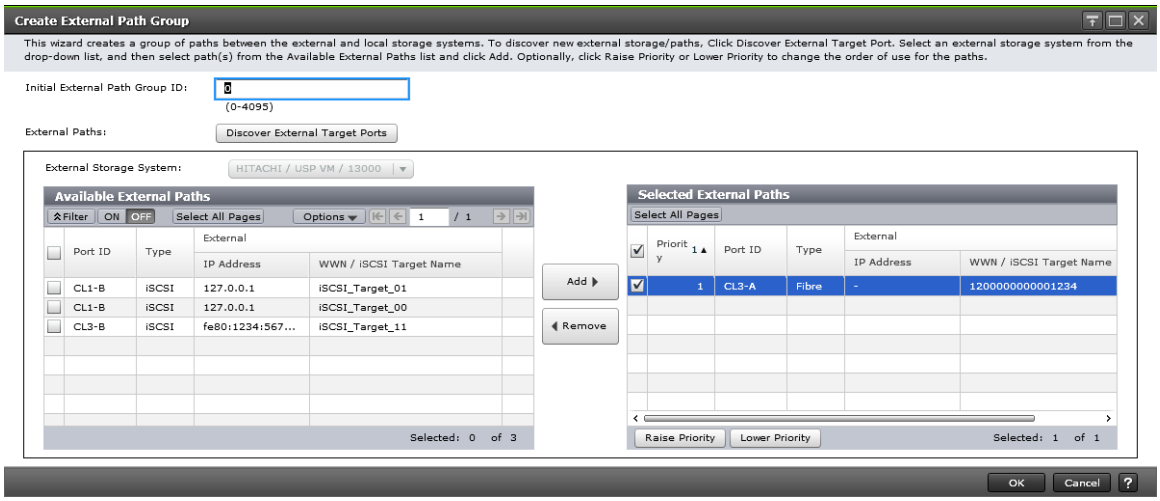
Only external ports assigned to the user display.

Item	Description
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
Add	When clicked, moves selected paths to the Selected External Ports list.
Remove	When clicked, removes the selected path from the Selected External Ports list.

Create External Path Group window

Use this window to create a new external path group.

This window is used in the operation, Mapping an external volume on page 4-8.



Only paths with ports assigned to the user can display.

Item	Description
Initial External Path Group ID	An initial ID for the path group. The storage system searches IDs in ascending order from this value and allocates an ID that can be used. Range of values: • VSP G200: 0 to 2,047 • VSP G400 and VSP G600: 0 to 4,095 • VSP G8000 to 14,079 The default is 0.
Discover External Target Ports	When clicked, opens the Discover External Target Ports window.
External Storage System	The external system selected (greyed out). If no system was selected, allows you to select the system from a list.
Available External Paths	
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port. • WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
Add	When clicked, moves selected paths to the Selected External Paths list.

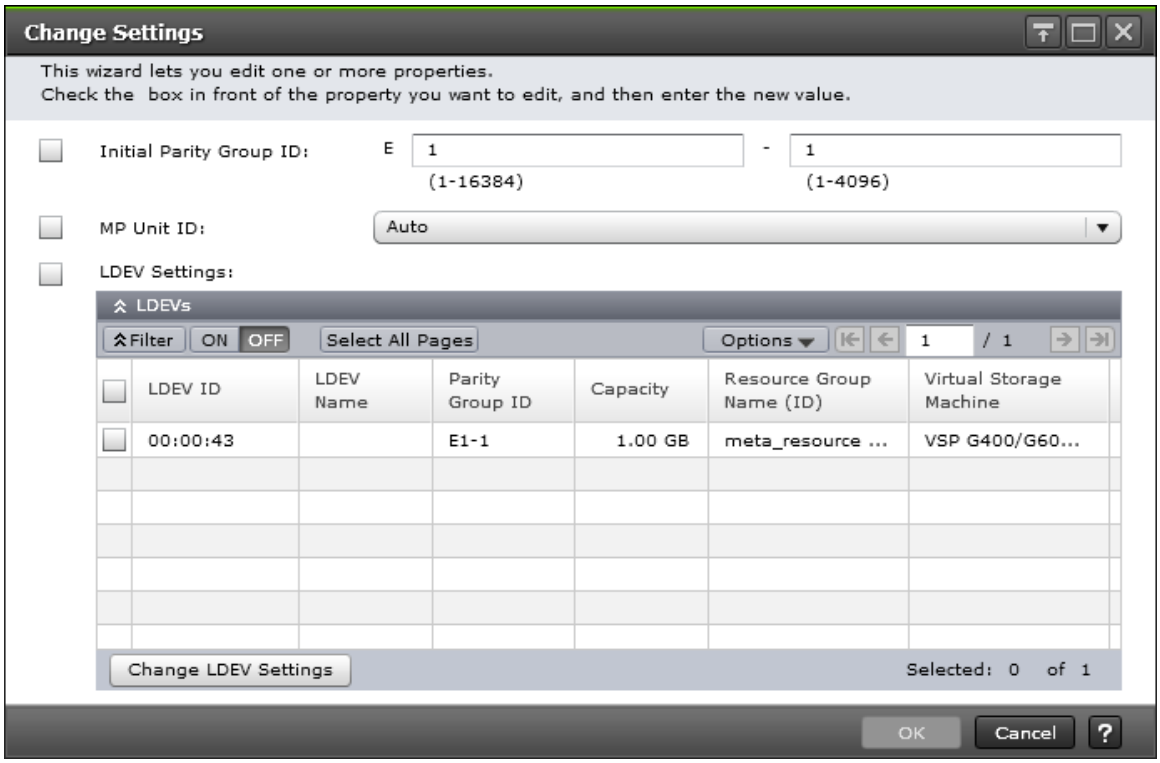
The following table provides descriptions of items in the **Selected External Paths** pane of the **Create External Path Group** window.

Item	Description
Selected External Paths	
Remove	When clicked, removes the selected path from the Selected External Paths list.
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port. • WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
Raise Priority	When clicked, raises the priority of the selected external path.
Lower Priority	When clicked, lowers the priority of the selected external path.

Change Settings window

Use this window to change the settings for selected external volumes.

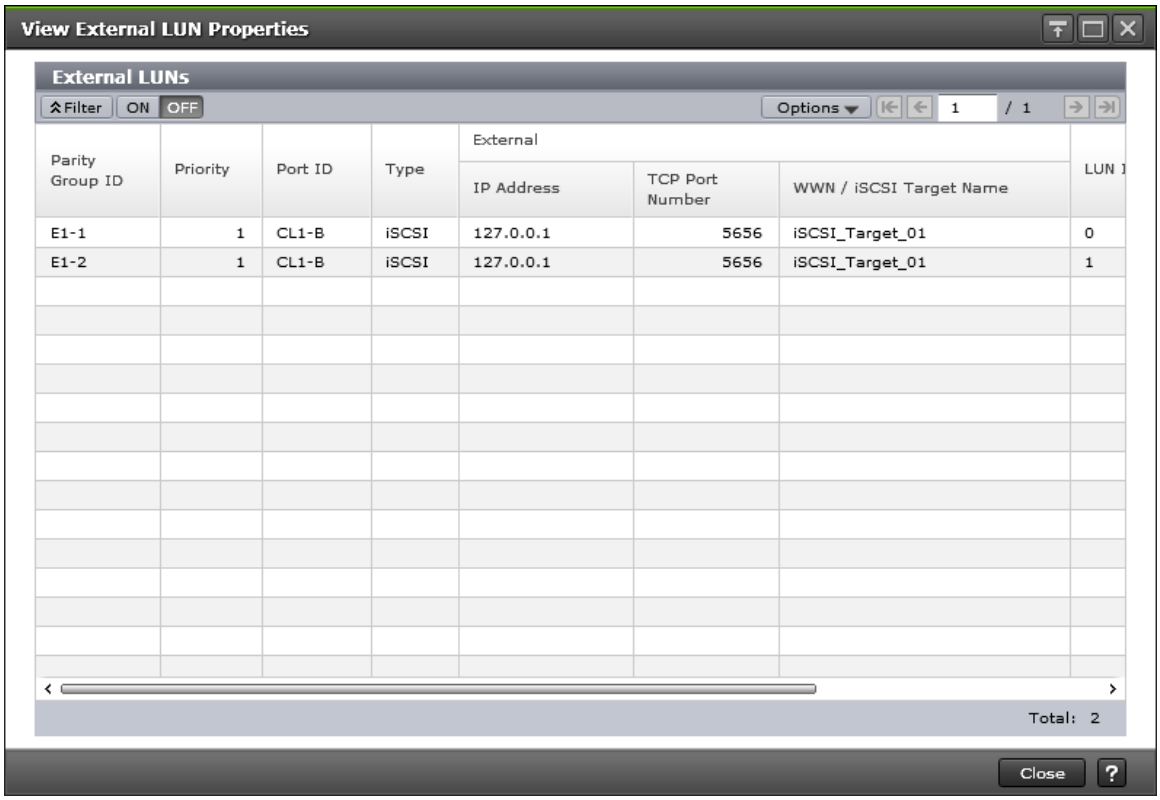
This window is used in the operation, Mapping an external volume on page 4-8.



Item	Description
Initial Parity Group ID	An external volume group number and sequence number. Values range from 1 - 1 to 16384 - 4096. When two or more volumes with different values are selected, blank displays.
MP Unit ID	• You can select MPU-10, MPU-11, MPU-20 or MPU-21. • Auto (default if it can be selected): Unit is automatically selected by the system, if available. • Unit with lowest number is the default when Auto cannot be selected. • When two or more volumes with different values are selected, blank displays.
LDEV Settings	If changes to LDEV settings are made, box must be checked to proceed.
LDEV ID	LDEV IDs allocated to the external volume.
LDEV Name	LDEV names.
Parity Group ID	Parity group numbers.
Capacity	LDEV capacity.
Resource Group Name (ID)	Name and ID of the resource group for the LDEV. ID is enclosed in parentheses.
Virtual Storage Machine	Model and serial number of the virtual storage machine for the LDEV.
Change LDEV Settings	When clicked, opens Change LDEV Settings window.

View External LUN Properties window

Use this window to view settings and other details about external LUNs.



Item	Description
Parity Group ID	Parity group numbers.
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port. • TCP Port Number: Displays the target TCP port number when port type is iSCSI port. • WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
LUN ID	When the external path is connected to the selected external volume, the LUN ID displays.
Status	Status of external paths.

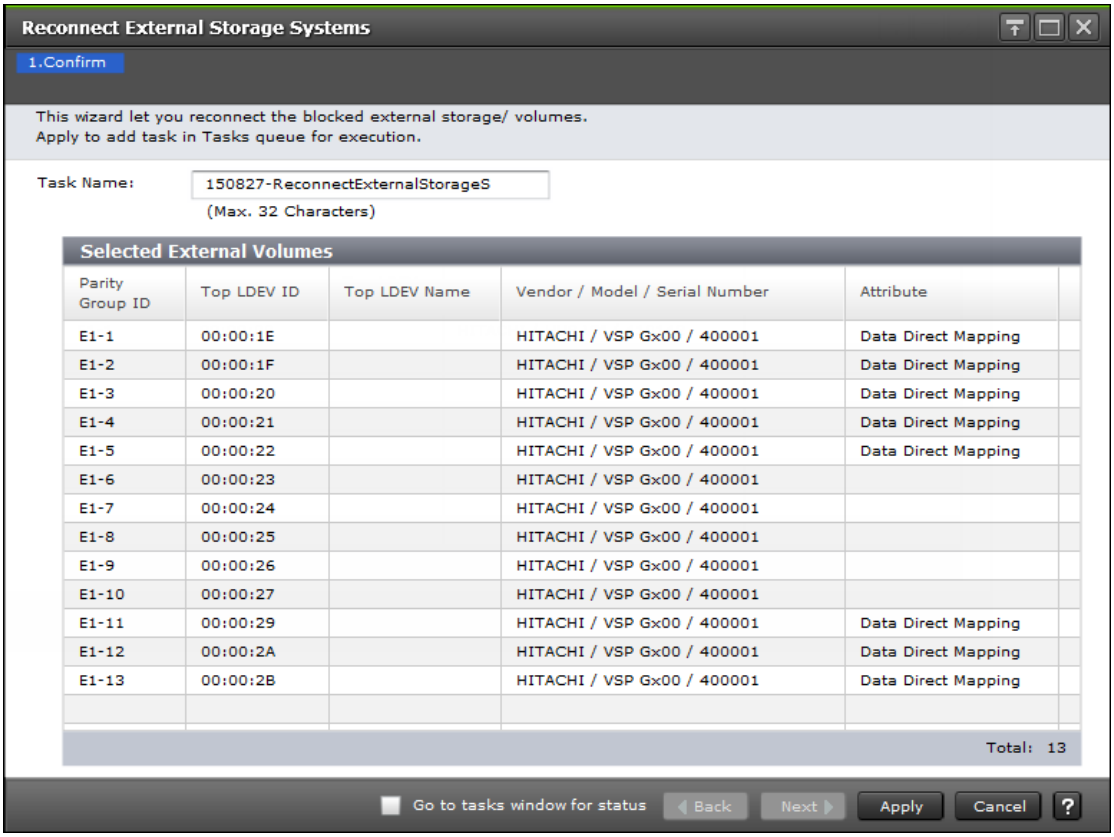
Item	Description
	• **Unknown**: The status of the mapping path is not known. • **Checking**: The system is checking the mapping path status. • **Blockade**: The mapping path is blocked. • **Normal**: There are no problems, the system is usable. • **Disconnect**: The external system or one of its mapped volumes has been intentionally disconnected. • **External Device Setting Changed**: An external system setting has been changed. For example, the path definition was deleted, or the external system itself was replaced by another device. • **LDEV Size Reduced**: The external volume's capacity was reduced. • **Not Ready**: The reply from the external system was NOT READY. • **Illegal Request**: The reply from the external system was ILLEGAL REQUEST. • **Command Aborted**: The reply from the external system was ABORTED COMMAND. • **Busy**: The external system is busy. • **LDEV Reserved**: The external system is reserved. • **Response Error**: The external system is blocked because of an abnormal reply. • **Initiator Port**: The port attribute of the external system has been changed to the initiator port. • **Unknown Port**: The port attribute of the external system is not known. • **Cannot Detect Port**: The path has been removed or the external system port cannot be found. • **Timeout**: Processing was retried because an abnormal reply was returned; however, processing has timed out. • **Passive**: The external system port is not active. Port status is normal but the port is not used for I/O. • **Standby**: The external system port is standing by. The port status is normal but cannot receive I/O. • **Target Error**: Port failures, such as controller blockade, are detected on the external system. • **Unavailable**: The reply from the external system was Unavailable. The external system demands to change the connected port. Once the status becomes Unavailable, the primary path is changed to an alternate path in Standby status. When the primary path is available, the status changes to Normal. • **Backoff**: The reply from the external system was Backoff. A temporary error has occurred in the external volume and the path is waiting for recovery. The primary path is not changed to the alternate path immediately. After recovery, the status changes to Normal. • **Destage Failed**: The writing of data from cache memory to the volume has failed.
Target Port Asymmetric Access State	When the path mode is ALUA, the port state of the external storage system displays. • **Active/Optimized**: The performance is in a good state.

Item	Description
	• **Active/Non-Optimized**: Data can be sent and received, but the performance is inferior to **Active/Optimized**. A space displays in one of the following cases: • The path mode is other than ALUA. • Mapping of an external volume is not completed.

Reconnect External Storage Systems window

Use this window to reconnect the external storage system.

See Reconnecting an external storage system and all mapped volumes on page 5-22 for instructions.



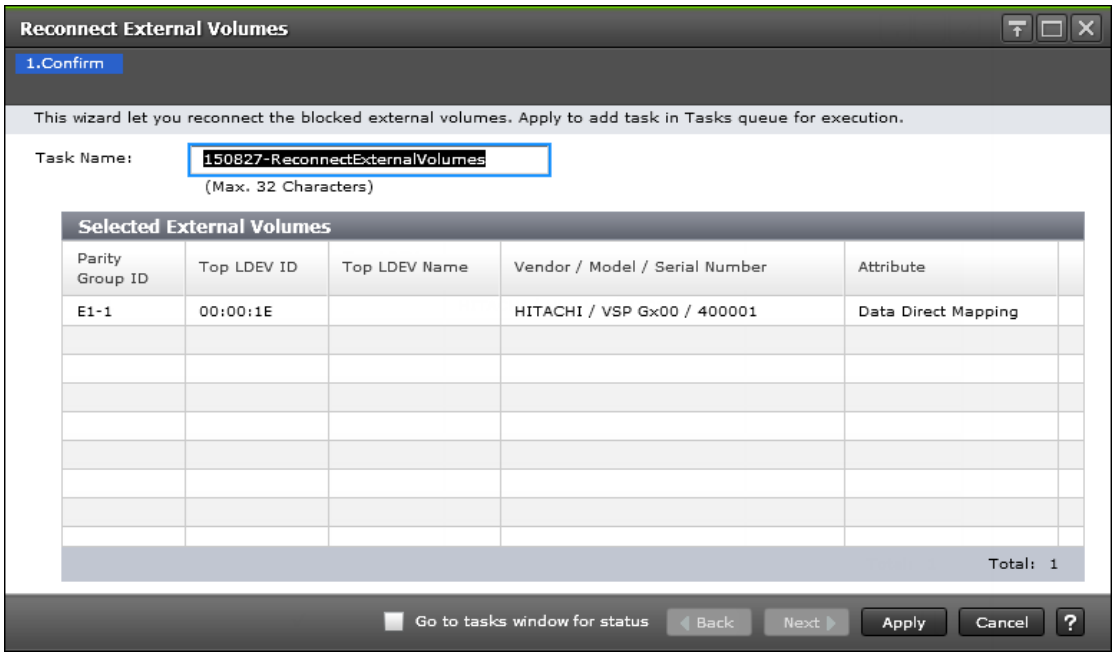
Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID. Blank displays when an LDEV is not created.
Top LDEV Name	External volume's top LDEV name. Blank displays when an LDEV is not created.
Vendor / Model / Serial Number	Identifying information for the external system.

Item	Description
Attribute	External volume's attribute.

Reconnect External Volumes window

Use this window to reconnect the external volume.

See Reconnecting a single mapped volume on page 5-23 for instructions.

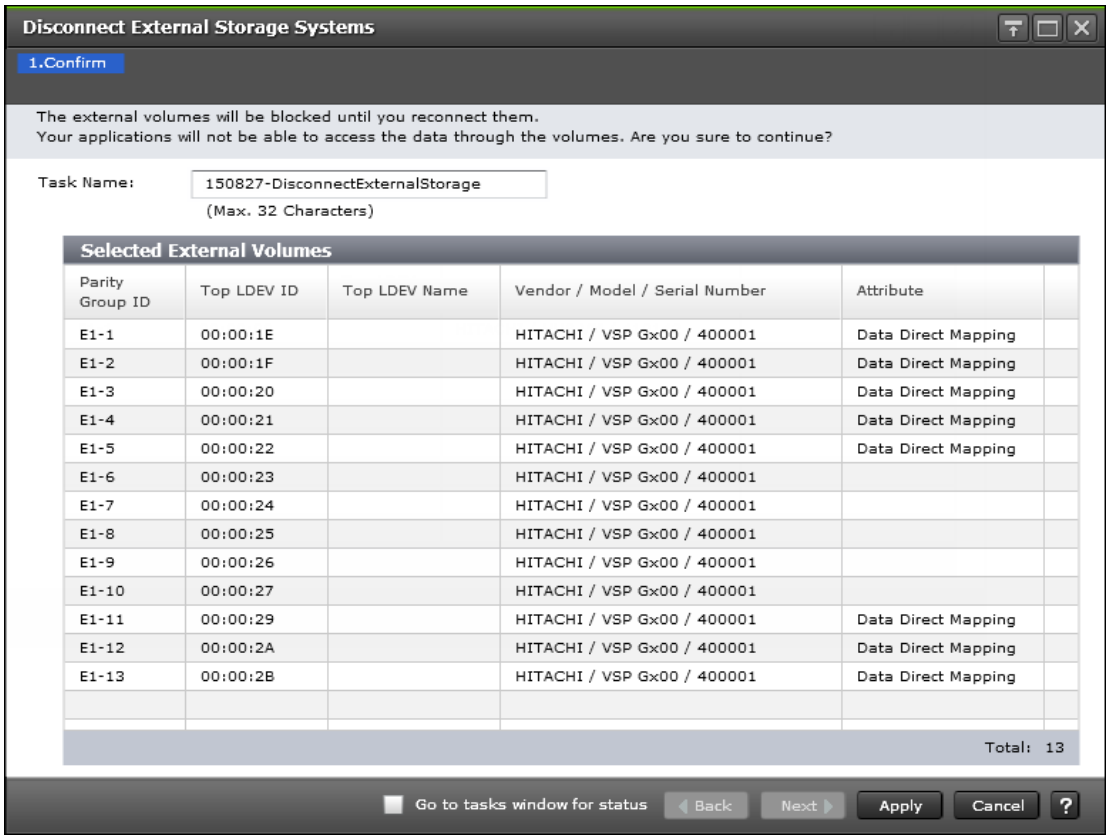


Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID. Blank displays when an LDEV is not created.
Top LDEV Name	External volume's top LDEV name. Blank displays when an LDEV is not created.
Vendor / Model / Serial Number	Identifying information for the external system.
Attribute	External volume's attribute.

Disconnect External Storage Systems window

Use this window to disconnect the storage system

See Disconnecting an external storage system, all mapped volumes on page 5-20 for instructions.

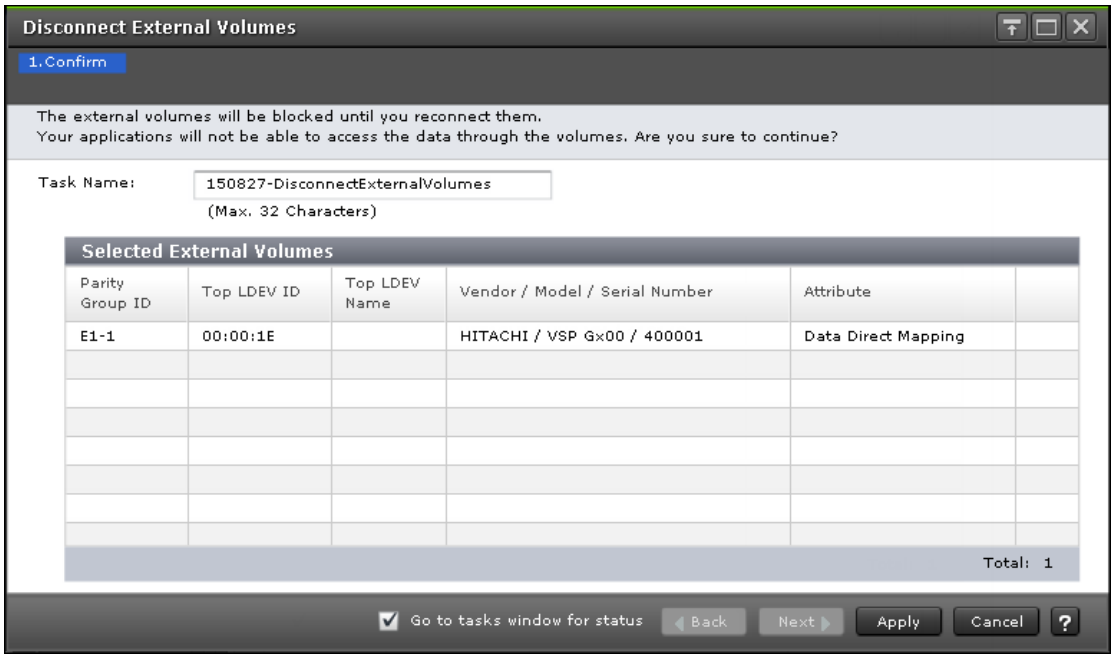


Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID. Blank displays when an LDEV is not created.
Top LDEV Name	External volume's top LDEV name. Blank displays when an LDEV is not created.
Vendor / Model / Serial Number	Identifying information for the external system.
Attribute	External volume's attribute.

Disconnect External Volumes window

Use this window to disconnect an external volume.

See Disconnecting a single mapped volume on page 5-21 for instructions.



Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID. Blank displays when an LDEV is not created.
Top LDEV Name	External volume's top LDEV name. Blank displays when an LDEV is not created.
Vendor / Model / Serial Number	Identifying information for the external system.
Attribute	External volume's attribute.

Assign MP Unit wizard

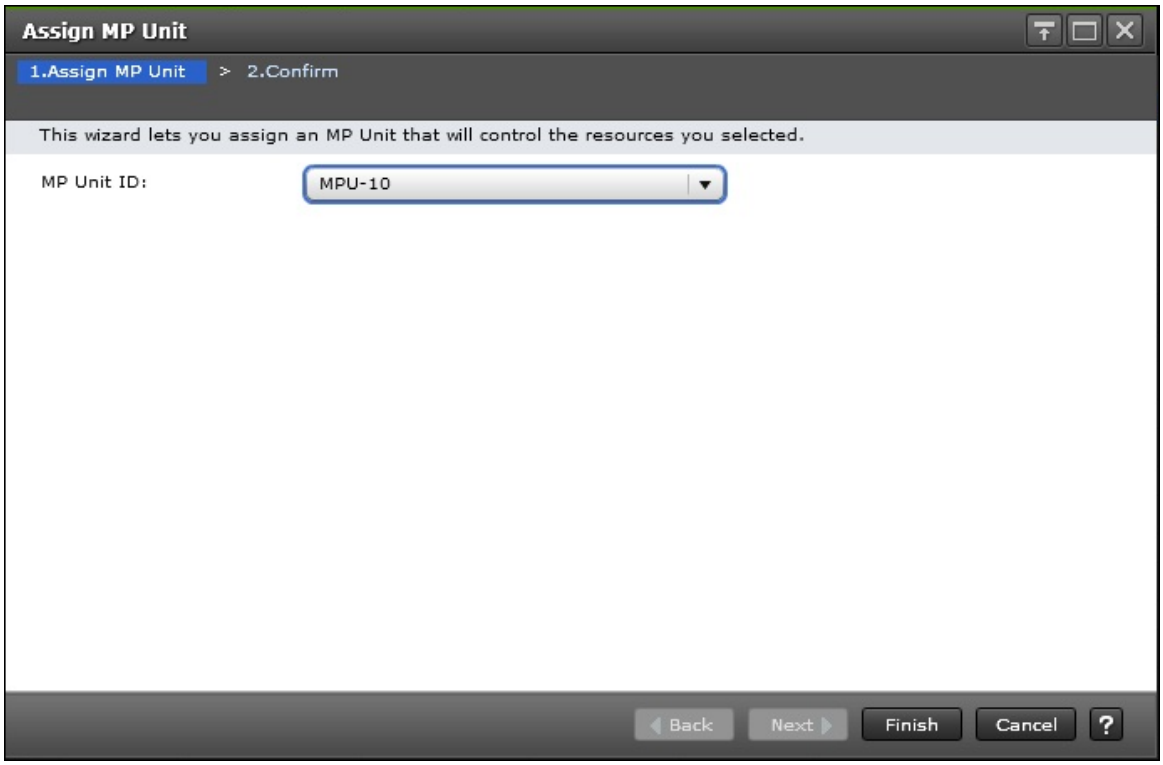
Use this wizard to select an MP unit for the external volume.

See Changing the MP Unit of an external volume on page 5-33 for instructions.

The windows in this wizard are:

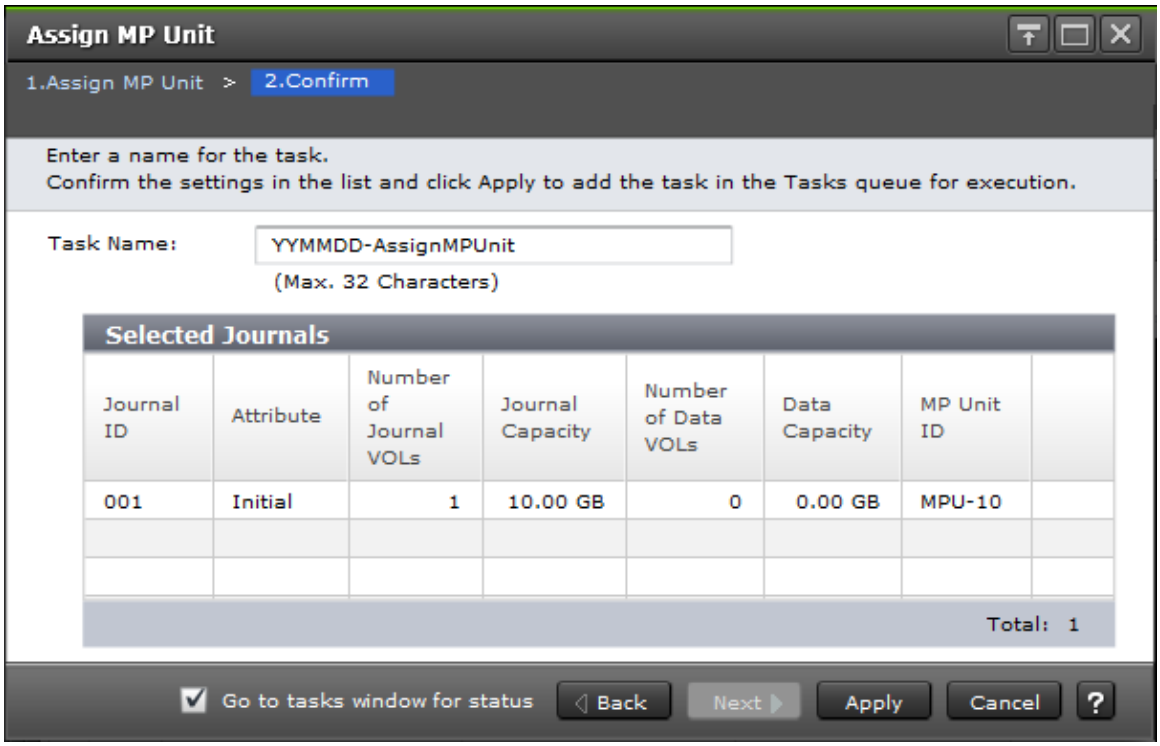
- Assign MP Unit window on page D-62
- Assign MP Unit confirmation window on page D-63

Assign MP Unit window



Item	Description
MP Unit ID	MP unit ID for the external volume. • You can select MPU-10, MPU-11, MPU-20 or MPU-21. • Default is the value configured in the selected external volume. • When two or more volumes with different values are selected, blank displays.

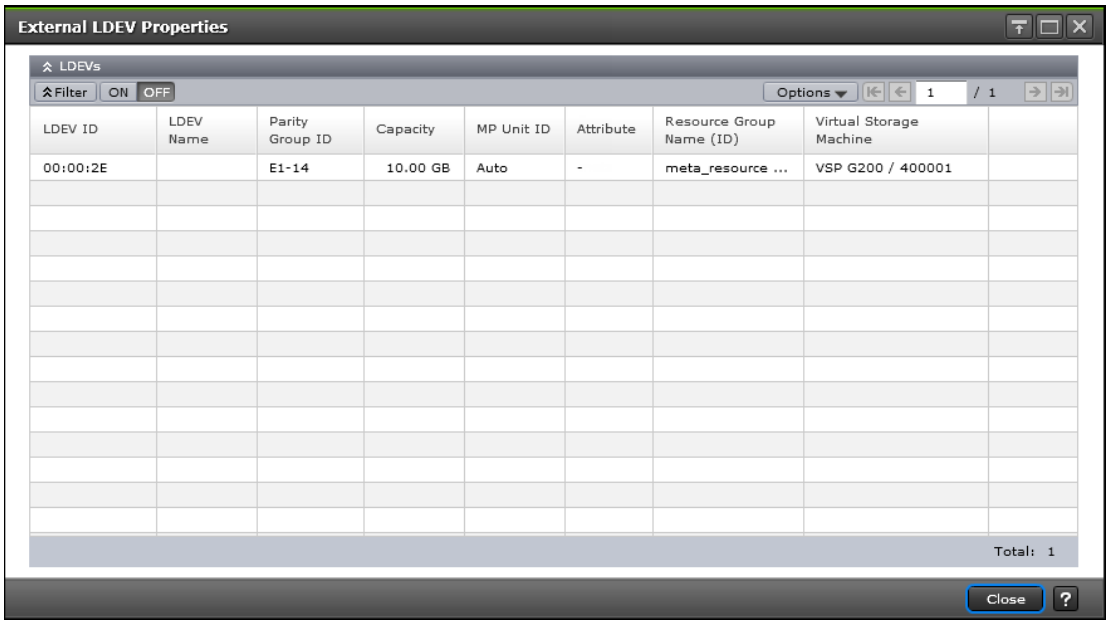
Assign MP Unit confirmation window



Item	Description
Parity Group ID	Parity group numbers.
Top LDEV ID	External volume's top LDEV ID. Blank displays when an LDEV is not created.
Top LDEV Name	External volume's top LDEV name. Blank displays when an LDEV is not created.
MP Unit ID	MP unit IDs allocated to the external volume.

External LDEV Properties window

Use this window to view settings for external LDEVs.

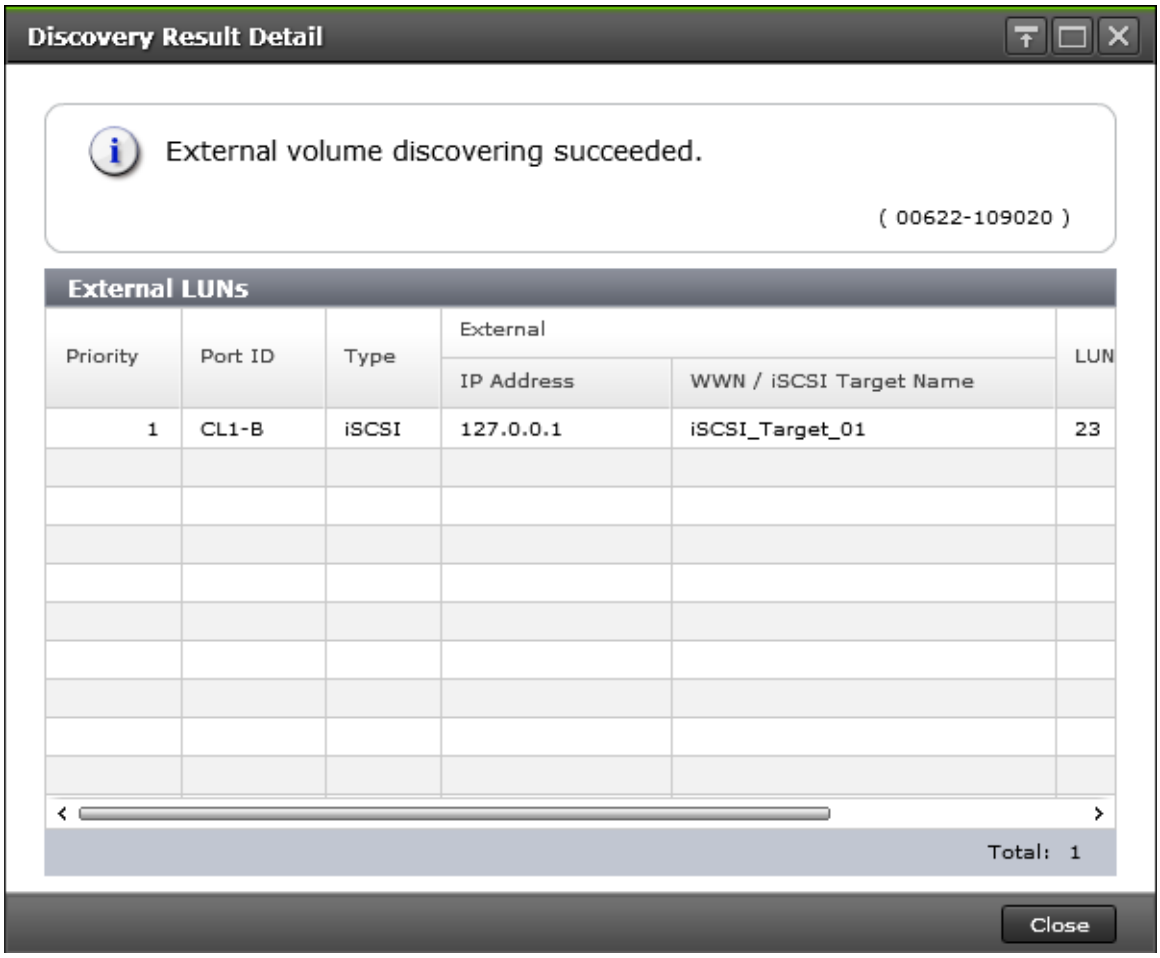


LDEVs table

Item	Description
LDEV ID	LDEV IDs allocated to the external volume.
LDEV Name	LDEV names.
Parity Group ID	Parity group numbers.
Capacity	Capacity of LDEVs.
MP Unit ID	MP unit IDs allocated to the LDEV.
Attribute	External volume's attribute.
Resource Group Name (ID)	Name and ID of the resource group for the LDEV. ID is enclosed in parentheses.
Virtual Storage Machine	Model and serial number of the virtual storage machine for the LDEV.

Discovery Result Detail window

Use this window to view discover result settings and other details.



Item	Description
Priority	Priority of external paths.
Port ID	Port connected to the external storage system for the local storage system.
Type	Displays the port type. • Fibre: Fibre Channel port • iSCSI: iSCSI port
External	Displays the information about external storage system's target port. • IP Address: Displays the target port IP address when port type is iSCSI port. • WWN / iSCSI Target Name: Displays the WWN to show the target port when port type is Fibre Channel port. If the port type is iSCSI port, iSCSI target name is displayed.
LUN ID	When the external path is connected to the selected external volume, the LUN ID displays.
Status	Status of external paths. • **Unknown**: The status of the mapping path is not known. • **Normal**: There are no problems, the system is usable.

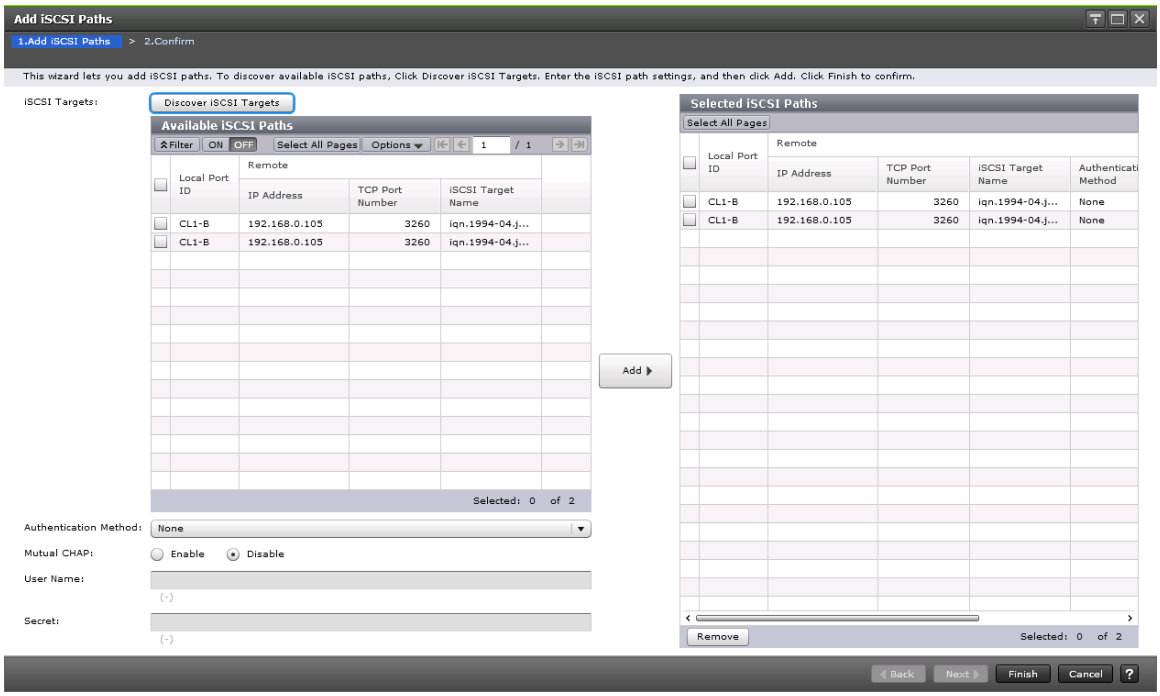
Add iSCSI Paths wizard

Use this wizard to add iSCSI path for the external volume. See Adding an iSCSI path on page 5-4 for instructions.

The windows in this wizard are:

- Add iSCSI paths window on page D-66
- Add iSCSI Paths confirmation window on page D-67

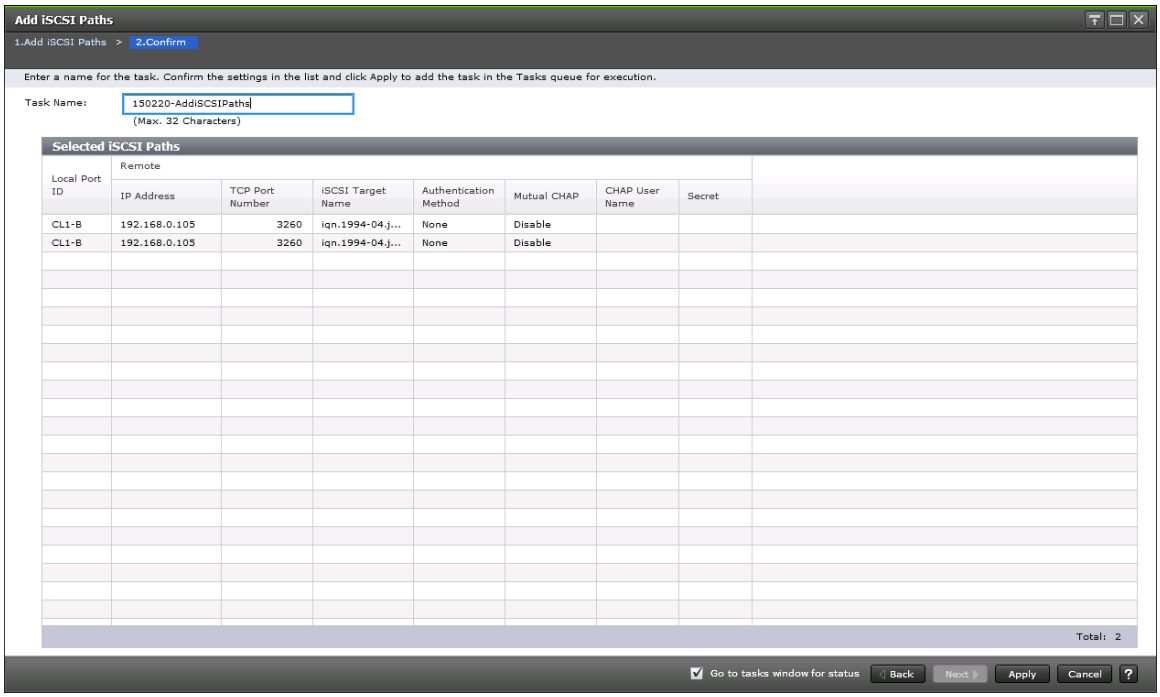
Add iSCSI paths window



Item	Description
Discover iSCSI Targets button	Displays the Discover iSCSI Targets window.
Local Port ID – Available iSCSI Paths table	Displays the port connected to the external storage system of the local storage system.
Remote– Available iSCSI Paths table	Displays the remote storage system port information. • IP Address: Displays the IP address. • TCP Port Number: Displays the TCP port number. • iSCSI Target Name: Displays the iSCSI target name.
Authentication Method	Select the authentication method (CHAP or None). If you select CHAP, the settings below can be set.
Mutual CHAP	Select **Enable** or **Disable**. If you select **Enable**, authentication becomes bidirectional. If you select **Disable**, authentication becomes unidirectional.

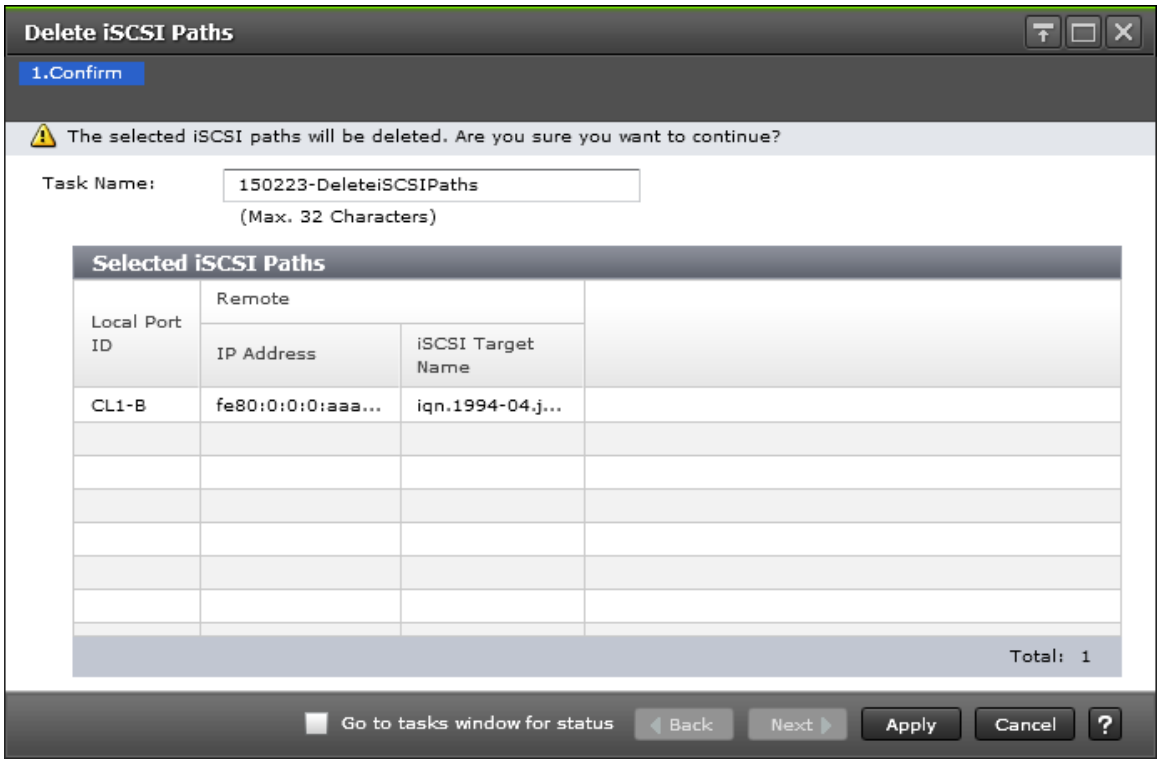
Item	Description
User Name	Set the user name. You can use up to 223 letters. Valid characters: Alphanumeric characters and symbols (. - + @ _ = : / [ ] ~)
Secret	Set the secret for host authentication. You can use between 12 and 32 letters. Valid characters: Alphanumeric characters and symbols (. - + @ _ = : / [ ] ~)
Local Port ID	Selected iSCSI Paths table: Displays the port connected to the external storage system of the local storage system.
Remote - Selected iSCSI Paths table	Displays the remote storage system port information. • IP Address: Displays the IP address. • TCP Port Number: Displays the TCP port number. • iSCSI Target Name: Displays the iSCSI target name. • Authentication Method: Displays the method for authentication. • Mutual CHAP: Displays the mutual CHAP setting (Enable or Disable) when CHAP is set for authentication method. • CHAP User Name: Displays the CHAP user name when Mutual CHAP is enabled.
Add button	Adds the iSCSI path selected in the Available iSCSI Paths table to the Selected iSCSI Paths table.
Remove button	Deletes the iSCSI path selected in the Selected iSCSI Paths table.

Add iSCSI Paths confirmation window



Item	Description
Local Port ID	Displays the port connected to the external storage system of the local storage system.
Remote	Displays the remote storage system port information. • IP Address: Displays the IP address. • TCP Port Number: Displays the TCP port number. • iSCSI Target Name: Displays the iSCSI target name. • Authentication Method: Displays the method for authentication. • Mutual CHAP: Displays the mutual CHAP setting (Enable or Disable) when CHAP is set for authentication method. • CHAP User Name: Displays the CHAP user name when Mutual CHAP is enabled. • Secret: If the Secret is set, displays ****** (6 asterisks).

Delete iSCSI Paths window



Item	Description
Local Port ID	Displays the port connected to external storage system of the local storage system.
Remote	Displays the external storage system port information. • IP Address: Displays the IP address. • iSCSI Target Name: Displays the iSCSI target name.

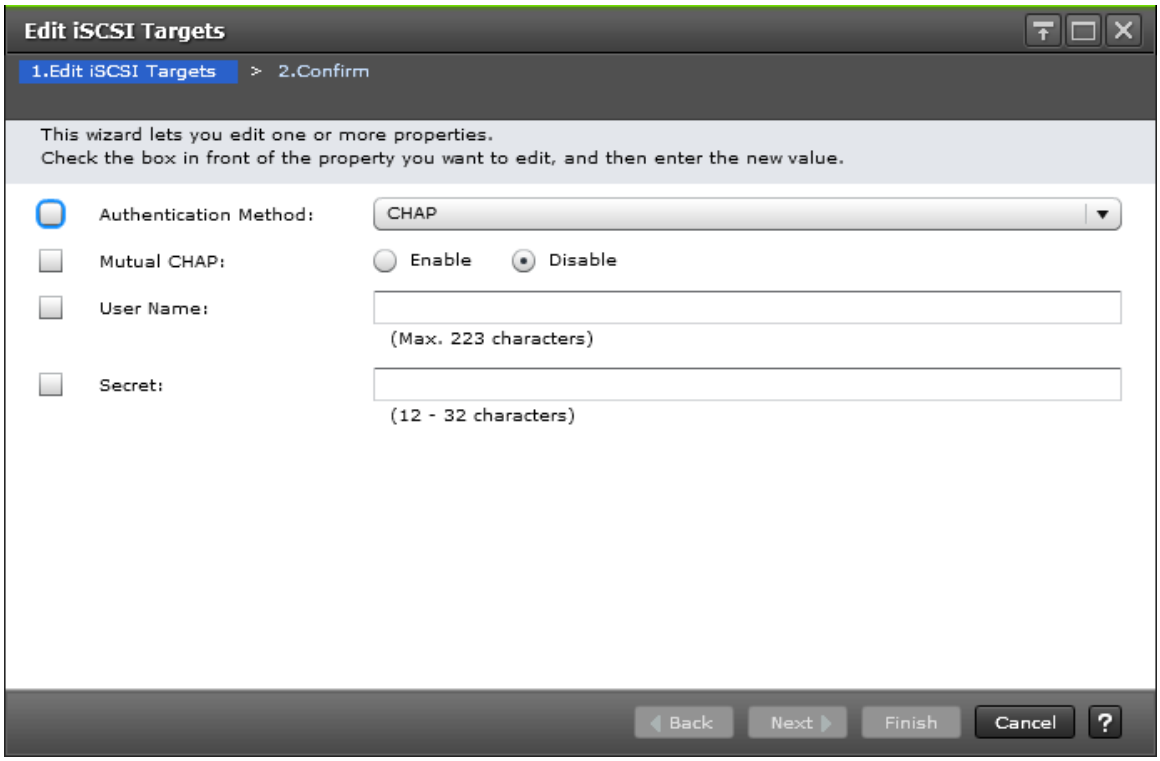
Edit iSCSI Targets wizard

Use this wizard to edit iSCSI targets for the external volume. See Editing an iSCSI target on page 5-5 for instructions.

The windows in this wizard are:

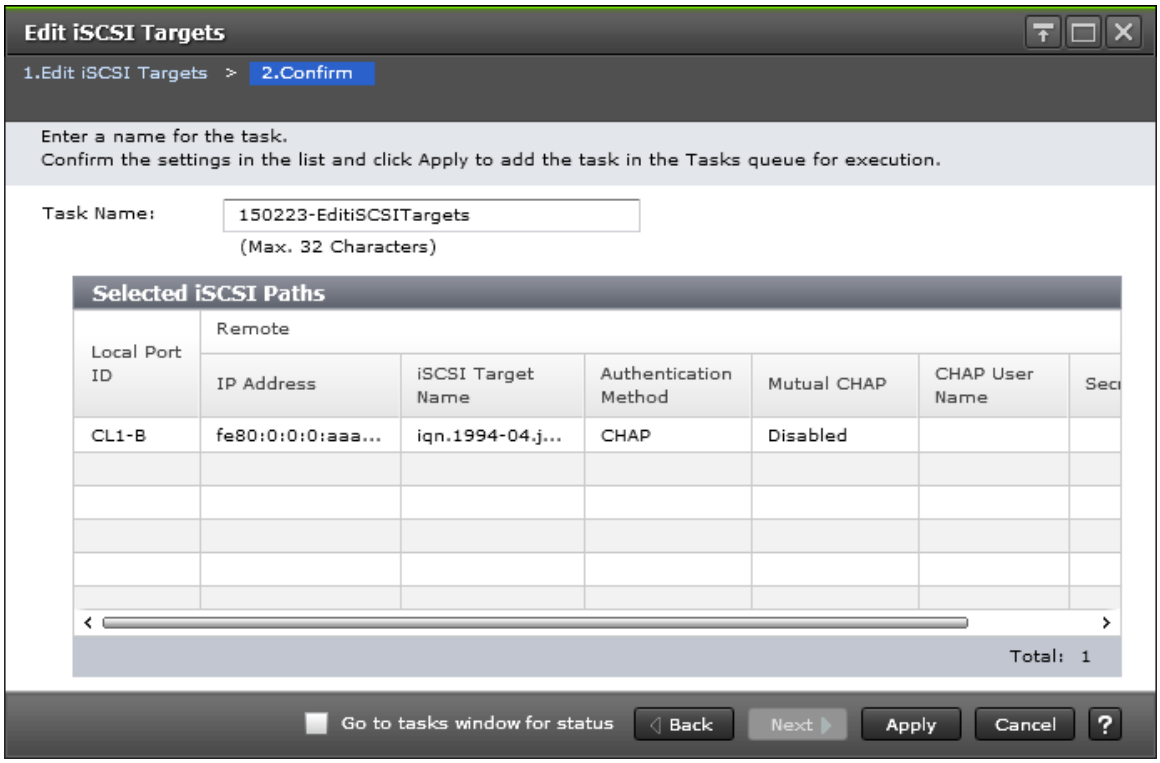
- Edit iSCSI Targets window on page D-69
- Edit External iSCSI Targets confirmation window on page D-41

Edit iSCSI Targets window



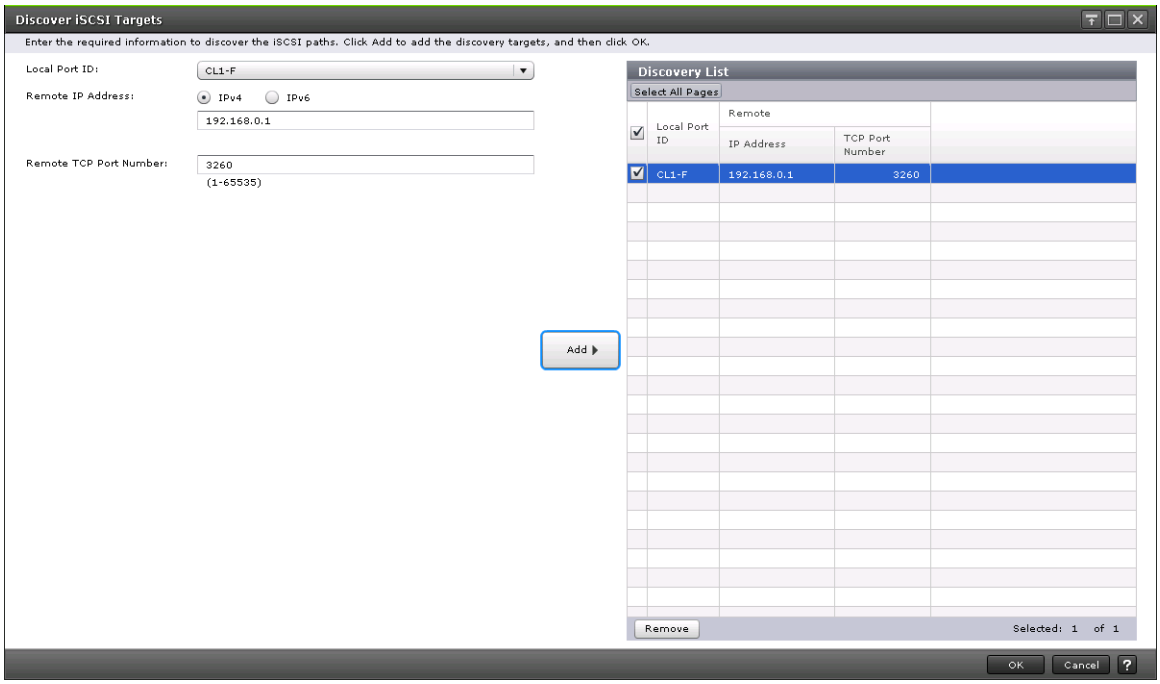
Item	Description
Authentication Method	Select the authentication method (CHAP or None). If you select CHAP, below settings can be set.
Mutual CHAP	Select **Enable** or **Disable**. If you select **Enable**, authentication becomes bidirectional. If you select **Disable**, authentication becomes unidirectional.
User Name	Set the user name. You can use up to 223 letters. Usable characters: Alphanumeric characters and symbols (. - + @ _ = : / [ ] ~)
Secret	Set the secret for host authentication. You can use from 12 to 32 letters. Usable characters: Alphanumeric characters and symbols (. - + @ _ = : / [ ] ~)

Edit iSCSI Targets confirmation window



Item	Description
Local Port ID	Displays the port connected to external storage system of the local storage system.
Remote	Displays the external storage system port information. • IP Address: Displays the IP address. • iSCSI Target Name: Displays the iSCSI target name. • Authentication Method: Displays the method for authentication. • Mutual CHAP: Displays the mutual CHAP setting (Enable or Disable) when CHAP is set for authentication method. • CHAP User Name: Displays the CHAP user name when Mutual CHAP is enabled. • Secret: Displays ****** (6 asterisks) if Secret is set.

Discover iSCSI Targets window



Item	Description
Local Port ID	Select the port connected to external storage system of the local storage system.
Remote IP Address	Enter the IP address of the external storage system port. • IPv4: Select if the external storage system supports IPv4. Enter the address in the box. • IPv6: Select if the external storage system supports IPv6. Enter the address in the box.
Remote TCP Port Number	Enter the TCP port number of external storage system port. You can enter from1 to 65535.
Add button	Adds the entered targets to the Discovery List table. You can add up to 8 targets.
Local Port ID – Discovery List table	Displays the port connected to external storage system of the local storage system.
Remote – Discovery List table	Displays the external storage system port information. • IP Address: Displays the IP address. • TCP Port Number: Displays the TCP port number.
Remove button – Discovery List table	Deletes the target selected in the Discovery List table.

Glossary

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

A

access attribute
The setting on a logical volume that determines whether hosts can read and/or write to the volume.

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

ALUA
Asymmetric logical unit access

AMS
Hitachi Adaptable Modular Storage

APLB
active path load balancing

array
Another name for a storage system.

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

B

bind mode
In bind mode the Cache Residency Manager extents are used to hold read and write data for specific extents on volumes. Data written to the Cache Residency Manager bind area is not destaged to the drives. For bind mode, all targeted read and write data is transferred at host data transfer speed.

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

C

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

capacity
The amount of data storage space available on a physical storage device.

CCI
Command Control Interface

CHA
channel adapter. Another name for a front-end director (FED).

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.

CLI
command line interface

CLPR
cache logical partition

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

custom volume (CV)
A customized (variable-sized) volume. The size is defined when Virtual LUN is used.

CVS
custom volume size

D

device
A physical or logical unit with a specific function.

device emulation
Indicates the type of logical volume.

DP
Hitachi Dynamic Provisioning

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

dynamic provisioning
An approach to managing storage. Instead of "reserving" a fixed amount of storage, it removes capacity from the available pool when data is actually written to disk. Dynamic provisioning is also referred to as thin provisioning.

E

emulation
The operation of the Hitachi RAID storage system to emulate the characteristics of a different storage system.

EXG
external volume group

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

F

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

FCIP
fibre-channel internet protocol

H

HDS
Hitachi Data Systems

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

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

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

I

initial copy
A copy operation that copies all data on the primary volume of a copy pair to the secondary volume of the pair. An initial copy operation is performed when a copy pair is created.

initiator
An attribute of the port that is connected to the port with RCU target attribute.

internal volume
A logical volume with data that resides on drives which are physically located within the storage system.

L

LDEV
logical device

logical device (LDEV)
An individual logical data volume (on multiple drives in a RAID configuration) in the storage system. An LDEV may or may not contain any data and may or may not be defined to any hosts. Each LDEV has a unique identifier or "address" within the storage system composed of the logical disk controller (LDKC) number, control unit (CU) number, and LDEV number. The LDEV IDs within a storage system do not change. An LDEV formatted for use by open-systems hosts is called a logical unit (LU).

logical partition (LPAR)
A subset of a system's hardware resources that is virtualized as a separate system. For a storage system, logical partitioning can be applied to cache memory or storage capacity.

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

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

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

LU
logical unit

LUN
logical unit number

LUNM
Hitachi LUN Manager

LV
logical volume

LVM
Logical Volume Manager; logical volume management.

M

MP Unit
Microprocessor unit.

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

N

NSC
Hitachi TagmaStore® Network Storage Controller

O

OEM
original equipment manufacturer

P

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

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

parity group
See RAID group.

path mode
Mode that indicates how a path is used between local and external storage systems. The path modes are multi, single, and ALUA.

physical device
A data drive.

pool
A set of volumes that are reserved for storing Thin Image, Dynamic Provisioning, Dynamic Tiering, or active flash data.

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

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

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

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

P-VOL
primary volume

Q

quorum disk
Used to determine the volume in the global-active device pair on which server I/O should continue when a failure occurs in a path or a storage system. Quorum disk is installed in an external storage system.

R

RAID
redundant array of inexpensive disks

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

RAID level
The type of RAID implementation. RAID levels include RAID0, RAID1, RAID2, RAID3, RAID4, RAID5 and RAID6.

RCU target
An attribute of the port that is connected to the port with initiator attribute.

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

remote copy
Another name for remote replication..

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

S

SATA
serial Advanced Technology Attachment

secondary volume
The volume in a copy pair that is the copy of the original data on the primary volume (P-VOL). The following Hitachi products use the term "secondary volume": ShadowImage, TrueCopy, Universal Replicator.

service information message (SIM)
SIMs are generated by a RAID storage system when it detects an error or service requirement. SIMs are reported to hosts and displayed on Storage Navigator.

snapshot
A point-in-time copy of a data volume in a storage system.

SNMP
simple network management protocol

SOM
system option mode

SSD
solid-state drive. Another name for a flash drive.

S-VOL
secondary volume

system option mode (SOM)
Additional operational parameters for the Unified Storage VM storage systems that enable the storage system to be tailored to unique customer operating requirements. SOMs are set on the SuperVisor PC (SVP).

T

TagmaStore USP
Hitachi TagmaStore® Universal Storage Platform

target
An attribute of the port that is connected to the host.

target port
A fibre-channel port that is configured to receive and process host I/Os.

TC
Hitachi TrueCopy®

U

UR
Hitachi Universal Replicator

USP VM
Hitachi Universal Storage Platform VM

USP V/VM
Hitachi Universal Storage Platform V/VM

UVM
Hitachi Universal Volume Manager

V

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

Virtual LUN volume
A custom-size volume with a size defined when Virtual LUN is used. Also called a custom volume (CV).

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

VLL
Virtual LUN

volume
A logical device (LDEV) that has been defined to one or more hosts as a single data storage unit. An open-systems volume is called a logical unit (LU).

V-VOL
virtual volume

W

WMS
Hitachi Workgroup Modular Storage

WWN
worldwide name

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Hitachi Data Systems

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

Regional Contact Information

Americas
+1 408 970 1000
info@hds.com

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

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

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