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Provisioning Guide

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Retention Utility

Hitachi Dynamic Provisioning

Hitachi Dynamic Tiering

Hitachi LUN Manager

Hitachi Resource Partition Manager

Hitachi Data Systems

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Contents

Preface

This document describes and provides instructions for performing provisioning operations on Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP Gx00 models) and Hitachi Virtual Storage Platform F400, F600, F800 (VSP Fx00 models). The provisioning software includes LUN Manager, Virtual LUN, Resource Partition Manager, Dynamic Provisioning, Dynamic Tiering, and Data Retention Utility.

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

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who install, configure, and operate VSP Gx00 models or VSP Fx00 models.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The VSP Gx00 models or VSP Fx00 models and the *Product Overview*.
- The software and *System Administrator Guide*.
- The concepts and functionality of storage provisioning operations.

Product version

This document revision applies to:

- Firmware 83-04-4*x* or later
- SVOS 7.2 or later

Release notes

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

Changes in this revision

- Added support for iSCSI virtual port mode for multi-VLAN operations (Multi VLAN operations with iSCSI virtual port mode on page 371).
- Added support for the inline mode for capacity saving processing (Capacity saving function: data deduplication and compression on page 41).
- Added the display of the Deduplication Data status of a volume to the following windows: Logical Devices, LDEV Properties, Pools (Virtual Volumes tab), Ports/Host Groups/iSCSI Targets (LUNs tab), LUN Properties (Logical Devices window on page 482, LDEV Properties window on page 515, Pools: Volume tabs on page 559, Ports / Host Groups / iSCSI Targets: Hosts, LUNs, Host Mode Options, and CHAP Users tabs on page 662, LUN Properties window on page 737).
- Changed the maximum queue depth per port for VSP Gx00 models and VSP Fx00 models (Rules, restrictions, and guidelines for managing LUs on page 318).

- Added a caution about deleting a host group that includes paths to LDEVs with the GAD reserve attribute (Deleting a host group on page 380).
- Added a caution about configuring ports that have paths to LDEVs with the GAD reserve attribute (Rules, restrictions, and guidelines for managing LUs on page 318, Setting the data transfer speed on a Fibre Channel port on page 320, Setting the Fibre Channel topology on page 325, Changing the name, host mode, or host mode options of a host group on page 375).

Referenced documents

The following documents are referenced in this guide:

- *Hitachi Thin Image User Guide*, MK-92RD8011
- *Performance Guide*, MK-94HM8012
- *Product Overview*, MK-94HM8013
- *System Administrator Guide*, MK-94HM8016
- *Hitachi TrueCopy® User Guide*, MK-92RD8019
- *Hitachi ShadowImage® User Guide*, MK-92RD8021
- *Hitachi Universal Replicator User Guide*, MK-92RD8023
- *Hitachi Universal Volume Manager User Guide*, MK-92RD8024
- *Hitachi Volume Shredder User Guide*, MK-92RD8025

Document conventions

This document uses the following storage system terminology conventions:

Convention	Description
VSP Gx00 models	Refers to all of the following models, unless otherwise noted. • Hitachi Virtual Storage Platform G200 • Hitachi Virtual Storage Platform G400 • Hitachi Virtual Storage Platform G600 • Hitachi Virtual Storage Platform G800
VSP Fx00 models	Refers to all of the following models, unless otherwise noted. • Hitachi Virtual Storage Platform F400 • Hitachi Virtual Storage Platform F600 • Hitachi Virtual Storage Platform F800

This document uses the following typographic conventions:

Convention	Description
Bold	• Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click **OK**. • Indicates emphasized words in list items.

Convention	Description
Italic	• Indicates a document title or emphasized words in text. • Indicates a variable, which is a placeholder for actual text provided by the user or for output by the system. Example: `pairdisplay -g group` (For exceptions to this convention for variables, see the entry for angle brackets.)
`Monospace`	Indicates text that is displayed on screen or entered by the user. Example: `pairdisplay -g oradb`
< > angle brackets	Indicates variables in the following scenarios: • Variables are not clearly separated from the surrounding text or from other variables. Example: `Status-<report-name><file-version>.csv` • Variables in headings.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.

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

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

Conventions for storage capacity values

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

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

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

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

Accessing product documentation

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

Getting help

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

Hitachi Data Systems Community is a global online community for HDS customers, partners, independent software vendors, employees, and prospects. It is the destination to get answers, discover insights, and make

connections. **Join the conversation today!** Go to community.hds.com, register, and complete your profile.

Comments

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

Thank you!

1

Introduction to provisioning

There are several provisioning strategies that you can implement on your storage system to solve business requirements. Provisioning your storage system requires balancing the costs of the solution with the benefits that the solution provides.

About provisioning

Provisioning is a method or strategy of managing the logical devices (LDEVs), also called volumes, on a storage system. Some provisioning methods are host-based, while other methods use inherent storage system capabilities such as concatenated parity groups. Provisioning methods can also be primarily hardware-based or software-based. Each method has its particular uses and benefits in a specific storage environment, such as optimizing capacity, reliability, performance, or cost. When used in the right scenario, each method can be cost-effective, efficient, reliable, and straightforward to configure and maintain. On the other hand, inappropriate implementations can be expensive, awkward, time-consuming to maintain, and potentially error prone. Your support representatives are available to help you configure the highest quality solution for your storage environment.

Provisioning strategies fall into the following two fundamental categories:

- Basic provisioning on page 25 (or traditional provisioning). Basic provisioning involves defining logical devices (LDEVs) on physical storage that are fixed-size volumes or custom-sized volumes.
- Dynamic Provisioning on page 30 (or virtual provisioning). Thin provisioning involves the use of virtualization to pool physical storage and provide on-demand allocation of volumes to hosts.

Key terms

Term	Description
access attributes	Security function used to control the access to a logical volume. Using Data Retention Utility, you can assign an access attribute to each volume: read only, read/write, or protect.
capacity expansion	The data compression services provided by the FMC drives, called accelerated compression.
capacity saving	The data deduplication and data compression functions provided by the storage system controllers.
CV	Custom-size volume. CVs are created by dividing a fixed-size volume (FV) into user-defined sizes.
deduplication system data volume	The volume used to manage data deduplication in a pool. The deduplication system data volume (also called DSD volume) is created when you enable deduplication on a pool.
DP pool	A group of DP-VOLs. The DP pool consists of one or more pool-VOLs.
DP-VOL	A virtual volume (V-VOL) used for Dynamic Provisioning.
expiration lock	Security option used to allow or prevent changing of the Data Retention Utility access attribute on a volume.
FMC (flash module compression)	A large-capacity flash module drive (FMD) that supports the accelerated compression functionality. A dedicated drive box is required for the FMC

Term	Description
	drives. The FMC drives and the dedicated FMC drive box are collectively referred to as *Accelerated Flash DC2 (HAF DC2)*.
FV	Fixed-sized volume. With the exception of OPEN-V, an FV is a logical volume of a specific device emulation type (for example, OPEN-3) that constitutes a parity group immediately after installation. The FV size varies according to the emulation type.
meta_resource	A resource group to which additional resources (other than external volumes) and the resources existing before installing Resource Partition Manager belong.
page	In Dynamic Provisioning, a page is 42 MB of continuous storage allocated from a DP pool to store data written to a DP-VOL.
pool	A set of volumes that are reserved for storing Dynamic Provisioning or Thin Image write data.
pool threshold	In Dynamic Provisioning, the proportion (%) of used capacity of the pool to the total pool capacity. Each pool has its own pool threshold values for warning and depletion.
pool volume (pool-VOL)	A volume that is reserved for storing Dynamic Provisioning data or Thin Image operations.
resource group	A group that is assigned one or more resources of the storage system. The resources that can be assigned to the resource group are LDEV IDs, parity groups, iSCSI targets, external volumes, ports, and host group IDs.
subscription limit	In a thin-provisioned storage system, the proportion (%) of total DP-VOL capacity associated with the pool versus the total capacity of the DP pool. You can set the percentage of DP-VOL capacity that can be created to the total capacity of the pool. This can help prevent DP-VOL blocking caused by a full pool. For example, when the subscription limit is set to 100%, the total DP-VOL capacity is equal to the DP pool capacity.
tier boundary	The value of the reached maximum I/O counts that each tier can process.
tier relocation	A combination of determining the appropriate storage tier and migrating the pages to the appropriate tier.
tiered storage	A storage hierarchy of layered structures of data drives consisting of different performance levels, or tiers, that match data access requirements with the appropriate performance tiers.

Basic provisioning

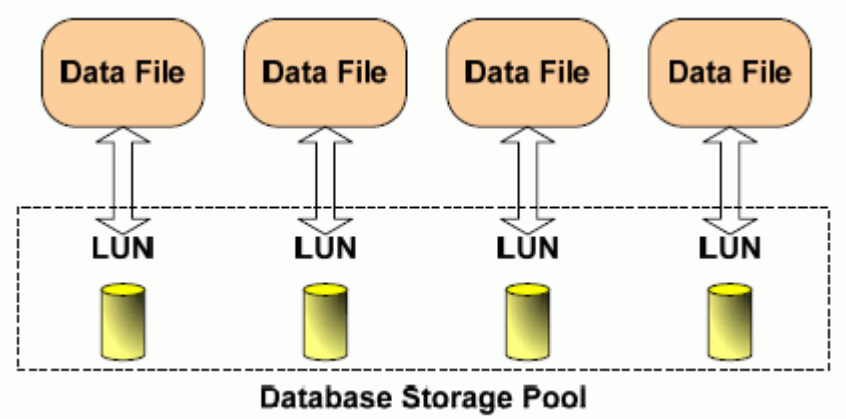
Several basic provisioning techniques traditionally are used to manage storage volumes. These strategies are useful in specific scenarios based on user needs, such as what type of storage to use or how to manually size volumes. Basic provisioning relies on carving up physical storage into logical devices. Custom-size volumes are configured by using the Virtual LUN software.

Basic provisioning includes fixed-size provisioning and custom-size provisioning.

Overview of fixed-sized provisioning

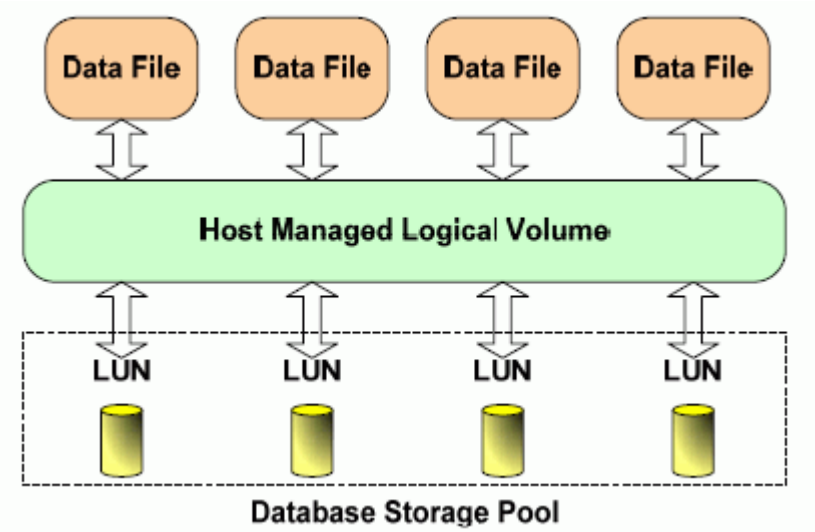
Two traditional fixed-size host-based volume management methods typically are used on open systems to organize storage space on a server. One method is the direct use of physical volumes as devices for use either as raw space or as a local file system. These are fixed-size volumes with a fixed number of disks, and as such, each has a certain inherent physical random input/output operation per second (IOPS) or sequential throughput (megabytes per second) capacity. A system administrator manages the aggregate server workloads against them. As workloads exceed the volume's available space or its IOPS capacity, the data is manually moved onto a larger or faster volume, if possible.

The following figure illustrates a simple fixed-size provisioning environment using individual fixed volumes on a host:



The other method is to use a host-based Logical Volume Manager (LVM) where the planned workloads require either more space or IOPS capacity than the individual physical volumes can provide. LVM is the disk management feature available on UNIX-based operating systems, including Linux, that manages their logical volumes.

The following illustrates a fixed-size provisioning environment using LUNs in host-managed logical volumes:



With either method, hosts recognize the size as fixed regardless of the actual used size. Therefore, it is not necessary to expand the volume (LDEV) size in the future if the actual used size does not exceed the fixed size.

When such a logical volume runs out of space or IOPS capacity, you can replace it with one that was created with even more physical volumes then copy over all of the user data. In some cases, it is best to add a second logical volume then manually relocate only part of the existing data to redistribute the workload across two such volumes. These two logical volumes would be mapped to the server using separate host paths.

Disadvantages

Some disadvantages to using fixed-sized provisioning are:

- If you use only part of the entire capacity specified by an emulation type, the rest of the capacity is wasted.
- After creating fixed-sized volumes, typically some physical capacity will be wasted.
- In a fixed-sized environment, manual intervention can become a costly and tedious exercise when a larger volume size is required.

When to use fixed-sized provisioning

Use fixed-sized provisioning when custom-sized provisioning is not supported.

Overview of custom-sized provisioning

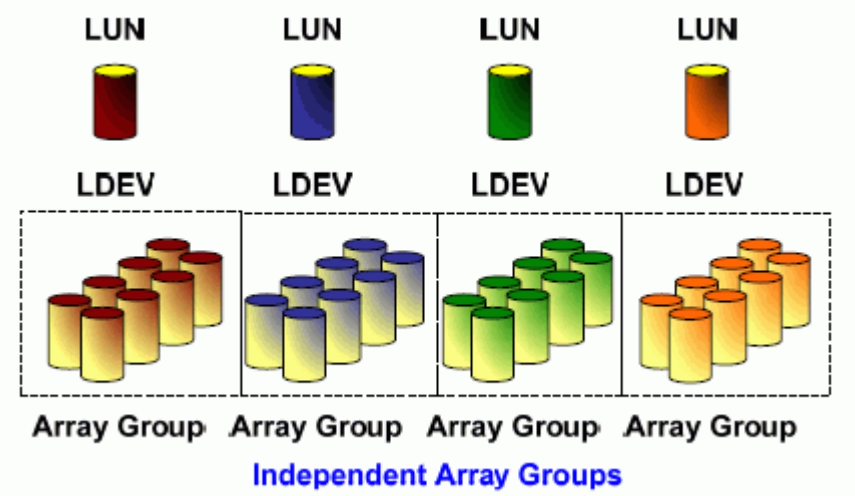
Custom-sized (or variable-sized) provisioning has more flexibility than fixed-sized provisioning and is the traditional storage-based volume management strategy.

To create custom-sized volumes on a storage system, an administrator creates volumes of the desired size from individual array groups. These volumes are then individually mapped to one or more host ports as logical units (LUs).

Custom-sized provisioning provides advantages in the following three scenarios:

- In fixed-sized provisioning, when several important files are located on the same volume and one unimportant file is being accessed, users cannot access the important files because of logical device contention. If the custom-sized feature is used to divide the volume into several smaller volumes and I/O workload is balanced (each file is allocated to a different volume), then access contention is reduced and access performance is improved.
- In fixed-sized provisioning, all of the volume's capacity might not be used. Unused capacity on the volume will remain inaccessible to other users. If the custom-sized feature is used, you can create smaller volumes that do not waste capacity.
- Applications that require the capacity of many fixed-sized volumes can instead be given fewer large volumes to relieve device addressing constraints.

The following illustrates custom-sized provisioning in an open-systems environment using standard volumes of independent array groups:



Disadvantages

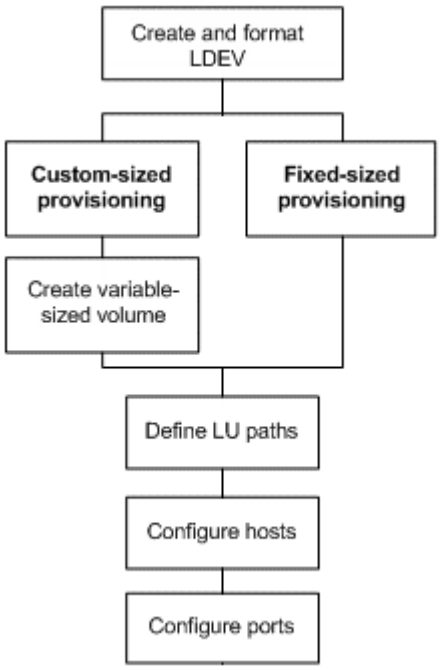
A disadvantage is that manual intervention can become costly and tedious. For example, to change the size of a volume already in use, you must first create a new volume larger (if possible) than the old volume, and then move the contents of the old volume to the new volume. The new volume is then remapped on the server to take the mount point of the old volume, which is then retired.

When to use custom-sized provisioning

Use custom-sized provisioning when you want to manually control and monitor your storage resources and usage scenarios.

Basic provisioning workflow

The following figure shows the basic provisioning workflow.



Complementary functions

The following functions supplement the provisioning features of the storage system:

- External storage: Universal Volume Manager enables you to map volumes in external storage systems to volumes within the storage system.
- Performance: The following performance features enable you to monitor, control, and optimize the performance of the storage system: Performance Monitor, Server Priority Manager (see the *Performance Guide*)
- Partitioning: Virtual Partition Manager enables you to create cache logical partitions (CLPRs) to control host utilization of cache (see the *Performance Guide*).
- Encryption: Encryption License Key enables you to encrypt the data on the drives in the storage system.

Dynamic Provisioning

Thin provisioning is an approach to managing storage that maximizes physical storage capacity. Instead of *reserving* a fixed amount of storage for a volume, capacity from the available physical pool is assigned when data is actually written to the storage media.

Thin provisioning provides automatic performance optimization and storage space savings across pools of virtual capacity. Provisioning storage from a virtual pool reduces administration costs by cutting the time to provision new storage. Capacity is allocated to an application without it being physically mapped until it is used. In this approach, it is possible to achieve overall higher rates of storage utilization with just-in-time provisioning. It also simplifies performance optimization by transparently spreading workloads across many physical devices, thereby reducing performance management concerns and self-optimizing performance and throughput.

About Dynamic Provisioning

While basic or traditional provisioning strategies can be appropriate and useful in specific scenarios, they can be expensive to set up, time-consuming to configure, difficult to monitor, and error prone. Dynamic Provisioning allows you to reserve virtual storage capacity based on anticipated future capacity needs, using virtual volumes instead of physical disk capacity. Although Dynamic Provisioning requires some additional setup steps, it can provide a simpler and more beneficial alternative to traditional provisioning methods.

Overall storage use rates can improve because you can potentially provide more virtual capacity to applications while using fewer physical drives. Dynamic Provisioning can provide lower initial cost, greater efficiency, and ease of storage management for storage administrators. The Dynamic Provisioning feature offers the following benefits:

- Simplifies storage management
- Provides a better balance of resources and performance optimization by default than traditional provisioning
- Optimizes physical drive usage
- Reduces device address requirements over traditional provisioning by providing larger volume sizes

When to use Dynamic Provisioning

Dynamic Provisioning is a best fit in an open-systems environment in the following scenarios:

- When the aggregation of storage pool capacity usage across many volumes provides the best opportunity for performance optimization.
- For stable environments and large consistently growing files or volumes.

- When device addressing constraints are a concern.

Dynamic Provisioning concepts

Dynamic Provisioning is a volume management feature that allows storage managers and system administrators to efficiently plan and allocate storage to users or applications. It provides a platform for the array to dynamically manage data and physical capacity without frequent manual involvement.

Dynamic Provisioning provides three important capabilities: as-needed provisioning of storage, enhanced volume performance, and larger volume sizes.

Dynamic Provisioning is more efficient than traditional provisioning strategies. It is implemented by creating one or more Dynamic Provisioning pools (DP pools) of physical storage space using multiple LDEVs. Then, you can establish virtual DP volumes (DP-VOLs) and associate them to the individual DP pools. In this way, capacity to support data can be optimally assigned on demand within the pool.

DP-VOLs are of a user-specified logical size without any corresponding physical space. Actual physical space allocated (in 42-MB pool page units) is automatically assigned to a DP-VOL from the associated DP pool as that volume's logical space is written to over time. A new DP-VOL does not have any pool pages assigned to it. The pages are *loaned out* from its associated pool to that DP volume until the volume is reformatted or deleted. At that point, all of that volume's assigned pages are returned to the pool's free page list. This handling of logical and physical capacity is called *thin provisioning*. In many cases, logical capacity will exceed physical capacity.

Dynamic Provisioning also enhances volume performance. This is an automatic result of how DP-VOLs map capacity from individual DP pools. A pool is created using from one to 1024 LDEVs (pool volumes) of physical space. Each pool volume is sectioned into 42-MB pages. Each page is consecutively laid down on a number of RAID stripes from one pool volume. The pool's 42-MB pool pages are assigned on demand to any of the DP-VOLs that are connected to that pool. Other pages assigned over time to that DP-VOL randomly originate from the next free page of some other pool volume in the pool.

Setting up a Dynamic Provisioning environment requires a few extra steps. Similar to basic provisioning, you still configure various array groups to a desired RAID level and create one or more volumes (LDEVs) on each of them (see Creating an LDEV on page 122). Then set up a Dynamic Provisioning environment by creating one or more DP pools of physical storage space that are each a collection of some of these LDEVs (DP pool volumes). This pool structure supports creation of Dynamic Provisioning virtual volumes (DP-VOLs), where 42-MB pages of data are randomly assigned on demand.

Advantages of using Dynamic Provisioning

Advantages	Without Dynamic Provisioning	With Dynamic Provisioning
Reduces initial costs	You must purchase physical drive capacity for expected future use. The unused capacity adds costs for both the storage system and software products.	You can logically allocate more capacity than is physically installed. You can purchase less capacity, reducing initial costs and you can add capacity later by expanding the pool. Some file systems take up little pool space. For more details, see Operating system and file system capacity on page 150.
Reduces management costs	You must stop the storage system to reconfigure it.	When physical capacity becomes insufficient, you can add pool capacity without service interruption. In addition, with Dynamic Tiering you can configure pool storage consisting of multiple types of data drives, including SSD, SAS, and external volumes. This eliminates unnecessary costs. For VSP Fx00 models, SAS drives cannot be specified.
Reduces management labor and increases availability of storage volumes for replication	As the expected physical drive capacity is purchased, the unused capacity of the storage system also needs to be managed on the storage system and on licensed products.	Licenses for storage system software products are based on used capacity rather than the total defined capacity. You can allocate volumes of up to 256 TB regardless of physical drive capacity. Dynamic Tiering allows you to use storage efficiently by automatically migrating data to the most suitable data drive.
Increases the performance efficiency of the data drive	Because physical drive capacity is initially purchased and installed to meet expected future needs, portions of the capacity may be unused. I/O loads may concentrate on just a subset of the storage which might decrease performance.	Effectively combines I/O patterns of many applications and evenly spreads the I/O activity across available physical resources, preventing bottlenecks in parity group performance. Configuring the volumes from multiple parity groups improves parity group performance. This also increases storage use while reducing power and pooling requirements (total cost of ownership).

Dynamic Provisioning advantage example

To illustrate the merits of a Dynamic Provisioning environment, assume you have twelve LDEVs from 12 RAID 1 (2D+2D) array groups assigned to a DP pool. All 48 drives contribute their IOPS and throughput power to all DP volumes assigned to that pool. Instead, if more random read IOPS horsepower is desired for a pool, then the DP pool can be created with 32

LDEVs from 32 RAID 5 (3D+1P) array groups, thus providing 128 drives of IOPS power to that pool. Up to 1024 LDEVs can be assigned to a single pool, providing a considerable amount of I/O capability to just a few DP volumes.

DP-VOL with data direct mapping attribute

By using a DP-VOL for which the data direct mapping attribute is enabled, you can create a mapping of an external volume larger than 4 TB without having to change its capacity as a DP-VOL of the local storage system.

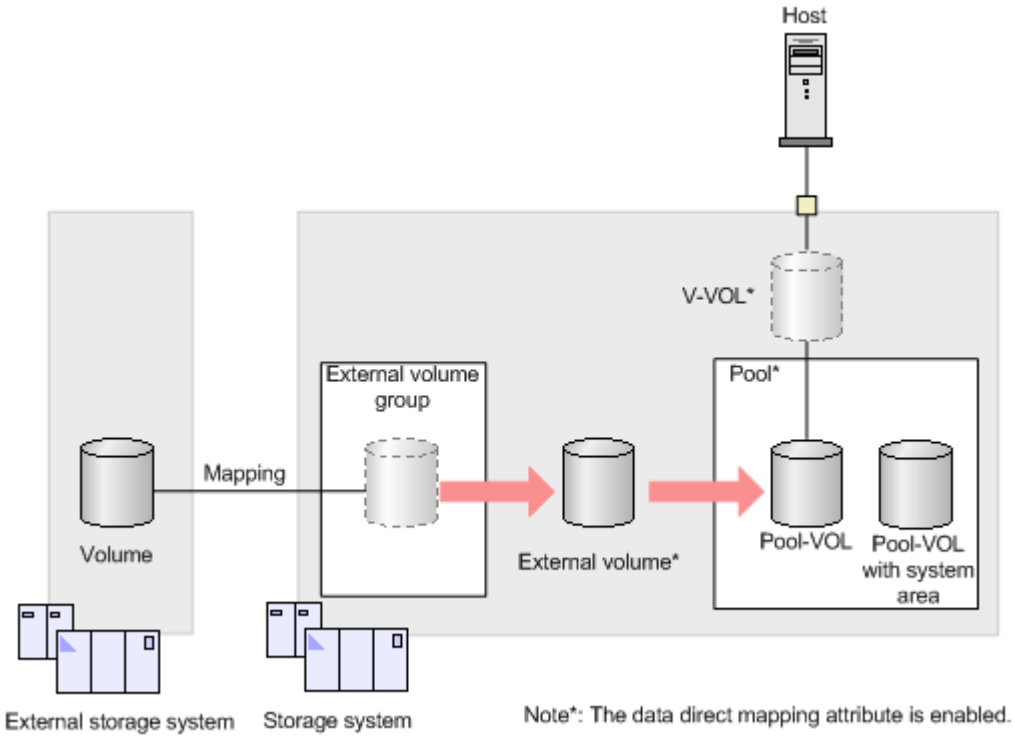
A DP-VOL with the data direct mapping attribute enabled is associated with the following pool-VOLs: an external volume for which the data direct mapping attribute is enabled and a pool-VOL with System Area.

To use DP-VOLs with the data direct mapping attribute enabled, you must enable the data direct mapping attribute for pool-VOLs, pools, and DP-VOLs.

Procedure

1. In the Add External Volumes window, add a volume of an external storage system to an external volume group.
2. In the Create LDEVs window, create an external volume for which the data direct mapping attribute enabled.
3. In the Create Pools window, create a Dynamic Provisioning pool for which the data direct mapping attribute is enabled. Specify the following volumes as pool-VOLs:
   - The external volume with the data direct mapping attribute enabled.
   - One or more normal volumes or external volumes.
4. In the Create LDEVs window, create a DP-VOL with the data direct mapping attribute enabled.

5. In the Add LUN Paths window, configure a LU path to the DP-VOL with the data direct mapping attribute enabled.



The following table shows what kind of external volumes can be added as pool-VOLs:

Operation	Data direct mapping attribute of external volumes	
	Disabled	Enabled
Add volumes to a pool with the data direct mapping attribute enabled	The volumes can be added.	The volumes can be added.
Add volumes to the following pools: • Dynamic Provisioning pools • Dynamic Tiering pools (including active flash)	The volumes can be added.	The volumes cannot be added.

The following table shows what kind of operations can be performed when the data direct mapping attribute of a Dynamic Provisioning pool is enabled or disabled:

Operation	Data direct mapping attribute of the pool		Remark
	Disabled	Enabled	
Add an LDEV for which the data direct mapping	The operation can be performed.	The operation can be performed.	None

attribute is disabled to the pool			
Add an external volume for which the data direct mapping attribute is enabled to the pool	The operation cannot be performed.	The operation can be performed.	None
Set the depletion threshold and the warning threshold	The operation can be performed.	The operation cannot be performed.	None
Set subscription	The operation can be performed.	The operation can be performed.	None
Protect V-VOLs when I/O fails to Blocked Pool VOL	The operation can be performed.	The operation can be performed.	None
Protect V-VOLs when I/O fails to Full Pool	The operation can be performed.	The operation can be performed.	None
Performing rebalancing	The operation can be performed.	The operation can be performed.	None
Define the used capacity of the pool	The sum of the reserved pages capacity and the mapped capacity	The sum of the reserved pages capacity and the mapped capacity	None
Define the licensed capacity	The sum of the pool-VOLs	The sum of pool-VOLs for which the data direct mapping attribute is disabled. However, the license capacity does not include the capacity of pool-VOLs for which the data direct mapping attribute is enabled.	None
Expand pool	The operation can be performed.	The operation can be performed. However, the capacity of pool-VOLs with System Area must be reserved in advance. For details on how to estimate the capacity of pool-VOLs with System Area.	None
Shrink pool	The operation can be performed.	The operation can be performed. However, if a pool-VOL for which the data direct mapping attribute is enabled is associated with a DP-VOL, you cannot shrink the pool.	None

Delete pool	The operation can be performed.	The operation can be performed.	You can delete a pool only if there is no DP-VOL that is associated with the pool
Create DP-VOL	You can only create DP-VOLs for which the data direct mapping attribute is disabled.	You can only create DP-VOLs for which the data direct mapping attribute is enabled.	None
Implement a change to Dynamic Tiering (including active flash pool)	The operation can be performed.	The operation can be performed.	None

The following table shows what kind of operations can be performed when the data direct mapping attribute of a DP-VOL is enabled or disabled:

Operation	**Data direct mapping attribute of the DP-VOL**	
	Disabled	**Enabled**
Configure LU paths	The operation can be performed.	The operation can be performed.
Format LDEVs	The operation can be performed.	The operation can be performed.
Delete LDEVs	The operation can be performed.	The operation can be performed.
Expand V-VOLs	The operation can be performed.	The operation cannot be performed.
Reclaim zero pages	The operation can be performed.	The operation cannot be performed.
Execute the V-VOL full allocation function	The operation can be performed.	The operation cannot be performed.
Protect V-VOLs when I/O fails to Blocked Pool VOL	The operation can be performed.	The operation can be performed.
Protect V-VOLs when I/O fails to Full Pool	The operation can be performed.	The operation can be performed.
Apply to LDEVs of SLU attribution	The operation can be performed.	The operation cannot be performed.

Estimating the required capacity of pool-VOLs with System Area in the pool of the data direct mapping attribute

If you want to expand a pool of the data direct mapping attribute, you must free up space in the pool. Make sure that the estimated capacity of free space is available before expanding the pool.

Use the following mathematical formulas to estimate the capacity of free space required in the pool:

Formula 1

```
Required-free-space-for-a-pool-to-be-added-of-one-external-
volume-of-the-data-direct-mapping-attribute [in MB] =
(ceil (pool-VOL-capacity [in MB] / 3,145,548) × 4 pages × 42 MB)
+
      ( ceil (pool-VOL-capacity [MB] / 42 MB) -
      floor (pool-VOL-capacity [in MB] / 42 MB) ) ×
42 MB
```

Formula 2

```
Required-capacity-of-pool-VOL-with-system-area-in-one-pool-of-a-
data-direct-mapping-attribute [in MB] =
Total-of-calculated-values-by-the-Formula-1-for-each-volume +
Management area (4200) [in MB] +
42 [in MB]
```

The (ceil) indicates the number enclosed by brackets must be rounded up to the whole number.

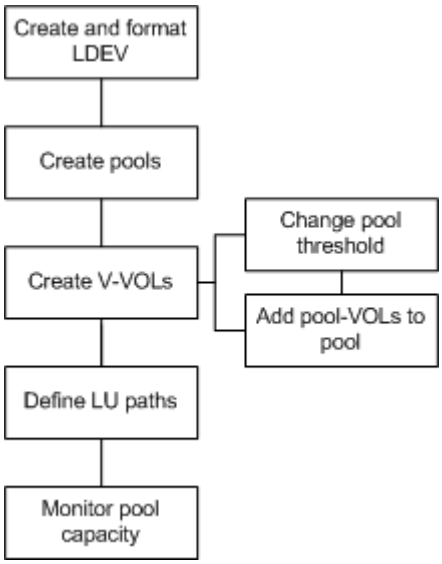
The (floor) indicates the number enclosed by brackets must be rounded down to the whole number.

Note:

- One DP-VOL of the data direct mapping attribute uses the following capacities:
- Mapped capacity uses multiples of 42 MB in the capacity of the pool volume, as well as the capacity for one page (The area of the capacity other than multiples of 42 MB).
- Control information (168 MB is used per 3,145,548 MB)
  The pool-VOL with system area contains the one page capacity and the control information.

Dynamic Provisioning high-level workflow

The following illustrates the Dynamic Provisioning workflow.



Capacity saving and accelerated compression functions

The VSP G series and VSP F series storage systems provide the following functions to make efficient use of user capacity:

- **Capacity saving:** The capacity saving function includes data deduplication and data compression. Capacity saving enables you to reduce your bitcost for the stored data by deduplicating and compressing the data. Data deduplication and compression are performed by the controllers of the storage system. You can specify the post-process mode or inline mode for the capacity saving processing to control how the pool used capacity changes over time in response to new write data.
- **Accelerated compression:** The accelerated compression function enables you to reduce your bitcost for the stored data by allowing you to take advantage of the compression function in the FMC drives. Accelerated compression allows you to assign FMC capacity to a pool that is larger than the physical capacity of the FMC parity groups. The data access performance of the storage system is maintained when the accelerated compression function is used, as the compression engine is offloaded to the FMC drives.

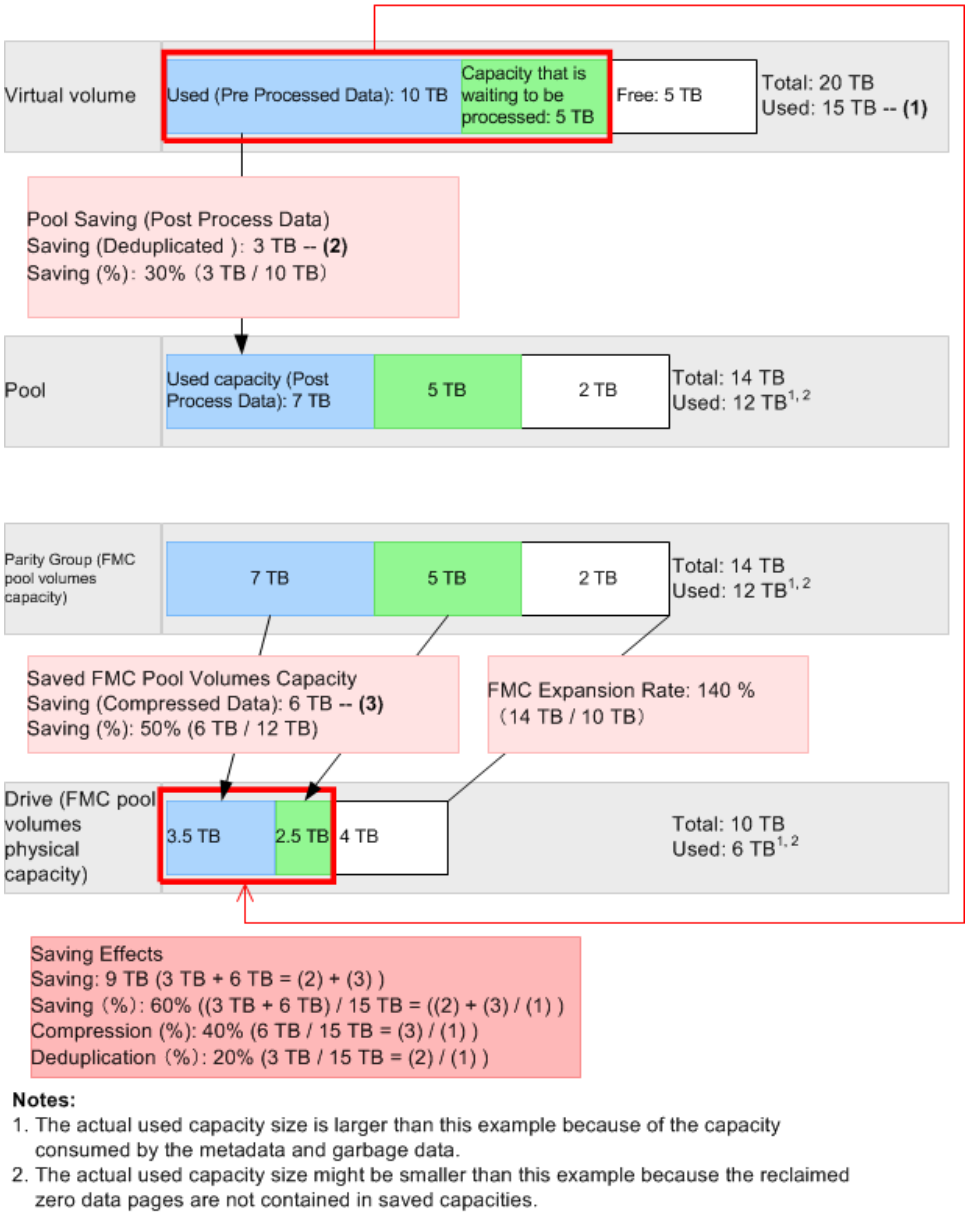
The following table lists the combinations of applying accelerated compression and capacity saving and describes the functionality of each combination.

Combination	Functionality
Use only accelerated compression	Data compression is performed by the FMC drives. The storage controller does not perform the compression. I/O performance is not affected because there is no overhead due to compression processing by the storage controller.

Combination	Functionality
Use only controller-based compression	The storage controller compresses data and stores the compressed data in the pool. Drives other than FMC and the encryption function can be used at the same time as controller-based compression. Using accelerated compression and controller-based compression at the same time results in compression being performed in the FMC drives only. Because of differences in storing and managing data by the storage controller, performance is lower than when only accelerated compression is used. It is not recommended to enable controller compression when accelerated compression can be enabled.
Use accelerated compression and deduplication and compression See Example 1 below	When multiple copies of identical data are stored in a pool, the storage controller keeps only one copy (deduplication). For compression, the storage controller detects that accelerated compression is enabled* and uses it instead of controller-based compression. *Accelerated compression must be enabled for all parity groups in the pool.
Use deduplication and compression See Example 2 below	The storage controller performs compression and deduplication processing. The storage controller has the largest overhead of the capacity saving processing.

Note:
- When BED encryption is not being utilized, use accelerated compression.
- When accelerated compression is being utilized, do not enable controller-based compression.

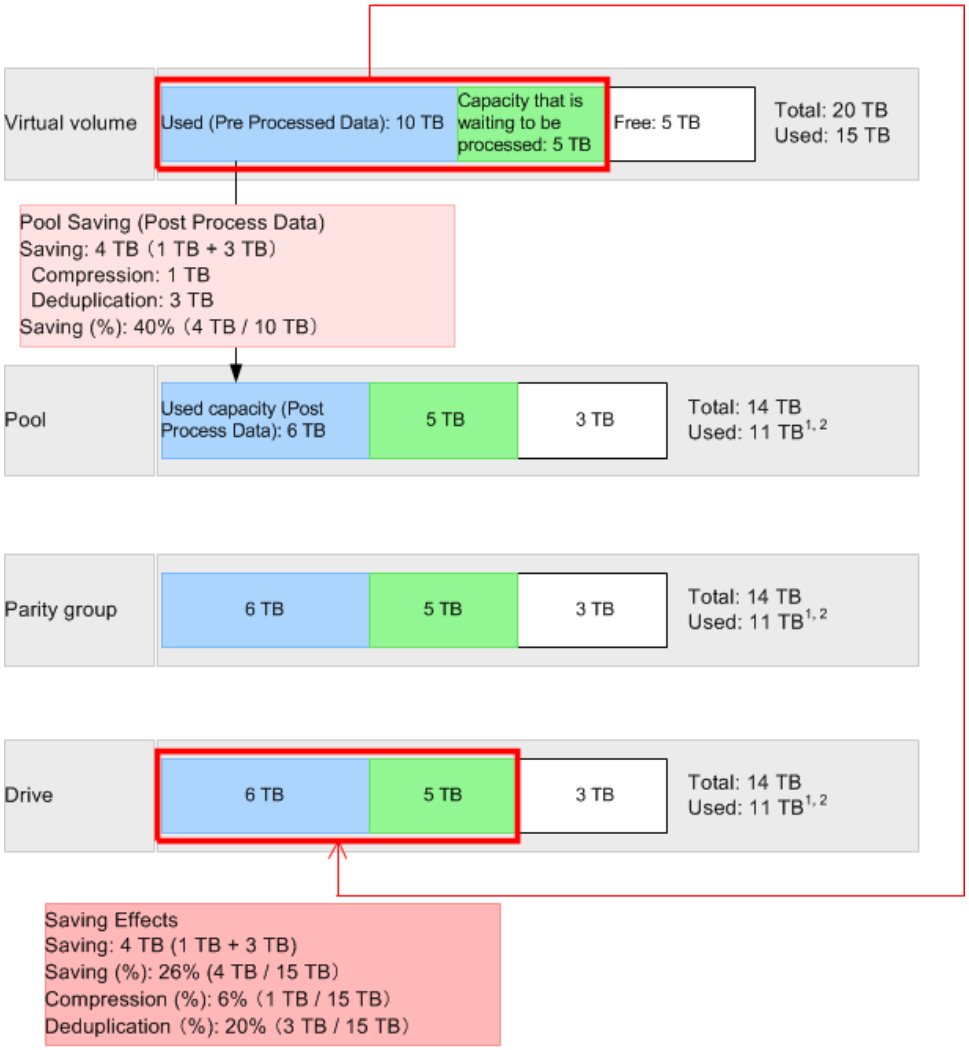
Example 1: Applying deduplication (post-process mode) and accelerated compression



Notes:

1. The actual used capacity size is larger than this example because of the capacity consumed by the metadata and garbage data.
2. The actual used capacity size might be smaller than this example because the reclaimed zero data pages are not contained in saved capacities.

Example 2: Applying deduplication (post-process mode) and compression (capacity saving function)



Notes:

1. The actual used capacity size is larger than this example because of the capacity consumed by the metadata and garbage data.
2. The actual used capacity size might be smaller than this example because the reclaimed zero data pages are not contained in saved capacities.

Capacity saving function: data deduplication and compression

When the capacity saving function is in use, the controller of the storage system performs data deduplication and compression to reduce the size of data to be stored. Capacity saving can be enabled on DP-VOLs in Dynamic Provisioning pools. You can use the capacity saving function on internal flash drives only, including data stored on encrypted flash drives.

How capacity saving works

The capacity saving function includes deduplication and compression:

- Deduplication

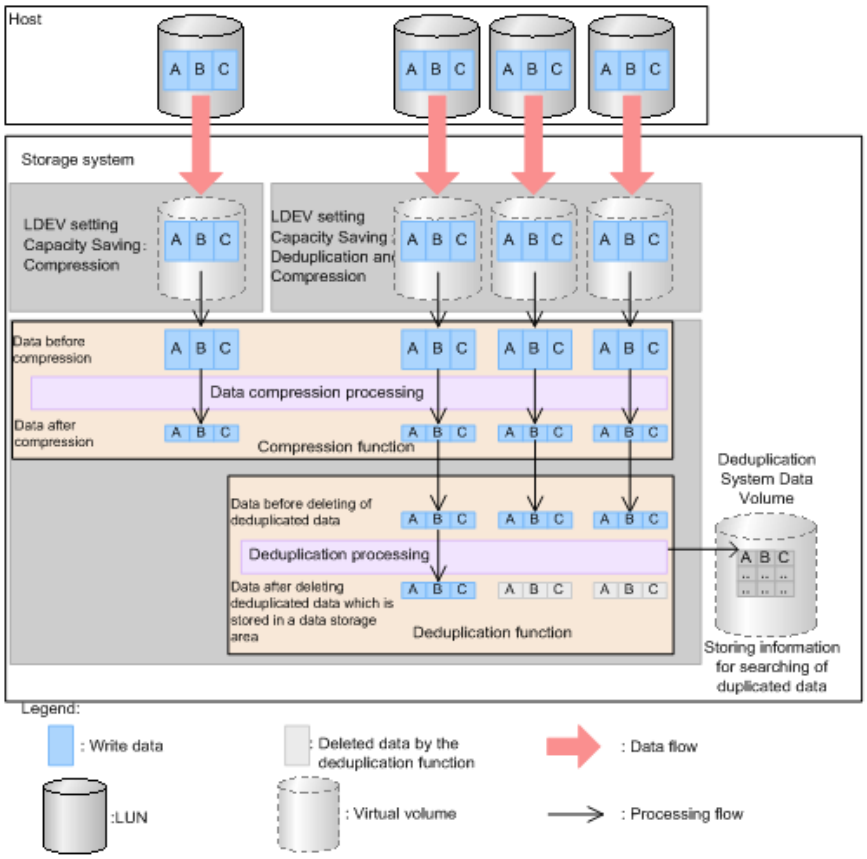
The data deduplication function deletes duplicate copies of data written to different addresses in the same pool and maintains only a single copy of the data at one address. The deduplication function is enabled on a Dynamic Provisioning pool and then on the desired DP-VOLs in the pool. When deduplication is enabled, data that has multiple copies between DP-VOLs assigned to that pool is removed.

When you enable deduplication on a pool, the deduplication system data volume (DSD volume) for that pool is created. The deduplication system data volume is used exclusively by the storage system to manage the deduplication function. A search table in the deduplication system data volume is used to locate redundant data in the pool.

- Compression

  The data compression function utilizes the LZ4 compression algorithm to compress the data. The compression function is also enabled per DP-VOL.

The following figure illustrates the capacity saving function.



Data received by the storage controller is stored in a temporary area in the pool. When the data is classified as inactive (one hour since the last update for Dynamic Provisioning), the capacity saving processing is performed, and the post-process data is stored in the data storage area. When post-process

data is updated again, the data stored in the data storage area is no longer required. The used capacity of the pool increases until garbage collection, which collects old data that is no longer required. The pool capacity that is eventually required is the sum of the physical data capacity after capacity saving plus the amount of metadata.

Note:

- The temporary area and the data storage area are not assigned fixed capacities. They share the pool and use the pool as needed.
- The temporary area is used when the post-process mode is applied. When the inline mode is applied, capacity saving processing is performed simultaneously with receiving of data from the host, and host data is not stored in the temporary area.

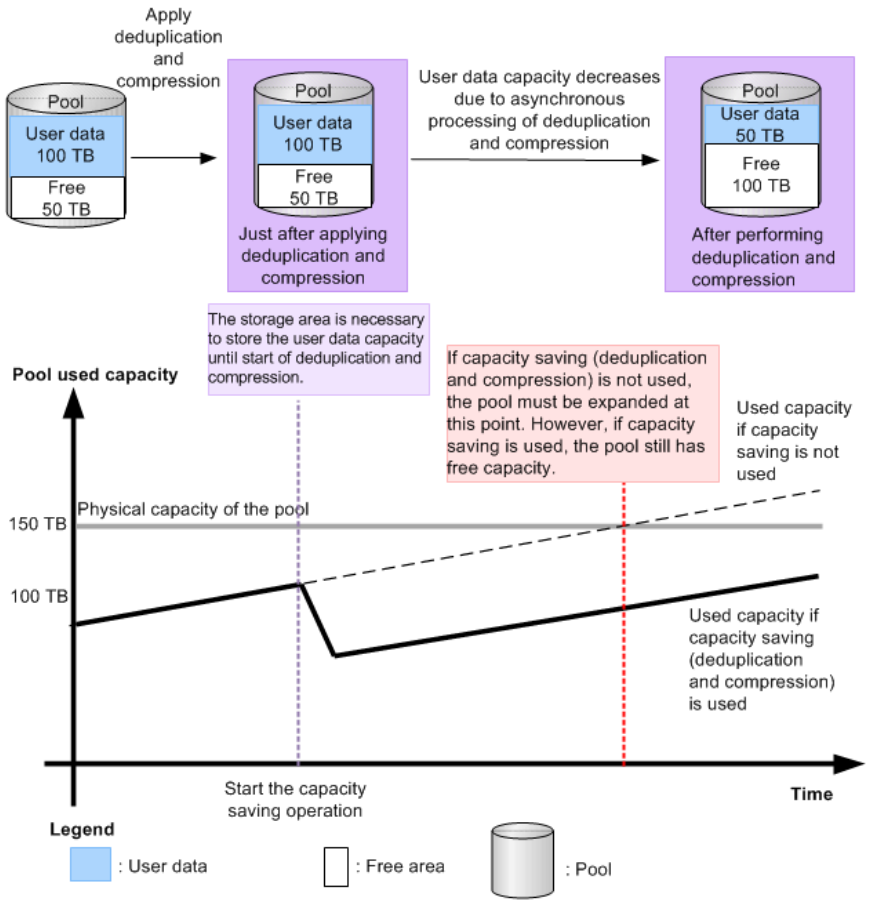
The capacity overheads associated with the capacity saving function include the following:

- Capacity consumed by metadata
  The capacity consumed by metadata for the capacity saving function (deduplication and compression) is approximately 3% of the consumed DP-VOL capacity that has been processed by capacity saving. For example, if the consumed capacity of a DP-VOL is 150 TB and the capacity saving feature has processed 100 TB of the 150 TB consumed capacity and reduced it to 30 TB, the capacity consumed by metadata for capacity saving function is approximately 3 TB (3% of 100 TB). The total consumed capacity of this DP-VOL at this instant is 83 TB (30 TB + 50 TB + 3 TB).
- Capacity consumed by garbage (invalid) data
  The capacity consumed by garbage data is approximately 7% of the total consumed capacity of all DP-VOLs with capacity saving enabled. The capacity is dynamically consumed based on garbage data created by the capacity saving process and cleaned by the background garbage collection process. The garbage collection process is a background process with a lower priority than host I/O, so the capacity consumed by garbage data depends on both the garbage created and the host I/O rate.

Caution: Do not use capacity saving and NAS deduplication on the same volumes, because the additional processing decreases the I/O performance substantially. For information about the NAS deduplication function, see the *File Services Administration Guide*.

Capacity saving processing for existing data

The compression and deduplication processing is performed asynchronously for pages that store data, and the free area of the pool can be increased, thereby reducing the cost of purchasing drives over time.



Capacity saving processing for new write data

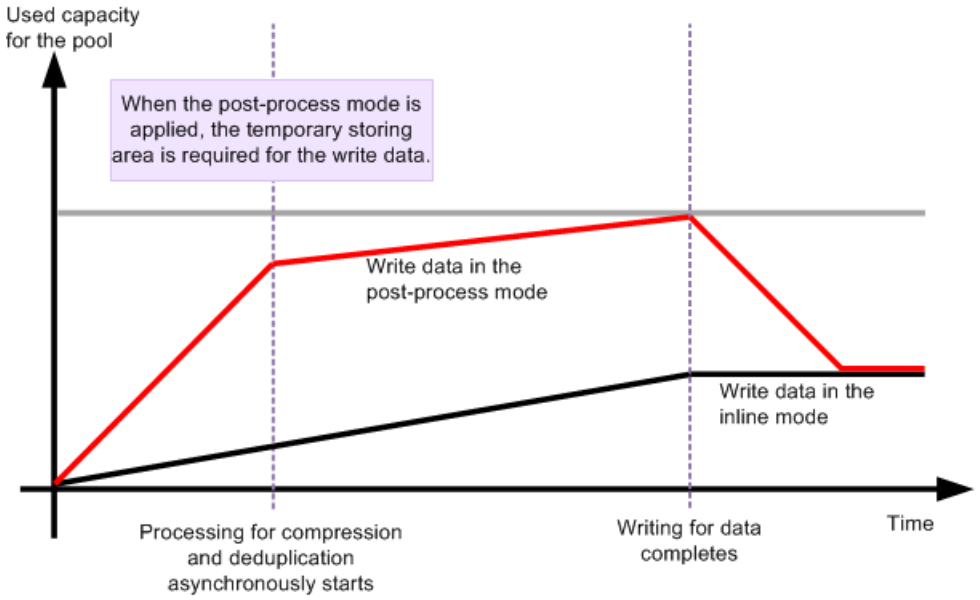
The capacity saving mode of a DP-VOL (post-process mode or inline mode) determines how capacity saving is applied to new write data from the host:

- **Post-process mode:** When you apply capacity saving with the post-process mode to a DP-VOL, the compression and deduplication processing are performed asynchronously for new write data. Since capacity saving processing is not performed at the time the new data is written, the post-process mode can reduce the impact of capacity saving processing on I/O performance, but pool capacity is required to store the new write data until the capacity saving processing is performed.

  When you enable capacity saving on a DP-VOL using Device Manager - Storage Navigator, post-process mode is applied.
- **Inline mode (CCI only):** When you apply capacity saving with the inline mode to a DP-VOL, the compression and deduplication processing are performed synchronously for new write data. The inline mode minimizes the pool capacity required to store new write data but can impact I/O performance more than the post-process mode. The inline mode should be applied when writing data with sequential I/Os, for example, when writing data to target volumes of data migration or secondary volumes of copy

pairs. When the data migration or copy pair creation has completed, the mode should be changed from the inline mode to the post-process mode. If you want to use inline mode, you must use CCI (raidcom add ldev [-capacity_saving_mode <saving mode>]).

The following example illustrates how the pool used capacity changes over time when performing data migration. The red line shows the capacity when the post-process mode is applied, and the black line shows the capacity when the inline mode is applied. This example assumes that the writing speed (GB/h) for the new data is faster than the initial capacity saving processing (GB/h).



When the inline mode is applied, capacity saving processing is performed synchronously for the writing of data. When the post-process mode is applied, capacity saving processing is performed asynchronously for the writing of data, and the temporary storing area is required for the write data. The capacity required for the temporary storing area depends on the writing speed of the new data, or on the frequency of data updates during migration.

The following table shows the processing method (synchronous or asynchronous) for initial data, new write data, and update data. For new write data, the capacity saving processing is performed at different times for the post-process mode and the inline mode.

Mode	Initial data*	New write data		Updated write data	
		Compression processing	Deduplication processing	Compression processing	Deduplication processing
Post-process mode	Asynchronous	Asynchronous	Asynchronous	Synchronous when compressed data is updated Asynchronous when uncompressed data is updated	Asynchronous
Inline mode	Asynchronous	Synchronous	Synchronous for sequential I/Os Asynchronous for random I/Os	Synchronous when compressed data is updated Asynchronous when uncompressed data is updated	Asynchronous
* The initial data is the existing data on the DP-VOL when the capacity saving function is enabled. Both compression and deduplication processing are performed asynchronously for the initial data.					

Use cases for capacity saving

The results of enabling the capacity saving functions of deduplication and compression depend on the properties and access patterns of the stored data. In addition, when capacity saving is enabled, some storage behaviors are different from conventional behaviors because of the increase in load of storage controller processing caused by data scanning and garbage collection by data update. Before implementing capacity saving, you need to confirm whether it should be applied to your specific storage environment.

The following table lists several storage use cases and describes the application of capacity saving to each use case.

Use case	Settings	Description
Office	Deduplication and compression	Because there are many identical file copies, deduplication is effective.
VDI	Deduplication and compression	Deduplication is very effective because of OS area cloning.
Database (TPC-H)	Compression	Deduplication is not effective because the database has unique information for each block.
Database (TPC-C)	Compression	For a database that has many data updates, garbage data is increased, so it is not suitable.
Image/video	Not suitable (Disable)	Compressed by application.

Use case	Settings	Description
Backup/ archive	Deduplication and compression	Deduplication is effective between backups.

Caution:
- I/O performance to data with compression and deduplication is degraded. Verify the performance by utilizing best practices or Cache Optimization Tool (COT) tool before using the capacity saving function.
- Because approximately 10% is used for metadata and garbage data, capacity saving should be applied only when the result is expected to be 20% or higher.
- In deduplication and compression, processing is performed per 8 KB. Therefore, if the block size of the file system is an integral multiple of 8 KB, capacity saving is likely to be effective.
- The capacity saving function is not a good fit for high-write workloads. If the write workload rate is higher than garbage collection throughput, Cache Write Pending increases, causing performance degradation. Contact customer support to determine the garbage collection throughput for your configuration.

About pool volumes from accelerated compression-enabled parity groups

Volumes carved from accelerated compression-enabled parity groups can only be used as pool volumes to create or expand a pool. Pools that contain pool volumes from accelerated compression-enabled parity groups must be monitored to ensure adequate pool capacity. You can set thresholds for used pool capacity that trigger the output of SIMs when exceeded, enabling you to expand the pool or delete unwanted data before the pool becomes full.

Accelerated compression-enabled parity groups

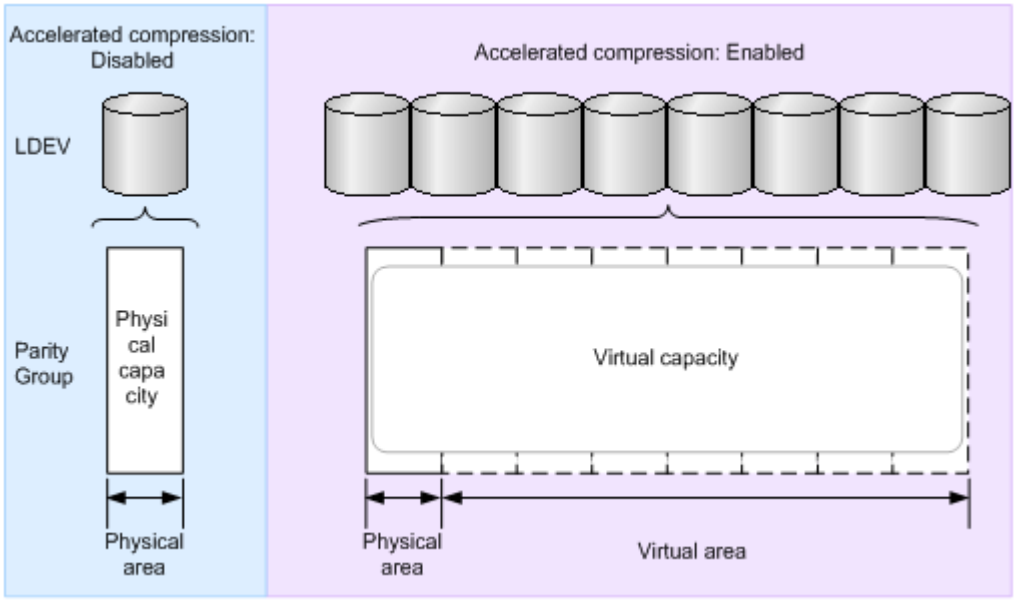
Data on LDEVs carved from parity groups comprised of FMC drives is compressed before it is stored onto the drives. The default setting of accelerated compression is Disabled. You must set this feature to Enable to take advantage of the data compression services on the FMC drives.

Note: If encryption is enabled on an FMC parity group, accelerated compression cannot be enabled on that parity group. You can use the deduplication and compression functions on encrypted FMC parity groups.

When you enable accelerated compression on a parity group comprised of FMC drives:
- The capacity of the parity group expands the usable physical capacity of the parity group. You can potentially carve out LDEVs from this expanded capacity and use them as pool volumes to create or expand a pool. When

you do this, you can utilize the increased available capacity because the data on the FMC drives has been compressed.

- LDEVs carved from the accelerated compression-enabled parity groups can only be used as pool volumes to create or expand a pool. These LDEVs cannot be assigned directly to a host and must be assigned to a single pool as pool volumes. LDEVs from a single parity group cannot be shared among multiple pools.



Storing data written to DP-VOLs

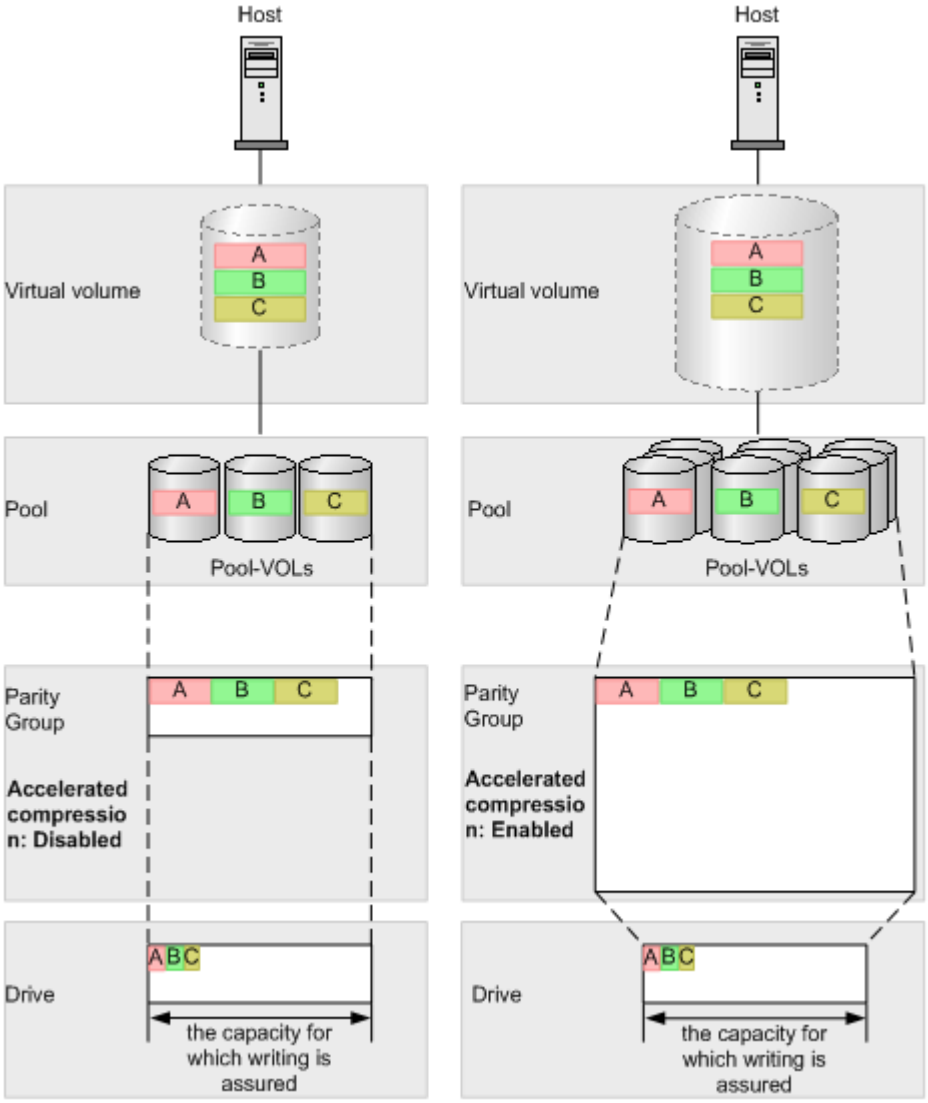
Data written by hosts to DP-VOLs is stored in pool volumes on a page basis. If pool volumes are created from the parity group used by FMC drives, data is compressed and stored to drives. The compression ratio of data varies for each data update or data deletion operation. Therefore, the capacity of data that can be stored fully is the capacity of the physical area of the FMC used to create the parity group. For a pool containing pool volumes with accelerated compression enabled, the smaller of the following two capacities is the FMC capacity that corresponds to the pool capacity reserved for writing:

- The total capacity of the pool volumes
- The FMC capacity of the parity group to which the pool volumes belong

If pool volumes carved from the FMC parity group and pool volumes carved from other parity groups are intermixed, the total capacity that corresponds to the pool capacity reserved for writing is calculated by the following formula:

Total capacity that corresponds to the pool capacity reserved for writing = FMC capacity of the parity group to which the pool volumes belong + Total capacity of pool volumes carved from other parity groups.

The purchased license of Dynamic Provisioning is consumed with respect to the defined pool capacity. However, if you are using a pool comprised of pool volumes assigned by accelerated compression-enabled parity groups, the purchased license of Dynamic Provisioning is used with respect to the pool capacity reserved for writing.



Monitoring used pool capacity and used pool capacity reserved for writing

- Monitoring used pool capacity
  The used pool capacity must always be monitored. As data is written to DP-VOLs and stored in the pool, in cases where DP-VOLs are over-provisioned, the pool might become full before the DP-VOLs become full. Therefore, the used pool capacity must always be monitored to prevent this from happening. A threshold value is set for the used pool capacity. If the used pool capacity exceeds the threshold value, a SIM is reported and a notification is sent to the hosts. If these SIMs are reported, you can resolve the status of threshold exceeded by expanding the pool capacity or

by deleting data. For details about the threshold values, see Thresholds for monitoring pools on page 257.

- Monitoring used pool capacity reserved for writing
  For the pools consisting of pool volumes carved from accelerated compression-enabled parity groups, you must monitor both the used pool capacity and the used pool capacity reserved for writing. If the used pool capacity reserved for writing exceeds the threshold value, a SIM is reported. The used pool capacity and the pool capacity reserved for writing are not always the same, and the SIMs are independent of each other. The following conditions can occur:
  - The used pool capacity exceeds the threshold, but the used pool capacity reserved for writing is lower than the threshold.
  - The used pool capacity is lower than the threshold, but the used pool capacity reserved for writing exceeds the threshold.
  - Both used capacities exceed the threshold.

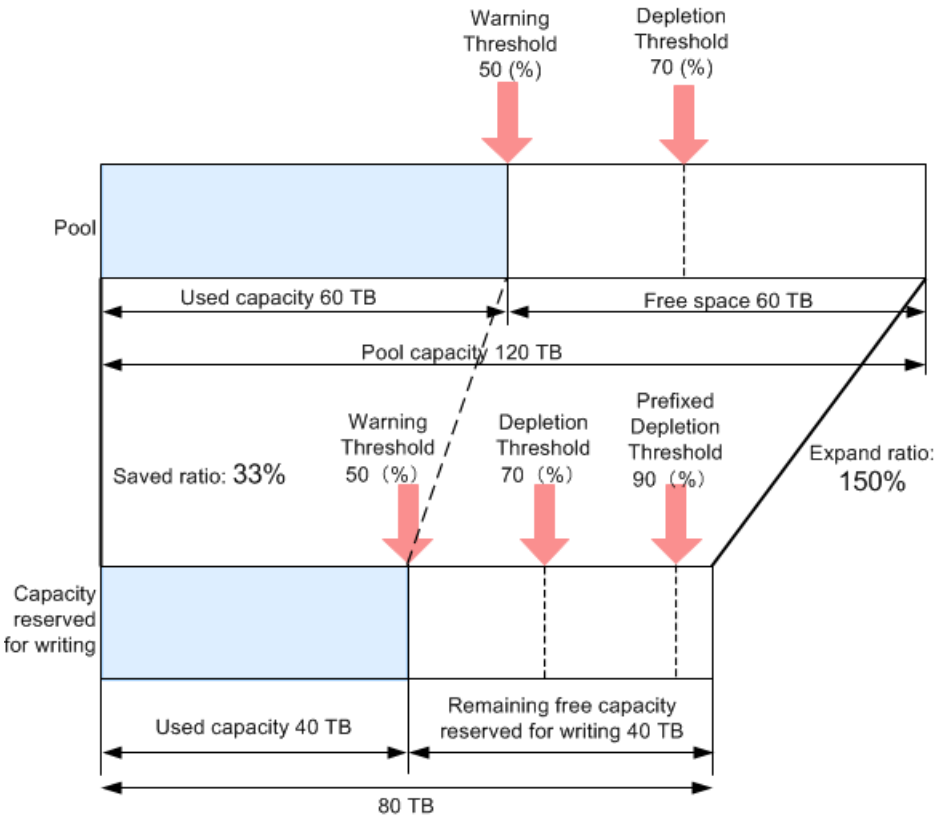
If SIMs are reported, you can resolve the status of the exceeded threshold by expanding the pool capacity or by deleting unwanted data.

If pool volumes that are carved from accelerated compression-enabled parity group are used to create a new pool, you must estimate the data savings percentage beforehand.

For a pool with a pool volume that has accelerated compression enabled, the used pool capacity and the used pool capacity reserved for writing are monitored. The following shows the threshold values for the used pool capacity and used pool capacity reserved for writing that trigger output of SIMs when exceeded:

- Warning Threshold: You can set a value from 1% to 100% in 1% increments. The initial value is 70%.
- Depletion Threshold: You can set a value from 1% to 100% in 1% increments. The initial value is 80%.
- Prefixed Depletion Threshold: The value is set for the used capacity of the parity group. The value is fixed at 90%.

The following figure shows the used pool capacity and used pool capacity reserved for writing with threshold values. Hereinafter, the smaller free capacity between the pool or drive is called the remaining free capacity reserved for writing. The used capacity reserved for writing is the result of deducting the remaining free capacity for writing from the total capacity reserved for writing.



Dynamic Tiering

Hitachi Dynamic Tiering (HDT) simplifies storage administration by automatically optimizing data placement in 1, 2 or 3 tiers of storage that can be defined and used within a single virtual volume. Tiers of storage can be made up of internal or external (virtualized) storage, and use of HDT can lower capital costs. Simplified and unified management of HDT allows for lower operational costs and reduces the challenges of ensuring applications are placed on the appropriate classes of storage.

Dynamic Tiering

After using Dynamic Provisioning software to virtualize LUs and pool storage into a thin provisioning strategy, the array now has all the elements in place to offer automatic self-optimizing storage tiers provided by Hitachi Dynamic Tiering (HDT). Using Dynamic Tiering, you can configure a storage system with multiple storage tiers using different kinds of data drives, including SSD, SAS, and external volumes. This helps improve the speed and cost of performance. Dynamic Tiering extends and improves the functionality and value of Dynamic Provisioning. Both use pools of physical storage against which virtual disk capacity, or V-VOLs, is defined. Each thin provisioning pool can be configured to operate either as a DP pool or a Dynamic Tiering pool. Dynamic Tiering is supported on only VSP Gx00 models.

Automated tiering of physical storage is the logical next step for thin provisioned enterprise arrays. Automated tiering is the ability of the array to dynamically monitor and relocate data to the optimum tier of storage. It focuses on data segments rather than entire volumes. The functionality is entirely within the array without any mandated host level involvement. Dynamic Tiering adds another layer to the thin provisioned environment.

Using Dynamic Tiering you can:

- Configure physical storage into tiers consisting of multiple kinds of data drives, including SSD, and SAS. Although host volumes are conventionally configured from a common pool, the pool is efficiently configured using multiple kinds of data drives. Placing data that needs high performance while reducing storage costs by using high cost disks such as SSDs as efficiently as possible, resulting in data that is accessed infrequently being placed on lower cost physical storage.
- Automatically migrate small portions of host volumes to the most suitable tier according to access frequency. Frequently accessed data is migrated to higher speed, higher cost data drives (for example, SSD). Infrequently accessed data is migrated to lower cost and lower speed data drives (for example, SAS7.2K) to use the storage efficiently.

Dynamic Tiering simplifies storage administration by automating and eliminating the complexities of efficiently using tiered storage. It automatically moves data on pages in Dynamic Provisioning virtual volumes to the most appropriate storage media, according to workload, to maximize service levels and minimize total cost of storage.

Dynamic Tiering gives you:

- Improved storage resource usage
- Improved return on costly storage tiers
- Reduced storage management effort
- More automation
- Nondisruptive storage management
- Reduced costs
- Improved performance

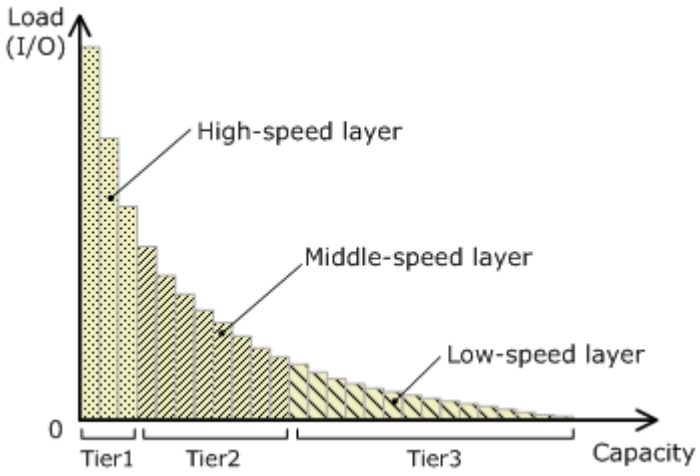
Overview of tiers

When not using Dynamic Tiering data is allocated to only one kind of data drive (typically an expensive high-speed data drive) without regard to the workload because the volumes are configured with only one kind of data drive. When using Dynamic Tiering, frequently access data is automatically allocated to the higher-speed HDT pool volumes and the lower speed drive to the volumes of low workload. This improves performance and reduces costs.

Dynamic Tiering places the host volume's data across multiple tiers of storage contained in a pool. There can be up to three tiers (high-, medium-, and low-speed layers) in a pool. Dynamic Tiering determines tier usage based

on data access levels. It allocates the page with high I/O load to the upper tier, which contains a higher speed drive, and the page with low I/O load to the lower tier, which contains a lower speed drive.

The following figure illustrates the basic tier concept.



Active flash

The active flash feature of Dynamic Tiering monitors page accesses over a set time frame and attempts to keep the most frequently accessed pages in Tier 1.

The active flash feature monitors a page's access frequency level real time and promotes pages that suddenly became busy from a slower media to high-performance flash media, in real-time.

The active flash feature can be enabled on any Dynamic Tiering pool as long as you have SSD drives in Tier 1 of the pool. No special configuration beyond what is needed for active flash is required.

Prompt Promotion

A primary goal of Dynamic Tiering and active flash is to have the most frequently access pages in Tier 1. As the workload varies in both the frequency of access and the type of access, reads or writes, the threshold for moving pages from one tier to another changes. Dynamic Tiering generates a dynamic tier range value that is used to determine which pages need to be in Tier 1 and which need to be in a lower tier.

The active flash feature compares the recent the access frequency of each page to the Prompt Promotion threshold to determine whether a page should be promoted to Tier 1. The Prompt Promotion threshold is a dynamic threshold that adjusts based upon changes in workload to make most efficient use of the SSD drives. If the recent access frequency for a page meets or exceeds the Prompt Promotion threshold, the page is relocated to Tier 1 without waiting for the next Dynamic Tiering relocation cycle.

Certain type of I/O benefit more from being served by flash media then others. To achieve the best performance gains for certain I/O, active flash gives read I/O greater weight than write I/O when calculating the total access frequency for a page.

High Prioritized Demotion

In order to be certain that there is always some room for active flash to do Prompt Promotion of pages to Tier 1, High Prioritized Demotion is used to demote pages out of Tier 1. Pages that have the lowest IOPH are candidates for High Prioritized Demotion. Similar to Prompt Promotion, High Prioritized Demotion does not wait for the current Dynamic Tiering cycle to end to make relocation decisions.

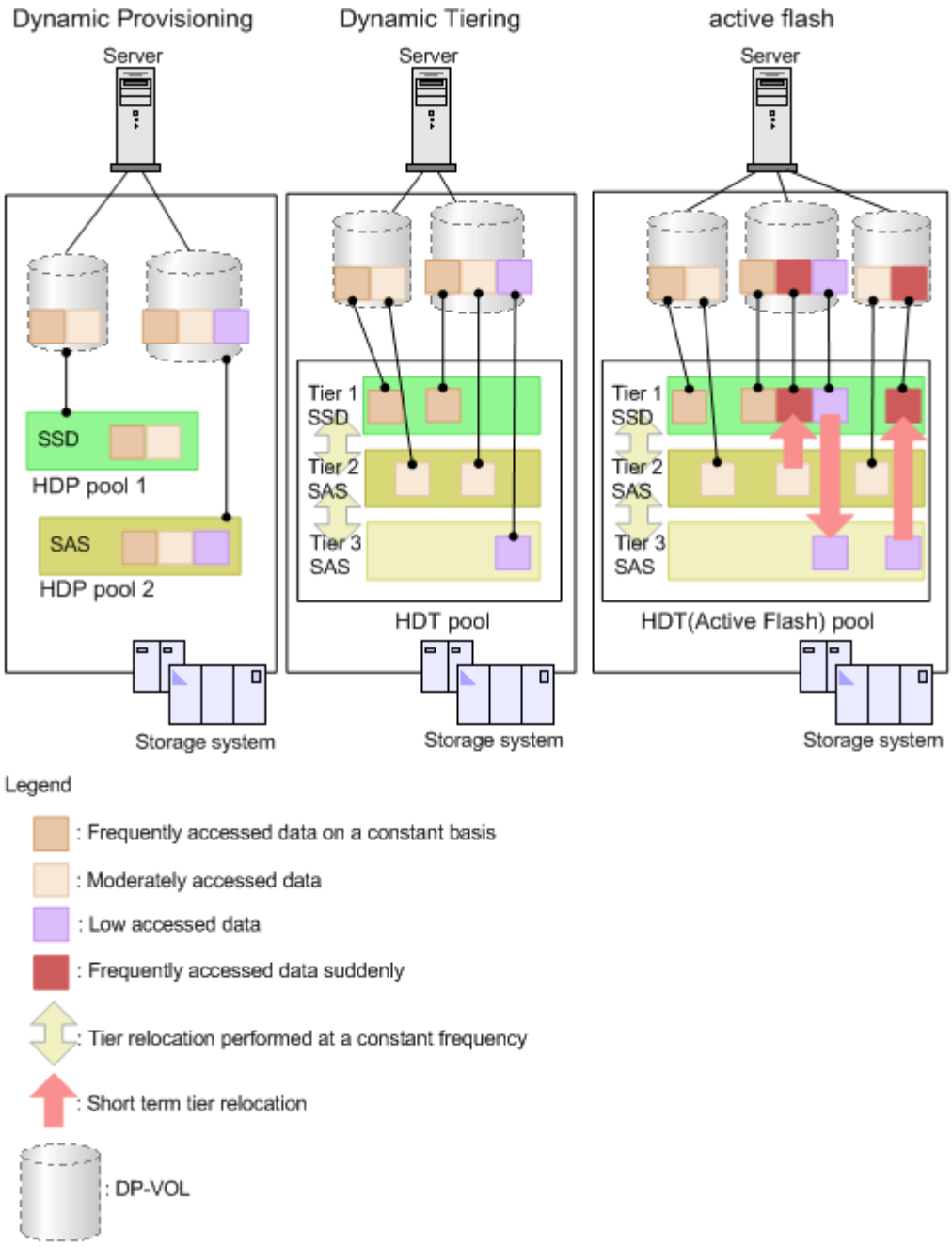
Page demotion is only triggered when:

- Tier 1 free capacity is depleted
- performance utilization reaches 80%

Peak performance utilization is predefined for a particular media.

Performance utilization of a tier is the maximum amount of I/O it can receive. The maximum I/O load that should be targeted to a tier depends upon the media type used to make the tier. A performance utilization of 100% means that the tier is receiving the maximum amount of I/O it can sustain. When performance utilization reaches about the 60% level, response time to the particular media becomes noticeably slower. For more information about performance utilization, see Tier relocation workflow on page 168.

The following diagram shows the differences in the way pools are managed between Dynamic Provisioning, Dynamic Tiering, and active flash



Requirements

In addition to basic hardware and licensing requirements, certain provisioning strategies and implementations have additional requirements.

System requirements

- The hardware and firmware for the storage system must be configured and ready for use.
- The parity groups in the storage system must be configured and ready for use.
- Hitachi Device Manager - Storage Navigator must be configured and ready for use. See the *System Administrator Guide* for your storage system.
- The license keys for the provisioning software products must be enabled. See the *System Administrator Guide* for your storage system.

Shared memory requirements

Additional shared memory is required when Dynamic Provisioning is used in conjunction with Dynamic Tiering, active flash, capacity saving (deduplication and compression), or Thin Image pools. The amount of additional shared memory needed depends on the size of the Dynamic Provisioning and Dynamic Tiering pools.

Shared memory is installed and removed by your service representative. For details about the installation and removal of shared memory, see the hardware reference guide for your storage system.

Caution: Before shared memory is removed, all Dynamic Provisioning, Dynamic Tiering, and active flash pools must be deleted.

Cache management device requirements

Cache management devices are used to manage the cache associated with volumes (LDEVs). Each volume (LDEV) requires at least one cache management device. An LDEV that is not a DP-VOL requires one cache management device. For an LDEV that is a DP-VOL, you need to calculate the number of cache management devices required.

The storage system can manage up to the following number of cache management devices:

- VSP G800 or VSP F800: 32,512
- VSP G400, G600 or VSP F400, F600: 7,936
- VSP G200: 3,840

The View Management Resource Usage window displays the number of cache management devices in use and the maximum number of cache management devices. For details, see Viewing the number of cache management devices on page 57.

Calculating the number of cache management devices required for DP-VOLs

The number of cache management devices that a DP-VOL requires depends on the capacity of the V-VOL (capacity of the user area) and the maximum

capacity of cache management device. The maximum capacity of cache management device depends on the pool attribute (internal volume or external volume) associated with V-VOL.

The following table explains the relationship between the pool attribute and the maximum capacity of cache management device.

Maximum capacity of cache management devices

Pool attribute	Maximum capacity (MB)	Maximum capacity (blocks)
Internal volume	3,145,548 (2.99 TB)	6,442,082,304
External volume	3,145,548 (2.99 TB)	6,442,082,304

Use the following formula to calculate the number of cache management devices that a DP-VOL requires. In this formula, the user-specified capacity is the user area capacity of a V-VOL.

ceil(*user-specified-capacity* ÷ *max-capacity-of-cache-management-device*)

where
- ceil: The value enclosed in *ceil( )* must be rounded up to the nearest whole number.

Note:
- For a DP-VOL with the deduplication or compression function enabled, use twice the number of the cache management devices calculated by this formula.
- For each deduplication system data volume, 14 cache management devices are used.

Calculating the number of cache management devices required by a volume that is not a DP-VOL

One volume that is not a DP-VOL requires one cache management device.

Viewing the number of cache management devices

Click Actions and select View Management Resource Usage to display the number of cache management devices in the **View Management Resource Usage** window.

System option modes for provisioning

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

for your storage system, and work with your service representative to ensure that the appropriate SOMs for your operational environment are configured on your storage system.

The following table lists and describes the SOMs that apply to Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, Virtual LVI/LUN, and Data Retention Utility. For a complete list of SOMs, see the *System Administrator Guide* for your storage system.

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

Table 1 System option modes for provisioning

Mode	Category	Description	Default	MCU/RCU
729	Dynamic Provisioning Data Retention Utility	To set the Protect attribute for the target DP-VOL using Data Retention Utility (DRU), when any write operation is requested to the area where the page allocation is not provided at a time when the DP Pool is full. **Mode 729 = ON:** To set the Protect attribute for the target DP-VOL using DRU, when any write operation is requested to the area where the page allocation is not provided at a time when the DP pool is full. (Not to set in the case of Read request.) **Mode 729 = OFF (default):** Not to set the Protect attribute for the target DP-VOL using DRU, when any write operation is requested to the area where the page allocation is not provided at a time when DP pool is full. For details, contact customer support (see SOM729 & 803 sheet). **Notes:** **1.** This SOM is applied when: • The threshold of pool is high (for example, 95%) and the pool may be full. • File system is used. • Data Retention Utility is installed. **2.** Since the Protect attribute is set for V-VOL, the Read operation cannot be allowed as well. **3.** When Data Retention Utility is not installed, the desired effect is not achieved. **4.** Protect attribute can be released from the **Data Retention** window of Device Manager - Storage Navigator after releasing the full status of the pool by adding a Pool-VOL. **5.** With 83-01-21-x0/00 and later, the Virtual Volume Protection (VVP) function is supported. VVP can be enabled/disabled for each pool. With SOM 729 disabled, VVP is also disabled by default, but you can enable VVP for each pool as needed. With SOM 729 enabled, VVP is also enabled automatically (by default) when you create a new pool. **Caution:** A pool is NOT protected by ANY FUNCTION if you	OFF	-

Mode	Category	Description	Default	MCU/RCU
		deliberately turn VVP for the pool from ON (default) to OFF, even with SOM 729 enabled. **6.** With or 83-01-21-x0/00 and later, when HMO 63 or 73 is set to ON, the setting of the HMO is prioritized over the SOM 729 setting so that the behavior remains as that of setting the mode to OFF even when the SOM is set to ON.		
734	Dynamic Provisioning Dynamic Provisioning for Mainframe	When exceeding the pool threshold, the SIM is reported as follows: **Mode 734 = ON:** A SIM is reported at the time when the pool usage rate exceeds the pool threshold (warning, system, or depletion). Once the pool usage rate falls below the pool threshold, and then exceeds again, the SIM is reported again. If the pool usage rate continues to exceed the warning threshold and the depletion threshold, the SIM (SIM-RC625000) is repeatedly reported every eight (8) hours until the pool usage rate falls below the depletion threshold. **Mode 734 = OFF (default):** A SIM is reported at the time when the pool usage rate exceeds the pool threshold (warning, system, or depletion). Once the pool usage rate falls below the pool threshold, and then exceeds again, the SIM is reported again. The SIM is not reported while the pool usage rate continues to exceed the warning threshold and the depletion threshold. **Notes:** **1.** This mode is turned ON to prevent the write I/O operation from being unavailable due to pool full. **2.** If the exceeding pool threshold SIM occurs frequently, other SIMs may not be reported. **3.** Though turning on this mode can increase the warning effect, if measures such as adding a pool fail to be done in time so that the pool becomes full, SOM 729 can be used to prevent file systems from being destroyed. **4.** Turning on SOM 741 can provide the SIM report to not only the users but also the service personnel.	OFF	-
741	Dynamic Provisioning Dynamic Provisioning for Mainframe	The mode enables to switch over whether to report the following SIM for users to the service personnel: SIM-RC 625000 (DP pool usage rate continues to exceed the threshold) **Mode 741 = ON:** SIM is reported to the service personnel. **Mode 741 = OFF (default):** SIM is not reported to the service personnel. **Notes:** **1.** This SOM is set to ON to have SIM for users reported to the service personnel: • For the system where SNMP and E-mail notification are not set. • If Device Manager - Storage Navigator is not periodically activated.	OFF	-

Mode	Category	Description	Default	MCU/RCU
		2. When SOM 734 is turned OFF, SIM-RC625000 is not reported; accordingly the SIM is not reported to the service personnel even though this mode is ON.		
749	Dynamic Provisioning Dynamic Provisioning for Mainframe Dynamic Tiering Dynamic Tiering for Mainframe Thin Image	This mode disables the HDP Rebalance function and the HDT Tier relocation function which allow the drives of all ECC Groups in the pool to share the load. **Mode 749 = ON:** The HDP Rebalance function and the HDT Tier relocation function are disabled. **Mode 749 = OFF (default):** The HDP Rebalance function and the HDT Tier relocation function are enabled. **Notes:** **1.** This mode is applied when no change in performance characteristic is desired. **2.** When a pool is newly installed, the load may be concentrated on the installed pool volumes. **3.** When 0 data discarding is executed, load may be unbalanced among pool volumes. **4.** Pool VOL deletion while the mode is set to ON fails. To delete pool VOLs, set the mode to OFF.	OFF	-
803	Dynamic Provisioning Data Retention Utility	While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, this mode can enable the Protect attribute of DRU for the target DP-VOL. **Mode 803 = ON:** While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, the DRU attribute is set to Protect. **Mode 803 = OFF (default):** While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, the DRU attribute is not set to Protect. For more details, contact customer support (see SOM729 & 803 sheet). **Notes:** **1.** This mode is applied when: • A file system using DP pool VOLs is used. • Data Retention Utility is installed. **2.** Because the DRU attribute is set to Protect for the V-VOL, a read I/O is also disabled. **3.** If Data Retention Utility is not installed, the expected effect cannot be achieved. **4.** The Protect attribute of DRU for the DP V-VOL can be released on the **Data Retention** window of Device Manager - Storage Navigator after recovering the blocked pool VOL. **5.** With 83-01-21-x0/00 and later, the Virtual Volume Protection (VVP) function is supported. VVP can be enabled/disabled for each pool. With SOM 803 disabled, VVP is also disabled by default, but you can enable VVP for each pool as needed. With SOM 803 enabled, VVP is also enabled automatically (by default) when you create a new pool. **Caution:** A pool is NOT protected by ANY FUNCTION if you	OFF	-

Mode	Category	Description	Default	MCU/RCU
		deliberately turn VVP for the pool from ON (default) to OFF, even with SOM 803 enabled.		
867	Dynamic Provisioning Dynamic Tiering	All-page reclamation (discarding all mapping information between DP pool and DP volumes) is executed in DP-VOL LDEV format. This new method is enabled or disabled by setting the mode to ON or OFF. **Mode 867 = ON (default*):** LDEV format of the DP-VOL is performed with page reclamation. **Mode 867 = OFF:**LDEV format of the DP-VOL is performed with 0 data writing. *The default is OFF for VSP, HUS VM, and VSP Gx00 models and VSP Fx00 models with firmware 83-03-*xx* and earlier. **Notes:** **1.** This mode is applied from factory shipment. **2.** Do not change the setting of the mode during DP-VOL format. **3.** If the setting of the mode is changed during DP-VOL format, the change is not reflected to the format of the DP-VOL being executed but the format continues in the same method.	ON	-
896	Dynamic Provisioning Dynamic Provisioning for Mainframe Dynamic Tiering Dynamic Tiering for Mainframe Thin Image	This mode enables or disables the background format function performed on an unformatted area of a DP/DT/TI pool. For information regarding operating conditions, see the Provisioning Guide for your storage system. **Mode 896 = ON:** The background format function is disabled. **Mode 896 = OFF (default):** The background format function is enabled. **Notes:** **1.** This mode is applied when a customer requires the background format for a DP/DT/TI pool in the environment where new page allocation (in the case that system files are created from a host for newly created multiple DP-VOLs, for example) frequently occurs and the write performance degrades because of an increase in write pending rate. **2.** When the background format function is enabled, because up to 42 MB/s of ECCG performance is used, local copy performance may degrade by about 10%. Therefore, confirm whether the 10% performance degradation is acceptable or not before enabling the function. **3.** When a Dynamic Provisioning VOL on an external storage system, which is used as an external VOL, is used as a pool VOL, if the external pool on the external storage side becomes full due to the background format, the external VOL may be blocked.	OFF	-

Mode	Category	Description	Default	MCU/RCU
		If the external pool capacity is smaller than the external VOL capacity (Dynamic Provisioning VOL of external storage system), do not enable the background format function. **4.** If the background format function is disabled by changing the mode setting, the format progress is initialized and the entire area becomes unformatted. **5.** The background format for FMC drives is not disabled. When FMC drives are used, use SOM 1093.		
897	Dynamic Tiering Dynamic Tiering for Mainframe	By the combination of SOM 897 and 898 setting, the expansion width of Tier Range upper I/O value (IOPH) can be changed as follows. **Mode 897 = ON:** • SOM 898 is OFF: 110%+0IO • SOM 898 is ON: 110%+2IO **Mode 897 = OFF (default):** • SOM 898 is OFF: 110%+5IO (default) • SOM 898 is ON: 110%+1IO By setting the SOMs to ON to lower the upper limit for each tier, the gray zone between other tiers becomes narrow and the frequency of page allocation increases. **Notes:** **1.** Apply the mode when the upper tier usage is low and lower tier usage is high. **2.** The mode must be used with SOM 898. **3.** Narrowing the gray zone increases the number of pages to migrate between tiers per relocation. **4.** When Tier1 is SSD while SOM 901 is set to ON, the effect of SOM 897 and 898 to the gray zone of Tier1 and Tier2 is disabled and the SOM 901 setting is enabled instead. In addition, the settings of SOM 897 and 898 are effective for Tier2 and Tier3. For more details about the interactions between SOMs 897, 898, and 901, contact customer support (see SOM897_898_901 sheet).	OFF	-
898	Dynamic Tiering Dynamic Tiering for Mainframe	By the combination of SOM 898 and 897 setting, the expansion width of Tier Range upper I/O value (IOPH) can be changed as follows. **Mode 898 = ON:** • SOM 897 is OFF: 110%+1IO • SOM 897 is ON: 110%+2IO **Mode 898 = OFF (default):** • SOM 897 is OFF: 110%+5IO (default) • SOM 897 is ON: 110%+0IO By setting the SOMs to ON to lower the upper limit for each tier, the gray zone between other tiers becomes narrow and the frequency of page allocation increases. **Notes:**	OFF	-

Mode	Category	Description	Default	MCU/RCU
		1. Apply the mode when the usage of upper tier is low and that of lower tier is high. **2.** The mode must be used with SOM 897. **3.** Narrowing the gray zone increases the number of pages to migrate between tiers per relocation. **4.** When Tier1 is SSD while SOM 901 is set to ON, the effect of SOM 897 and 898 to the gray zone of Tier1 and Tier2 is disabled and the SOM 901 setting is enabled instead. In addition, the settings of SOM 897 and 898 are effective for Tier2 and Tier3. For more details about the interactions between SOMs 897, 898, and 901, contact customer support (see SOM897_898_901 sheet).		
901	Dynamic Tiering Dynamic Tiering for Mainframe	By setting the mode to ON or OFF, the page allocation method of Tier Level ALL when the drive type of tier1 is SSD changes as follows. **Mode 901 = ON:** For tier1 (drive type is SSD), pages are allocated until the capacity reaches the limit. Without consideration of exceeding performance limitation, allocation is done from highly loaded pages until reaching the capacity limit When the capacity of the tier1 reaches the threshold value, the minimum value of the tier range is set to the starting value of the lower IOPH zone, and the maximum value of the lower tier range is set to the boundary value. **Mode 901 = OFF (default):** For tier1 (drive type is SSD), page allocation is performed based on performance potential limitation. With consideration of exceeding performance limitation, allocation is done from highly loaded pages but at the point when the performance limitation is reached, pages are not allocated any more even there is free space. When the capacity of the tier1 reaches the threshold value, the minimum value of the tier range is set to the boundary value, and the maximum value of the lower tier range is set to a value of boundary value × 110% + 5 [IOPH]. **Notes:** **1.** This mode is applied when pages with the maximum capacity need to be allocated to tier1 (drive type is SSD) with Dynamic Tiering or Dynamic Tiering for Mainframe. **2.** When Tier1 is SSD while SOM 901 is set to ON, the effect of SOM 897 and 898 to the gray zone of Tier1 and Tier2 is disabled and the SOM 901 setting is enabled instead. In addition, the settings of SOM 897 and 898 are effective for Tier2 and Tier3. **3.** The following is recommended when applying SOM 901. actual I/O value (total number of I/Os of all tiering policies) < performance potential value of Tier 1* × 0.6	OFF	-

Mode	Category	Description	Default	MCU/RCU
		* The performance potential value of Tier1 displayed on Monitor information by using Dx-ray. For more details about the interactions between SOMs 897, 898, and 901, contact customer support (see SOM897_898_901 sheet).		
904	Dynamic Tiering Dynamic Tiering for Mainframe	By setting the mode to ON or OFF, the number of pages to be migrated per unit time at tier relocation is changed. **Mode 904 = ON:** The number of pages to be migrated at tier relocation is set to up to one page per second. **Mode 904 = OFF (default):**No restriction on the number of pages to be migrated at tier relocation (existing specification). **Notes:** **1.** This mode is applied when: • Dynamic Tiering for Mainframe is used (including multi-platform configuration). • The requirement for response time is severe. **2.** The number of pages to be migrated per unit time at tier relocation decreases.	OFF	-
930	Dynamic Provisioning Dynamic Tiering ShadowImage	When the mode is set to ON, all of the zero data page reclamation operations in processing are stopped. (Also the zero data page reclamation cannot be started.) * Zero data page reclamation by WriteSame and UNMAP functions, and IO synchronous page reclamation are not disabled. **Mode 930 = ON:** All of the zero data page reclamation operations in processing are stopped at once. (Also the zero data reclamation cannot be newly started.) **Mode 930 = OFF (default):** The zero data page reclamation is performed. For details about interactions with SOM 755, contact customer support (see SOM930 sheet). **Notes:** **1.** This mode is applied when stopping or disabling zero data page reclamation by user request is required. **2.** When the mode is set to ON, the zero data page reclamation does not work at all. * Zero data page reclamation by Write Same and UNMAP, and IO synchronous page reclamation can work. **3.** When downgrading micro-program to a version that does not support the mode while the mode is set to ON, set the mode to OFF after the downgrade. * Because the zero data page reclamation does not work at all while the mode is set to ON. **4.** The mode is related to SOM 755.	OFF	-
937	Dynamic Provisioning	By setting the mode to ON, HDT monitoring data is collected even if the pool is a DP pool.	OFF	-

Mode	Category	Description	Default	MCU/RCU
	Dynamic Provisioning for Mainframe Dynamic Tiering Dynamic Tiering for Mainframe	**Mode 937 = ON:** HDT monitoring data is collected even if the pool is a DP pool. Only Manual execution mode and Period mode are supported. **Mode 937 = OFF (default):** HDT monitoring data is not collected if the pool is a DP pool **Notes:** **1.** This mode is applied when HDT monitoring data collection is required in DP environment. **2.** When HDT is already used, do not set the mode to ON. **3.** For HDT monitoring data collection, shared memory for HDT must be installed. For details, contact customer support (see SOM937 sheet). **4.** If monitoring data collection is performed without shared memory for HDT installed, an error is reported and the monitoring data collection fails. **5.** Before removing the shared memory for HDT, set the mode to OFF and wait for 30 minutes. **6.** Tier relocation with monitoring data collected when the mode is set to ON is disabled. **7.** When DP is converted into HDT (after purchase of software license), the collected monitoring data is discarded. **8.** Before downgrading the micro-program to an unsupported version, set SOM 937 to OFF and wait for at least 30 minutes.		
1079	Dynamic Provisioning Dynamic Tiering	This mode is set not to run the Proprietary ANCHOR command during microcode downgrade from a version that supports the Proprietary ANCHOR command to a version that does not support the command. Mode 1079 = ON: The Proprietary ANCHOR command is unavailable. Mode 1079 = OFF (default): The Proprietary ANCHOR command is available. **Notes:** **1.** This mode is applied when downgrading the microcode from a version that supports the Proprietary ANCHOR command to a version that does not support the command. **2.** Whether the Proprietary ANCHOR command can be run or not varies depending on the setting combination of SOM 1079 and HMO 97 as follows: **a.** SOM 1097 setting ON/HMO 97 setting ON --> Proprietary ANCHOR command Unavailable **b.** SOM 1097 setting ON/HMO 97 setting OFF --> Proprietary ANCHOR command Unavailable **c.** SOM 1097 setting OFF/HMO 97 setting ON --> Proprietary ANCHOR command Available **d.** SOM 1097 setting OFF/HMO 97 setting OFF --> Proprietary ANCHOR command Unavailable	OFF	-

Mode	Category	Description	Default	MCU/RCU
1083	Dynamic Provisioning Universal Volume Manager	The mode enables or disables DP-VOL deletion while an external volume associated with the DP-VOL with data direct mapping attribute is not disconnected. Mode 1083 = ON: DP-VOL deletion is enabled. Mode 1083 = OFF (default): DP-VOL deletion is disabled. **Notes:** **1.** This mode is applied when the following conditions are met. • A DP-VOL with data direct mapping attribute is deleted. • The data of external volume with data direct mapping attribute associated with a deletion target DP-VOL with data direct mapping attribute will not be used again. **2.** When SOM 1083 is set to ON, the data of external volumes cannot be guaranteed. **3.** When DP-VOL deletion is performed without disconnecting an external volume, the data of the external volume cannot be guaranteed.	OFF	-
1086	Dynamic Provisioning Dynamic Provisioning for Mainframe Universal Volume Manager	This mode enables or disables the performance improvement for Dynamic Provisioning volumes that are Universal Volume Manager volumes used as pool volumes. **Mode 1086 = ON (default):** The performance improvement is enabled. **Mode 1086 = OFF:** The performance improvement is disabled. **Notes:** **1.** This mode is applied when the IOPS performance of an external storage system is higher than 80k x the number of installed MPBs, which is the value of IOPS that an entire local storage system sends to an external storage system. **2.** When it is required to set the mode to OFF, if IOPS sent from the local storage system to the external storage system is higher than 80k x the number of installed MPBs, reduce the IOPS to lower than 80k x the number of installed MPBs, and then set the mode to OFF. (Otherwise CWP increases and cache is overloaded.)	OFF	-
1093	Dynamic Provisioning Dynamic Tiering Thin Image	This mode is used to disable background unmap during microcode downgrade from a version that supports pool reduction rate correction to a version that does not support the function. **Mode 1093 = ON:** Background unmap cannot work. **Mode 1093 = OFF (default):** Background unmap can work. **Note:** This mode is applied when downgrading microcode from a version that supports pool reduction rate correction to a version that does not support the function is disabled.	OFF	-

Mode	Category	Description	Default	MCU/RCU
1106	Dynamic Provisioning Dynamic Provisioning for Mainframe Dynamic Tiering Dynamic Tiering for Mainframe	This mode is used to monitor the page usage rate of parity groups defined to a pool, and perform rebalance to balance the usage rate if the rate differs significantly among parity groups. **Mode 1106 = ON:** The usage rate is checked once a day and the rebalance works if the rate is not even. **Mode 1106 = OFF (default):** The rebalance does not work even when the usage rate is not balanced. The pool usage rate is determined as unbalanced when there is 25% or more difference between the usage rate of each parity group in the pool and the average. Note: For HDT pools (including those with active flash attribute), the average of parity group usage rates is calculated per tier. Examples: **1.** In an HDP pool, if the usage rates of PG1, PG2, and PG3 are 50%, 40%, and 30% respectively, it is not determined as unbalanced. Because the average parity group usage rate is (50% + 40%+ 30%) / 3 = 40% and the difference in the rate between each parity group and the average is 10% at the maximum. **2.** In an HDP pool, if the usage rates of PG1, PG2, and PG3 are 80%, 40%, and 30% respectively, it is determined as unbalanced. Because the average parity group usage rate is (80% + 40%+ 30%) / 3 = 50% and the difference in the rate between each parity group and the average is 30% at the maximum. **3.** In an HDT pool, if the usage rates of PG1, PG2, and PG3 are 80% (SSD), 40% (SAS15K) and 30% (SAS15K), it is not determined as unbalanced, because: - the average parity group usage rate of Tier1 is (80%) / 1 = 80% and the difference in the rate between the parity group and the average is 0%. - the average parity group usage rate of Tier2 is (40%+ 30%) / 2 = 35% and the difference in the rate between the parity group and the average is 5% at the maximum. **Note:** This mode is applied when balancing the usage rate is required at a customer site where the usage rate is not even.	OFF	-
1115	Deduplication and Compression	When this mode is set to ON, data is initialized without using metadata at LDEV format for a virtual volume with Capacity Saving enabled. **Mode 1115 = ON:** When LDEV format is performed for a virtual volume whose capacity saving setting is Compression, the data is initialized without using the metadata.	OFF	-

Mode	Category	Description	Default	MCU/RCU
		Mode 1115 = OFF (default): When LDEV format is performed for a virtual volume whose capacity saving setting is Compression, normal formatting is performed, but if one of the following conditions is met, the data is initialized without using metadata. • There is a pinned slot. • The capacity saving status is "Failed". • The virtual volume is blocked (Normal restore cannot be performed). **Notes:** **1.** This mode is applied to recover a blocked pool volume in a pool to which a virtual volume whose capacity saving setting is Compression belongs. For the information of setting timing, refer to the procedure for blocked pool volume recovery in the Maintenance Manual. **2.** The processing time increases with increase in pool capacity. Estimate of processing time: Processing time (minutes) = ceil(pool capacity (TB)/40) + 5 ceil: The value enclosed in *ceil( )* must be rounded up to the nearest whole number. The processing finishes early if there is less capacity of allocated pages. **3.** Do not change the mode setting during LDEV format for a virtual volume whose capacity saving setting is Compression. If the setting is changed, the processing cannot be performed correctly and may end abnormally depending on the timing. **4.** The mode is effective only for LDEV format for a virtual volume whose capacity saving setting is Compression, so that there is no side effect in relation to user data, but the processing may take more time than that when the mode is set to OFF depending on the pool capacity. Therefore, basically do not use the mode for cases other than pool volume blockage recovery.		
1119	Deduplication and Compression	This mode is used to downgrade the microcode as follows while capacity saving is enabled: • VSP G1000, VSP G1500, VSP F1500: From 80-05-05-00/00 or later to 80-05-01-00/00 or later • VSP Gx00 models, VSP Fx00 models: From 83-04-03-x0/00 or later to 83-04-01-x0/00 or 83-04-02-x0/00 New control information is added with 80-05-05/83-04-03 for the inflow control processing when capacity saving is enabled. However, it must be guaranteed that the area is not used when the microcode version is 80-05-01/83-04-01 or later. This system option mode disables the control information added with 80-05-21/83-04-21 when capacity saving is enabled to enable microcode downgrade. **Mode 1119 = ON:** The control information is not used when capacity saving is enabled.	OFF	-

Mode	Category	Description	Default	MCU/RCU
		Mode 1119 = OFF (default): The control information is used when capacity saving is enabled. **Notes:** **1.** Set this mode to ON when the microcode downgrade described above is performed, even if capacity saving is not currently in use but has been used before. **2.** After the microcode downgrade is complete, make sure to set the mode to OFF. **3.** The mode is effective for the entire storage system. **4.** The write performance might degrade when this mode is ON.		

2

Managing virtual storage machine resources

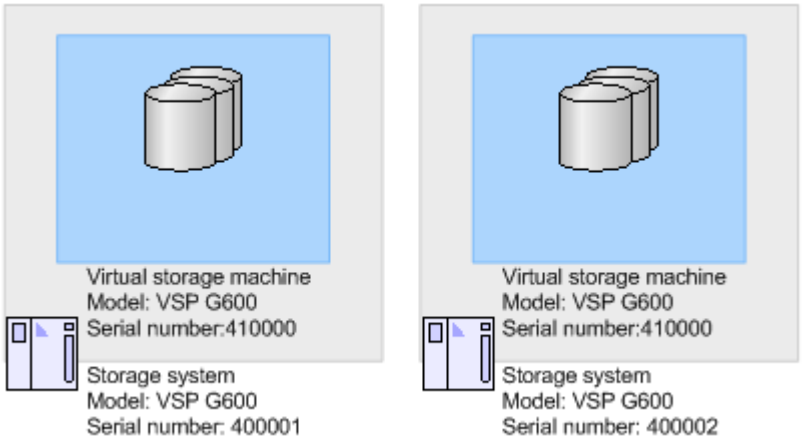
The virtual storage machine is the unit that is used to manage virtualized resources for each storage system. For software with global storage virtualization functions (for example, global-active device, nondisruptive migration), a virtual storage machine is created in the storage system.

For example, if nondisruptive migration is used to migrate a storage system to a Virtual Storage Platform G200, G400, G600, G800 storage system, the virtualized storage system is the migration source storage system. The migration source storage system is created in the migration target storage system. In global-active device (GAD), the virtualized storage system is the storage system that contains the secondary volume (S-VOL) of the GAD pair.

About virtual storage machines and virtualized resources

For operations involving virtualized resources in a virtual storage machine, physical resources must be linked to virtualized resources. For example, when you perform operations on LDEVs in a virtual storage machine, you must specify physical LDEV IDs (not virtual LDEV IDs) that link to resources in a virtual storage machine.

The following figure illustrates the relationship between a (physical) storage system and virtual storage machines. Virtual storage machines are used only for operations involving data migration or global-active device.



Information about the virtualized resources of a virtual storage machine appears in Device Manager - Storage Navigator with associated physical storage information. If the information about these resources is not displayed by default, you can change the column settings in the table options.

The following terms about virtualized resources are displayed in the Device Manager - Storage Navigator windows. For information about using Command Control Interface to display virtualized resources and remove virtual storage machines, see the *Command Control Interface User and Reference Guide*.

Term	Description
LDEV for which virtualization management is enabled	An LDEV that satisfies one of these conditions: • The model name and serial number of the virtual storage machine that manages a resource group with LDEVs are different than the storage system involved in the operation. • The model name and serial number of the virtual storage machine that manages a resource group with LDEVs are the same as

Term	Description
	the storage system involved in the operation, but the virtual LDEV ID and the LDEV ID are different.
LDEV for which virtualization management is disabled	An LDEV that satisfies both of these conditions: • The model name and serial number of the virtual storage machine that manages a resource group with LDEVs are the same as the storage system involved in the operation. • The virtual LDEV ID and the LDEV ID are the same.

Provisioning operations for resources in a virtual storage machine

For provisioning operations that involve virtualized resources in a virtual storage machine, you can perform provisioning operations that specify conventional physical resources or virtualized resources. However, provisioning operations that specify IDs of virtualized resources are limited.

For details about data management operations for virtualized resources, see the *Command Control Interface User and Reference Guide.*

Pair operations with virtual storage machine pairs

Specifying virtual IDs in pair operations

You can perform pair operations by specifying both of the following in the HORCM_LDEV parameters of the Command Control Interface configuration definition file:

- Serial number of the virtual storage machine in the `Serial#` parameter
- Virtual LDEV number in the `CU:LDEV(LDEV#)` parameter

You can perform conventional pair operations by specifying both of the following in the HORCM_LDEV parameters of the configuration definition file:

- Serial number of the physical storage system in the `Serial#` parameter
- Physical LDEV number in the `CU:LDEV(LDEV#)` parameter

Caution: If the following condition exists, the local copy pair operation cannot be performed by specifying virtual IDs:

- Primary volume and secondary volume are defined differently for the virtual storage machine.

If both of the following conditions exist, remote copy pair operations cannot be performed by specifying virtual IDs:

- The primary volume is an LDEV in a VSP, HUS VM, or USP V/VM storage system.
- The secondary volume is an LDEV in a VSP G200, G400, G600, G800 or VSP F400, F600, F800 storage system.

Caution: Global-active device pair operations that specify the virtual ID cannot be performed.

Displaying pair information

You can create pairs by specifying both of following in the HORCM_LDEV parameters of the Command Control Interface configuration definition file:
- Serial number of the physical storage system in the `Serial#` parameter
- Virtual LDEV number in the `CU:LDEV(LDEV#)` parameter

If the pair is created under the above conditions, the following are displayed as results of executing the `pairdisplay` command:
- Serial number of the virtual storage machine in the `Seq#` parameter
- Virtual LDEV number in the `LDEV#` parameter

You can create pairs by specifying both of the following in the HORCM_LDEV parameters of the configuration definition file:
- Serial number of the physical storage system in the `Serial#` parameter
- Physical LDEV number in the `CU:LDEV(LDEV#)` parameter

If the pair is created under the above conditions, the following are displayed as results of executing the `pairdisplay` command:
- Physical serial number of the virtual storage machine in the `Seq#` parameter
- Physical virtual LDEV number in the `LDEV#` parameter

Caution: You can create pairs by specifying both of the following in the HORCM_LDEV parameters of the configuration definition file:
- Serial number of the physical storage system in the `Serial#` parameter
- Physical LDEV number in the `CU:LDEV(LDEV#)` parameter

For pairs created under the above conditions, the device information that is recognized by the server and the device information that results from executing the `pairdisplay` command are different.

Software operations for resources in a virtual storage machine

For data management operations that involve virtualized resources in a virtual storage machine, you can perform data management operations that

specify conventional physical resources or virtualized resources. However, data management operations that specify IDs of virtualized resources are limited.

For details about data management operations for virtualized resources, see the *Command Control Interface User and Reference Guide.*

Editing virtualization management settings

You can edit the virtualization management settings of volumes to enable and disable virtualization management, set the virtual LDEV ID, and specify the virtual configuration (emulation type, CVS settings, and SSID).

Caution: If the setting of the LDEV virtualization management is canceled, Transient is displayed in the Virtual LDEV ID and Failed is displayed on the Status column in the Task window. To resolve the transient status, perform one of the following operation on the LDEVs:

- Resolve the cause of the failure by addressing the error message in the Task window, and then retry the same operation by using the Edit Virtualization Management Settings window.
- In the Edit Virtualization Management Settings window, set Virtual Management Settings to Disable before applying the setting to the storage system.

Before you begin

You must have Security Administrator (View & Modify) role to perform this task.

Procedure

1. In the **Administration** tree, select **Resource Groups**.
2. Select the resource group that has the volume with the virtualization management settings you want to edit.
3. In the **LDEVs** tab, select the volume with the virtualization management settings you want to edit.
4. Click **Edit Virtualization Management Settings**.
5. In **Virtualization Management Settings**, select one of the following virtualization management settings:
   - **Enable**: Virtualization management can be used. You can set an initial virtual LDEV ID or the virtual configuration, or both.
   - **Enable (Not Set)**: Virtualization management can be used. However, you cannot set the initial virtual LDEV ID or virtual configuration.
   - **Disable**: Virtual management cannot be used.
6. If you select **Enable** in **Virtualization Management Settings** and can set a virtual LDEV ID, set the starting virtual LDEV ID for **Initial Virtual LDEV ID**.

A virtual LDEV ID that is not used in the virtual storage machine is assigned at the interval specified in Interval, sequentially starting from the specified virtual LDEV ID.

Note: If the virtual storage machine is the same as the storage system, assign a virtual LDEV ID that is different from the LDEV ID of the selected LDEV. If the virtual storage machine is the same as the storage system and you need to assign a virtual LDEV ID that is the same as the LDEV ID of the selected LDEV, select **Disable** in **Virtualization Management Settings**.

Caution: If the virtual storage machine is configured by multiple storage systems, a virtual LDEV ID that is already used in another storage system might be assigned. In such a configuration, set the interval so that a virtual LDEV ID that is already used in another storage system is not assigned.

7. If you select **Enable** in **Virtualization Management Settings**, select **Virtual Configuration**. If you want to specify the virtual configuration of the LDEV (to make the configuration different from that of the LDEV), select **Specify**. If you do not want to specify the virtual configuration of the LDEV (to make the configuration the same as that of the LDEV), select **Not Set**.
   a. In **Emulation Type**, select the virtual emulation type. For the virtual emulation type, which is similar to the emulation type, set one of the emulation types that exists in the same group of 32 volumes with LDEV IDs.
   b. Select **CVS Settings**.
   c. In **Number of Concatenated LDEVs**, specify the number of concatenated virtual LDEVs with a value from 1 to 36 (decimal number).
      If you do not concatenate virtual LDEVs, enter 1.
   d. In **SSID**, specify a virtual SSID with a value from 0004 to FFFE (hexadecimal number).

      Set a virtual SSID for each virtual LDEV address (64, 128, 256) in the virtual storage machine.

      Note: For the virtual configuration, the specified values are set for all selected LDEVs.

8. Click **Finish**.
9. Enter the task name in **Task Name**.
10. Click **Apply**.

The task is registered, and if the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

3

Creating resource groups and managing storage system resources

You can divide a provisioned storage system into resource groups that allow you to manage the storage system as multiple virtual private storage systems. Configuring resource groups involves creating resource groups, moving storage system resources into the resource groups, and assigning resource groups to user groups.

Resource group strategies

A storage system can connect to multiple hosts and be shared by multiple divisions in a company or by multiple companies. Many storage administrators from different organizations can access the storage system. Managing the entire storage system can become complex and difficult. Potential problems are that private data might be accessed by other users, or a volume in one organization might be accidentally destroyed by a storage administrator in another organization.

To avoid such problems, use Hitachi Resource Partition Manager software to set up resource groups that allow you to manage one storage system as multiple virtual private storage systems. The storage administrator in each resource group can access only their assigned resources. Resource groups prevent the risk of data leakage or data destruction by another storage administrator in another resource group.

Resources such as LDEVs, parity groups, iSCSI targets, external volumes, ports, or host groups can be assigned to a resource group. These resources can be combined to flexibly compose a virtual private storage system.

Resource groups should be planned and created before creating volumes. For more information, see Creating resource groups and managing storage system resources on page 79.

System configuration using resource groups

Configuring resource groups prevents the risk of data leakage or data destruction by another Storage Administrator in another resource group. The Storage Administrator considers and plans which resource should be managed by which user, and then the Security Administrator creates resource groups and assigns each resource to the resource groups.

A resource group is assigned one or more storage system resources. The following resources can be assigned to resource groups.

- LDEV IDs
- Parity groups
- External volumes
- Ports
- Host group IDs
- iSCSI target IDs

Note: Before you create LDEVs, the LDEV IDs can be reserved and assigned to a resource group for future use. Host group numbers can also be reserved and assigned in advance because the number of host groups created on a single port is limited. The iSCSI targets numbers can also be reserved and

assigned in advance because the number of iSCSI targets created on a single port is limited.

The following tasks provide instructions for configuring resource groups.

- Creating resource groups on page 87
- Editing resource groups on page 88
- Deleting resource groups on page 89

Resource group examples

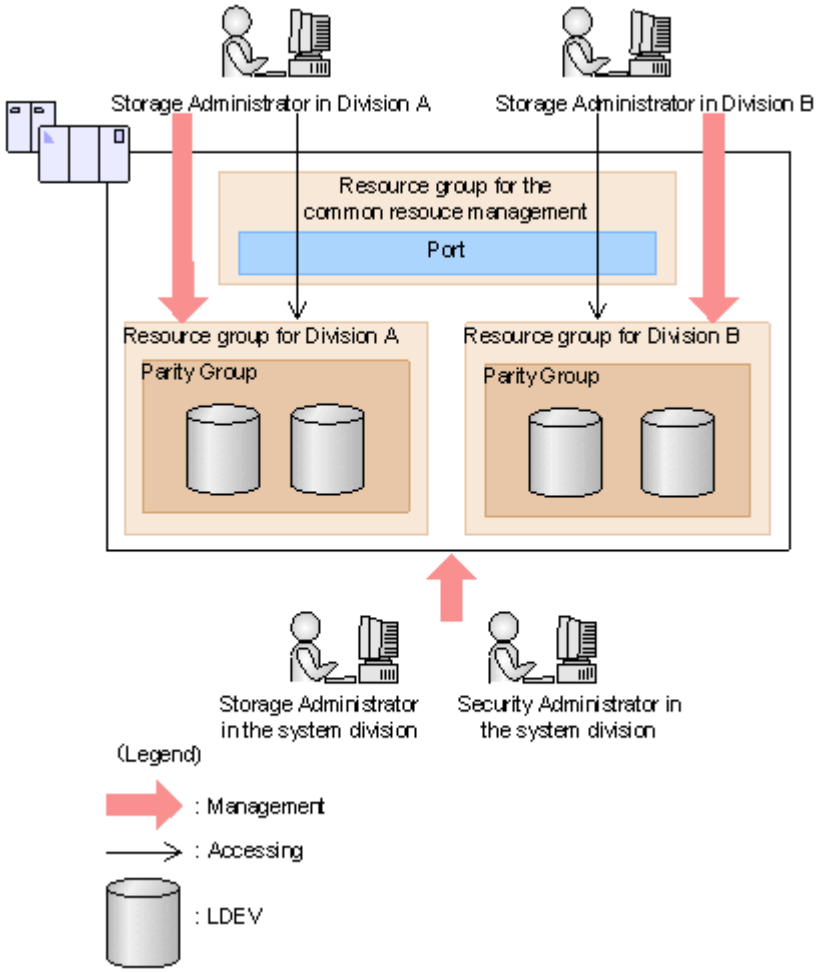
The following examples illustrate how you can configure resource groups on your storage system.

- Example of resource groups sharing a port on page 81
- Example of resource groups not sharing ports on page 83

Example of resource groups sharing a port

If you have a limited number of ports, you can still operate a storage system effectively by sharing ports using resource groups.

The following example shows the system configuration of an in-house division providing virtual private storage system for two divisions. Divisions A and B each use their own assigned parity group, but share a port between the two divisions. The shared port is managed by the system division.



The Security Administrator in the system division creates resource groups for each division in the storage system and assigns them to the respective divisions. The Storage Administrator in Division A can manage the resource groups for Division A, but cannot access the resource groups for Division B. In the same manner, the Storage Administrator in Division B can manage the resource groups for Division B, but cannot access the resource groups for Division A.

The Security Administrator creates a resource group for managing the common resources, and the Storage Administrator in the system division manages the port that is shared between Divisions A and B. The Storage Administrators in Divisions A and B cannot manage the shared port belonging to the resource group for common resources management.

Configuration workflow for resource groups sharing a port

1. The system division forms a plan about the resource group creation and assignment of the resources.
2. The Security Administrator creates the resource groups. For more information, see Creating resource groups on page 87.

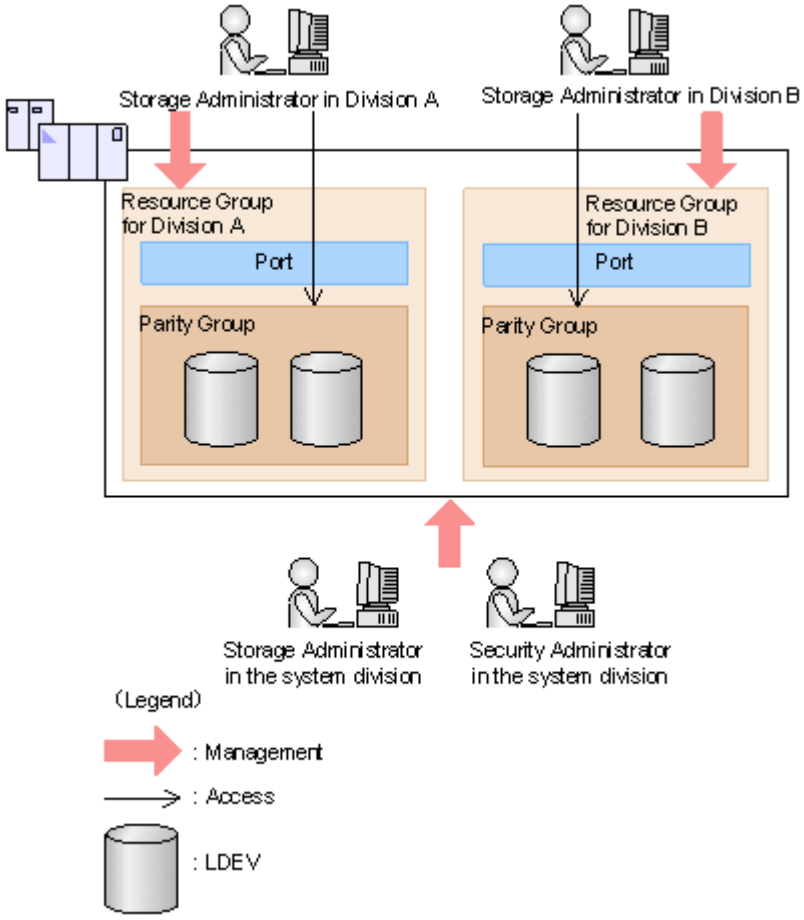
3. The Security Administrator creates the user groups.
   For more information, see the *System Administrator Guide*.
4. The Security Administrator assigns the resource groups to the user groups.
   For more information, see the *System Administrator Guide*.
5. The Storage Administrator in the system division sets a port.
6. The Security Administrator assigns resources to the resource groups. For more information, see Editing resource groups on page 88.
7. The Security Administrator assigns the Storage Administrators to the appropriate user groups.
   For more information, see the *System Administrator Guide*.

After the above procedures, the Storage Administrators in A and B divisions can manage the resource groups assigned to their own division.

Example of resource groups not sharing ports

If you assign ports to each resource group without sharing, performance can be maintained on a different port even if the bulk of I/O is issued from one side port.

The following shows a system configuration example of an in-house system division providing the virtual private storage system for two divisions. Divisions A and B each use individual assigned ports and parity groups. In this example, they do not share a port.



The Security Administrator in the system division creates resource groups for each division in the storage system and assigns them to the respective divisions. The Storage Administrator in Division A can manage the resource groups for Division A, but cannot access the resource groups for Division B. In the same manner, the Storage Administrator in Division B can manage the resource groups for Division B, but cannot access the resource groups for Division A.

Configuration workflow for resource groups not sharing a port

1. The system division forms a plan about creating resource groups and the assigning resources to the groups.
2. The Security Administrator creates the resource groups. For more information, see Creating resource groups on page 87.
3. The Security Administrator creates the user groups.
   For more information, see the *System Administrator Guide*.
4. The Security Administrator assigns the resource groups to user groups.
   For more information, see the *System Administrator Guide*.
5. The Storage Administrator in the system division sets ports.

6. The Security Administrator assigns resources to the resource groups. For more information, see Editing resource groups on page 88.
7. The Security Administrator assigns each Storage Administrator to each user group.
   For more information, see the *System Administrator Guide*.

After the above procedures, the Storage Administrators in A and B divisions can access the resource groups allocated to their own division.

Meta_resource

The meta_resource is a resource group comprised of additional resources (other than external volumes) and the resources that exist on the storage system before the Resource Partition Manager is installed. By default, existing resources initially belong to the meta_resource group to ensure compatibility with older software when a system is upgraded to include Resource Partition Manager.

Resource lock

While processing a task on a resource, all of the resource groups assigned to the logged-on user are locked for exclusive access.

A secondary window (such as the **Basic Information Display**) or an operation from the service processor (SVP) locks all of the resource groups in the storage system.

When a resource is locked, a status indicator appears on the Device Manager - Storage Navigator status bar. Click the Resource Locked button to view information about the locked resource.

User groups

User groups and associated built-in roles are defined in Device Manager - Storage Navigator. A user belongs to one or more user groups. Privileges allowed to a particular user are determined by the user group or groups to which the user belongs.

The Security Administrator assigns resource groups to user groups. A user group might already be configured, or a new user group might be required for certain resources.

For more information, see the System Administrator Guide of your storage system.

Resource group assignments

All resource groups are normally assigned to the Security Administrator and the Audit Log Administrator.

Each resource group has a designated Storage Administrator who can access only their assigned resources and cannot access other resources.

All resource groups to which all resources in the storage system belong can be assigned to a user group. Configure this in Device Manager - Storage Navigator by setting All Resource Groups Assigned to Yes.

A user who has All Resource Groups Assigned set to Yes can access all resources in the storage system. For example, if a user is a Security Administrator (with View & Modify privileges) and a Storage Administrator (with View and Modify privileges) and All Resource Groups Assigned is Yes on that user account, the user can edit the storage for all the resources.

If allowing this access becomes a problem with security on the storage system, then register the following two user accounts and use these different accounts for different purposes.

- A user account for a Security Administrator where All Resource Groups Assigned is set to Yes.
- A user account for a Storage Administrator who does not have all resource groups assigned and has only some of the resource groups assigned.

Operations in a resource group for NAS modules

In the storage system in which the NAS module is installed, a resource group for NAS is created with the name NAS_Platform_System_RSG. Resources in NAS_Platform_System_RSG, such as LDEV format or delete, cannot be operated. Therefore, move resources in NAS_Platform_System_RSG to a different resource group before operating. For about operations for NAS_Platform_System_RSG, contact customer support.

Resource group license requirements

Use of Resource Partition Manager on your storage system requires the following:

- A license key for the Resource Partition Manager software product. For details about the license key or software product installation, see the System Administrator Guide for your storage system.

Resource group rules, restrictions, and guidelines

Rules

- The maximum number of resource groups that can be created on a storage system is 1023. However, if the NAS module is installed in the storage system, the maximum number of resource groups that can be created on the storage system is 1022.
- A Storage Administrator with the Security Administrator (View & Modify) role can create resource groups and assign resources to resource groups.
- Resources removed from a resource group are returned to meta_resource.
- Only a Security Administrator (View & Modify) can manage the resources in assigned resource groups.

Restrictions

- No new resources can be added to meta_resource and NAS_Platform_System_RSG.
- Resources cannot be deleted from meta_resource and NAS_Platform_System_RSG.
- LDEVs with the same pool IDs or journal IDs cannot be added to multiple resource groups.

  In the case of adding LDEVs that are used as pool volumes or journal volumes, add all the LDEVs that have the same pool IDs or journal IDs by using a function such as sort.

Guidelines

- If you are providing a virtual private storage system to different companies, you should not share parity groups, external volumes, or pools if you want to limit the capacity that can be used by each user. When parity groups, external volumes, or pools are shared between multiple users, and if one user uses too much capacity of the shared resource, the other users might not be able to create an LDEV.

Managing resource groups

Managing resource groups includes creating, editing, and deleting resource groups.

Creating resource groups

When you create a resource group, you enter a name and assign the desired resources (parity groups, LDEVs, ports, host groups, and iSCSI targets) to the new group. You can create more than one resource group at a time.

Note the following restrictions for creating a resource group:

- The maximum number of resource groups that can be created on a storage system is 1023. If the NAS module is installed in the storage system, the maximum number of resource groups that can be created on the storage system is 1022.
- A resource group name can use alphanumeric characters, spaces, and the following symbols: ! # $ % & ' ( ) + - . = @ [ ] ^ _ ` { } ~
- The characters in a resource group name are case-sensitive.
- Duplicate occurrences of the same name are not allowed.
- You cannot use the following names: `meta_resource`, `NAS_Platform_System_RSG`

Before you begin

You must have Security Administrator (View & Modify) role to perform this task.

Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree, click the **Administration** tab, and then select **Resource Groups**.
2. Click **Create Resource Groups**.
3. In the **Create Resource Groups** window, enter the name for the new group, select the desired resources for the new group, and click **Add** to add the new group to list of resource groups to be added.
4. Repeat the previous step for each new resource group to be added. If you need to remove a group from the list of resource groups to be added, select the group, and click **Remove**.
5. When you are finished configuring new resource groups in the **Create Resource Groups** window, click **Next**.
6. Enter a task name or accept the default, and then click **Submit**.

   If you select **View task status**, the **Tasks & Alerts** tab opens.

Editing resource groups

You can add resources to, remove resources from, and rename existing resource groups.

Note the following restrictions for editing resource groups:

- Only resources allocated to meta_resource can be added to resource groups.
- Resources removed from a resource group are returned to meta_resource.
- No resource can be added to or removed from meta_resource.
- The name of the meta_resource group cannot be changed or used for any resource group other than the meta_resource group.
- Duplicate occurrences of the same name are not allowed.
- Resource group names can include alphanumeric characters, spaces, and the following symbols: ! # $ % & ' ( ) + - . = @ [ ] ^ _ ` { } ~
- Resource group names are case-sensitive.

- LDEVs with the same pool ID or journal ID cannot be added to multiple resource groups or partially removed from a resource group. For example, if two LDEVs belong to the same pool, you must allocate both to the same resource group. You cannot allocate them separately.
  You cannot partially remove LDEVs with the same pool ID or journal ID from a resource group. If LDEV1 and LDEV2 belong to the same pool, you cannot remove LDEV1 leave only LDEV2 in the resource group.
  Use the sort function to sort the LDEVs by pool ID or journal ID. Then select the IDs and add or remove them all at once.
- Host groups that belong to the initiator port cannot be added to a resource group.
- To add or delete DP pool volumes, you must first add or delete DP pools.

Before you begin

You must have Security Administrator (View & Modify) role to perform this task.

Procedure

1. In the **Explorer** pane, click the **Administration** tab, and then select **Resource Groups**.
2. Select the desired resource group (check the box next to the name of the resource group) to display the resource information for the resource group.
   - To change the name of the selected resource group, click **Edit Resource Group**, and enter the new name.
   - To add resources to the selected resource group, select the **Parity Groups**, **LDEVs**, **Ports**, or **Host Groups / iSCSI Targets** tab, click **Add Resources**, and follow the instructions on the **Add Resources** window.
   - To remove resources from the selected resource group, select the **Parity Groups**, **LDEVs**, **Ports**, or **Host Groups / iSCSI Targets** tab, select the resources to be removed, and then click **Remove Resources**.
3. Enter a task name or accept the default, and then click **Submit**.
   If you select **View task status**, the **Tasks & Alerts** tab opens.

Deleting resource groups

You can delete a resource group only when the resource group does not contain any resources and is not assigned to any user groups.

The following resource groups cannot be deleted:

- `meta_resource`, `NAS_Platform_System_RSG`
- A resource group that is assigned to a user group
- A resource group that has resources assigned to it

- Resource groups included in different resource groups cannot be removed at the same time.

Before you begin

The Security Administrator (View & Modify) role is required to perform this task.

Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree, click the **Administration** tab, select **Resource Groups**.
2. Click the check box of a **Resource Group Name**.
3. Click **Delete Resource Groups**.
4. Enter a task name or accept the default, and then click **Submit**.
   If you select **View task status**, the **Tasks & Alerts** tab opens.

Using Resource Partition Manager and other software products

To use Resource Partition Manager with other storage system software products, the resources that are required for the operation must satisfy specific conditions.

Dynamic Provisioning, Dynamic Tiering, or active flash

The following table provides information about specific Dynamic Provisioning conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Create LDEVs	If DP-VOLs are created, the following must be assigned to the Storage Administrator group that is permitted to manage them. • LDEV ID • Pool-VOL of the pool
Delete LDEVs	If DP-VOLs are deleted, the following must be assigned to the Storage Administrator group that is permitted to manage them. • LDEV ID • Pool-VOL of the pool
Create pools Expand pools	Volumes to be specified as pool-VOLs must be assigned to the Storage Administrator group permitted to manage them. All the volumes that are specified when creating a pool must belong to the same resource group.
Edit pools Delete pools	Pool-VOLs of the specified pool must be assigned to the Storage Administrator group permitted to manage them.
Expand V-VOLs	You can expand only the DP-VOLs that are assigned to the Storage Administrator group permitted to manage them.

Operation name	Condition
Reclaim zero pages Stop reclaiming zero pages	You can reclaim or stop reclaiming zero pages only for the DP-VOLs that are assigned to the Storage Administrator group permitted to manage them.

Encryption License Key

The following table provides information about specific Encryption License Key conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Edit encryption keys	When you specify a parity group and open the **Edit Encryption** window, the specified parity group and LDEVs carved from the parity group must be assigned to the Storage Administrator group permitted to manage them. When you open the **Edit Encryption** window without specifying a parity group, more than one parity group and LDEVs carved from the parity group must be assigned to the Storage Administrator group permitted to manage them.

LUN Manager

The following table provides information about specific LUN Manager conditions that must be observed when using Resource Partition Manager.

For Fibre Channel

Operation name	Condition
Add LUN paths	When you specify host groups and open the **Add LUN Paths** window, the specified host groups must be assigned to the Storage Administrator group permitted to manage them. When you specify LDEVs and open the **Add LUN paths** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them.
Delete LUN paths	When you specify a host group and open the **Delete LUN Paths** window, the specified host group must be assigned to the Storage Administrator group permitted to manage them. When you specify LDEVs and open the **Delete LUN Paths** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them. When selecting the Delete all defined LUN paths to above LDEVs check box, the host groups of all the alternate paths in the LDEV displayed on the Selected LUNs table must be assigned to the Storage Administrator group permitted to manage them.
Edit host groups	The specified host groups and initiator ports must be assigned to the Storage Administrator group permitted to manage them.

Operation name	Condition
Add hosts	The specified host groups must be assigned to the Storage Administrator group permitted to manage them.
Edit hosts	The specified host group must be assigned to the Storage Administrator group permitted to manage them. When you select the Apply same settings to the HBA WWN of all ports check box, all the host groups where the specified HBA WWNs are registered must be assigned to the Storage Administrator group permitted to manage them.
Remove hosts	When you select the Remove hosts from all host groups containing the hosts in the storage system check box, all the host groups where the HBA WWNs displayed in the Selected Hosts table are registered must be assigned to the Storage Administrator group permitted to manage them.
Edit ports	The specified port must be assigned to the Storage Administrator group permitted to manage them.
Create alternative LUN paths	The specified host groups and all the LDEVs where the paths are set to the host groups must be assigned to the Storage Administrator group permitted to manage them.
Copy LUN paths	The specified host groups and the LDEVs where the paths are set must be assigned to the Storage Administrator group permitted to manage them.
Edit command devices	LDEVs where the specified paths are set must be assigned to the Storage Administrator group permitted to manage them.
Edit UUIDs	The specified LDEV must be assigned to the Storage Administrator group permitted to manage them.
Delete UUIDs	The specified LDEV must be assigned to the Storage Administrator group permitted to manage them.
Create host groups	When you open the **Create Host Groups** window by specifying host groups, the specified host groups must be assigned to the Storage Administrator group permitted to manage them.
Delete host groups	The specified host groups and all the LDEVs where the paths are set to the host groups must be assigned to the Storage Administrator group permitted to manage them.
Release Host-Reserved LUNs	LDEVs where the specified paths are set must be assigned to you.

For iSCSI

Operation name	Condition
Add LUN paths	When you specify host groups and open the **Add LUN Paths** window, the specified iSCSI target must be assigned to the Storage Administrator group permitted to manage them. When you specify LDEVs and open the **Add LUN paths** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them.
Delete LUN paths	When you specify an iSCSI target and open the **Delete LUN Paths** window, the specified iSCSI target must be assigned to the Storage Administrator group permitted to manage them.

Operation name	Condition
	When you specify LDEVs and open the **Delete LUN Paths** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them. When selecting the Delete all defined LUN paths to above LDEVs check box, the iSCSI target of all the alternate paths in the LDEV displayed on the Selected LUNs table must be assigned to the Storage Administrator group permitted to manage them.
Add hosts	The specified iSCSI target must be assigned to the Storage Administrator group permitted to manage them.
Edit hosts	The specified iSCSI target must be assigned to the Storage Administrator group permitted to manage them. When you select the Apply same settings to the HBA WWN of all ports check box, all the iSCSI targets where the specified HBA WWNs are registered must be assigned to the Storage Administrator group permitted to manage them.
Remove hosts	The specified iSCSI target must be assigned to the Storage Administrator group permitted to manage them.
Edit ports	The specified port must be assigned to the Storage Administrator group permitted to manage them.
Create alternative LUN paths	The specified iSCSI target and all the LDEVs where the paths are set to the iSCSI target must be assigned to the Storage Administrator group permitted to manage them.
Copy LUN paths	The specified iSCSI target and the LDEVs where the paths are set must be assigned to the Storage Administrator group permitted to manage them.
Edit command devices	LDEVs where the specified paths are set must be assigned to the Storage Administrator group permitted to manage them.
Edit UUIDs	The specified LDEV must be assigned to the Storage Administrator group permitted to manage them.
Delete UUIDs	The specified LDEV must be assigned to the Storage Administrator group permitted to manage them.
Release Host-Reserved LUNs	LDEVs where the specified paths are set must be assigned to you.
Create iSCSI targets	When you open the **Create iSCSI targets** window by specifying iSCSI targets, the specified iSCSI targets must be assigned to the Storage Administrator group permitted to manage them.
Edit iSCSI targets	The specified iSCSI targets and ports must be assigned to the Storage Administrator group permitted to manage them.
Delete iSCSI targets	The specified iSCSI targets and all the LDEVs where the paths are set to the iSCSI targets must be assigned to the Storage Administrator group permitted to manage them.

Performance Monitor

The following table provides information about specific Performance Monitor conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Add to ports	The specified ports must be assigned to the Storage Administrator group permitted to manage them.
Add new monitored WWNs	
Edit WWNs	

ShadowImage

The following table provides information about specific ShadowImage conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Create pairs	Both primary volume and secondary volumes must be assigned to the Storage Administrator group permitted to manage them.
Split pairs	Primary volumes must be assigned to the Storage Administrator group permitted to manage them.
Suspend pairs	
Resynchronize pairs	
Release pairs	

Thin Image

The following table provides information about specific Thin Image conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Create LDEVs	If LDEVs for Thin Image are created, the following must be assigned to the Storage Administrator group that is permitted to manage them. • LDEV ID • Pool VOL of the pool
Delete LDEVs	If LDEVs for Thin Image are deleted, the following must be assigned to the Storage Administrator group that is permitted to manage them. • LDEV ID • Pool VOL of the pool
Create pools Expand Pool	Volumes that are specified when creating or expanding pools must be assigned to the Storage Administrator group that is permitted to manage them. All the volumes that are specified when creating pools must belong to the same resource group.
Edit Pools Delete Pools	Pool-VOLs of the specified pools must be assigned to the Storage Administrator group that is permitted to manage them.
Create pairs	Both primary volumes and secondary volumes must be assigned to the Storage Administrator group that is permitted to manage them.
Split pairs	Primary volumes must be assigned to the Storage Administrator group that is permitted to manage them.

Operation name	Condition
Suspend pairs	
Resynchronize pairs	
Release pairs	

TrueCopy

The following table provides information about specific TrueCopy conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Edit Ports	Specified ports must be assigned to the user.
Add Remote Connection	Specified initiator ports must be assigned to the user.
Edit Remote Connection Options	Operation can be performed with no conditions.
Create Pairs	Primary volumes must be assigned to the user. Initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Split Pairs	Specified primary volumes or secondary volumes must be assigned to the user.
Resync Pairs	Primary volumes must be assigned to the user.
Delete Pairs	Specified volumes must be assigned to the user. If primary volumes are specified, the initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Edit Pair Options	Primary volumes must be assigned to the user.
Add Remote Paths	Specified initiator ports must be assigned to the user.
Remove Remote Paths	Specified initiator ports must be assigned to the user.
Edit Remote Connection Options	Initiator ports of remote paths that are connected to a specified remote storage must be assigned to the user.
Remove Remote Connections	Initiator ports of remote paths that are connected to a specified remote storage must be assigned to the user.
Force Delete Pairs	Specified primary volumes or secondary volumes must be assigned to the user.

Global-active device

The following table provides information about specific global-active device conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Edit Ports	Specified ports must be assigned to the user.
Add Remote Connection	Specified initiator ports must be assigned to the user.

Operation name	Condition
Edit Remote Connection Options	Operation can be performed with no conditions.
Create Pairs	Primary volumes must be assigned to the user. Initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Split Pairs	Specified primary volumes or secondary volumes must be assigned to the user.
Resync Pairs	Primary volumes must be assigned to the user.
Delete Pairs	Specified volumes must be assigned to the user. If primary volumes are specified, the initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Edit Pair Options	Primary volumes must be assigned to the user.
Add Remote Paths	Specified initiator ports must be assigned to the user.
Remove Remote Paths	Specified initiator ports must be assigned to the user.
Edit Remote Connection Options	Initiator ports of remote paths that are connected to a specified remote storage must be assigned to the user.
Remove Remote Connections	Initiator ports of remote paths that are connected to a specified remote storage must be assigned to the user.
Force Delete Pairs	Specified primary volumes or secondary volumes must be assigned to the user.
Add Quorum Disks	LDEVs to be set as quorum disks must be assigned to the user.
Remove Quorum Disks	LDEVs to be set as quorum disks must be assigned to the user.

Universal Replicator

The following table provides information about specific Universal Replicator conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Edit Ports	Specified ports must be assigned to the user.
Add Remote Connection	Specified initiator ports must be assigned to the user.
Add Remote Paths	Specified initiator ports must be assigned to the user.
Create Journals	All LDEVs that are specified when creating a journal must belong to the same resource group. Volumes to be assigned to a journal must be assigned to the user.
Assign Journal Volumes	Volumes to be assigned to a journal must be assigned to the user. All volumes to be assigned to a journal must belong to a same resource group to which the existing journal volumes belong.
Assign MP Unit	Journal volumes must be assigned to the user.
Edit Remote Connection Options	Operation can be performed with no conditions.
Create Pairs	Journal volumes for pair volumes and primary volumes must be assigned to the user.

Operation name	Condition
	Initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Split Pairs	Specified primary volumes or secondary volumes must be assigned to the user.
Split Mirrors	All data volumes configured to a mirror must be assigned to the user.
Resync Pairs	Primary volumes must be assigned to the user.
Resync Mirrors	All data volumes configured to a mirror must be assigned to the user.
Delete Pairs	Specified volumes or secondary volume must be assigned to the user. Initiator ports of remote paths that are connected with the primary volume in the remote storage must be assigned to the user.
Delete Mirrors	All data volumes configured to a mirror must be assigned to the user.
Edit Pair Options	Primary volumes must be assigned to the user.
Force Delete Pairs	Specified volumes must be assigned to the user.
Edit Journal Options	All data volumes consisting of the specified journal must be assigned to the user. Journal volumes must be assigned to the user.
Edit Mirror Options	All data volumes configuring the specified journal must be assigned to the user. Journal volumes must be assigned to the user.
Remove Journals	Journal volumes must be assigned to the user.
Edit Remote Connection Options	Initiator ports of remote paths that are connected to a specified remote storage must be assigned to the user.
Remove Remote Paths	Specified initiator ports must be assigned to the user.
Move LDEVs to other resource groups	When you move LDEVs used for journal volumes to other resource groups, you must specify all the journal volumes of the journal to which the LDEVs belong.
Assign Remote Command Devices	Journal volumes must be assigned to the user. Specified remote command devices must be assigned to the user.
Release Remote Command Devices	Journal volumes must be assigned to the user. Specified remote command devices must be assigned to the user.

Universal Volume Manager

The following table provides information about specific Universal Volume Manager conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Add external volumes	When creating an external volume, a volume is created in the resource group where the external port belongs.

Operation name	Condition
	When you specify a path group and open the **Add External Volumes** window, all the ports that compose the path group must be assigned to the Storage Administrator group permitted to manage them.
Delete external volumes	The specified external volume and all the LDEVs allocated to that external volume must be assigned to the Storage Administrator group permitted to manage them.
Disconnect external storage systems	All the external volumes belonging to the specified external storage system and all the LDEVs allocated to that external volumes must be assigned to the Storage Administrator group permitted to manage them.
Reconnect external storage systems	All the external volumes belonging to the specified external storage system and all the LDEVs allocated to that external volumes must be assigned to the Storage Administrator group permitted to manage them.
Disconnect external volumes	The specified external volume and all the LDEVs allocated to the external volumes must be assigned to the Storage Administrator group permitted to manage them.
Reconnect external volumes	The specified external volume and all the LDEVs allocated to the external volumes must be assigned to the Storage Administrator group permitted to manage them.
Edit external volumes	The specified external volume must be assigned to the Storage Administrator group permitted to manage them.
Assign MP Unit	The specified external volumes and all the ports of the external paths connecting the external volumes must be assigned to the Storage Administrator group permitted to manage them.
Disconnect external paths	Ports of the specified external paths and all the external volumes connecting with the external path must be assigned to the Storage Administrator group permitted to manage them. When you specify By Ports, all the external paths connecting with the specified ports and all the external volumes connecting with the external paths must be assigned to the Storage Administrator group permitted to manage them. When you specify By External WWNs, all the ports of the external paths connecting to the specified external WWN and all the external volumes connecting with those external paths must be assigned to the Storage Administrator group permitted to manage them.
Reconnect external paths	Ports of the specified external paths and all the external volumes connecting with those external paths must be assigned to the Storage Administrator group permitted to manage them. When you specify By Ports, all the external paths connecting with the specified ports and all the external volumes connecting with the external paths must be assigned to the Storage Administrator group permitted to manage them. When you specify By External WWNs, all the ports of the external paths connecting to the specified external WWN and all the external volumes connecting with those external paths must be assigned to the Storage Administrator group permitted to manage them.
Edit external WWNs	All the ports of the external paths connecting to the specified external WWN and all the external volumes connecting with the

Operation name	Condition
	external paths must be assigned to the Storage Administrator group permitted to manage them.
Edit external path configuration	Ports of all the external paths composing the specified path group and all the external volumes that belong to the path group must be assigned to the Storage Administrator group permitted to manage them.

Open Volume Management

The following table provides information about specific Open Volume Management conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Create LDEVs	When you specify a parity group and open the **Create LDEVs** window, the parity group must be assigned to the Storage Administrator group permitted to manage them. When you create an internal or external volumes parity groups where the LDEV belongs and ID of the new LDEV must be assigned to the Storage Administrator group permitted to manage them.
Delete LDEVs	When deleting an internal or external volume, the deleted LDEV and parity groups where the LDEV belongs must be assigned to the Storage Administrator group permitted to manage them.
Edit LDEVs	The specified LDEV must be assigned to the Storage Administrator group permitted to manage them.
Restore LDEVs	When you specify LDEVs and open the **Restore LDEVs** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them. When you specify a parity group and open the **Restore LDEVs** window, the specified parity group and all the LDEVs in the parity group must be assigned to the Storage Administrator group permitted to manage them.
Block LDEVs	When you specify LDEVs and open the **Block LDEVs** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them. When you specify a parity group and open the **Block LDEVs** window, the specified parity group and all the LDEVs in the parity group must be assigned to the Storage Administrator group permitted to manage them.
Format LDEVs	When you specify LDEV and open the **Format LDEVs** window, the specified LDEV must be assigned to the Storage Administrator group permitted to manage them. When you specify a parity group and open the **Format LDEVs** window, the specified parity group and all the LDEVs in the parity group must be assigned to the Storage Administrator group permitted to manage them.

Operation name	Condition
Delete Parity Groups	When deleting a parity group, the parity group to be deleted must be assigned to the Storage Administrator group permitted to manage them.
Format Parity Groups	When you specify a parity group and open the **Format Parity Groups** window, the specified parity group must be assigned to the Storage Administrator group permitted to manage them.

Virtual Partition Manager

The following table provides information about specific Virtual Partition Manager conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Migrate parity groups	When you specify virtual volumes, the specified LDEV must be assigned to the Storage Administrator group permitted to manage them. When you specify a parity group, the specified parity group must be assigned to the Storage Administrator group permitted to manage them.

Volume Shredder

The following table provides information about specific Volume Shredder conditions that must be observed when using Resource Partition Manager.

Operation name	Condition
Shred LDEVs	When you specify LDEVs and open the **Shred LDEVs** window, the specified LDEVs must be assigned to the Storage Administrator group permitted to manage them. When you specify a parity group and open the **Shred LDEVs** window, the specified parity group and all the LDEVs in the parity group must be assigned to the Storage Administrator group permitted to manage them.

Server Priority Manager

The following table provides information about specific Server Priority Manager conditions that must be observed when using Resource Partition Manager.

Operation name	Conditions
Set priority of ports (attribute/threshold/upper limit)	The specified ports must be assigned to the Storage Administrator group permitted to manage them.

Operation name	Conditions
Release settings on ports by the decrease of ports	
Set priority of WWNs (attribute/upper limit)	
Change WWNs and SPM names	
Add WWNs (add WWNs to SPM groups)	
Delete WWNs (delete WWNs from SPM groups)	
Add SPM groups and WWNs	
Delete SPM groups	
Set priority of SPM groups (attribute/upper limit)	
Rename SPM groups	
Add WWNs	
Delete WWNs	
Initialization	All ports must be assigned to the Storage Administrator group permitted to manage them.
Set threshold	

4

Configuring custom-sized provisioning

Configuring custom-sized provisioning involves creating and configuring custom-size volumes (CVs). CVs are created by dividing a fixed-sized volume (FV) into several smaller volumes of arbitrary sizes.

- ☐ Editing an LDEV name
- ☐ Deleting an LDEV (converting to free space)
- ☐ Formatting LDEVs
- ☐ Assigning an MP unit

Spare drives and copy-back mode

Spare drives are mounted separately from the data drives for usual write and read operation. If a failure occurs in a data drive, data is copied to a spare drive so that the storage system can continue to be available.

Copy-back mode determines whether data on a spare drive is returned to a data drive after recovery. If copy-back mode is enabled, when a failed drive is recovered, data is moved from the spare drive to the recovered drive. If copy-back mode is disabled, when a failed drive is recovered, data is left on the spare drive. This mode can be specified for each parity group.

The following maximum number of spare drives can be specified for each storage system:

- VSP G200: 16
- VSP G400, G600, VSP F400, F600: 32
- VSP G800, VSP F800: 64

Assigning spare drives

Spare drives are used to store data if a data drive fails.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Open the **Assign Spare Drives** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems** and the target storage system.
   b. Right click **Parity Groups**, and then select **Assign Spare Drives**.

   In Device Manager - Storage Navigator:

   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **Parity Groups**.
   c. Select the **Drive** tab.

      If desired, select one or more drive boxes that have the value **Free** in the **Usage** column.
   d. Click **Assign Spare Drives**.
2. In the **Available Drives** table, select one or more drive boxes, and then click **Add**.

   The selected drive boxes are moved to the **Selected Spare Drives** table.
3. Click **Finish**.

   The **Confirm** window opens.

4. In the **Confirm** window verify the settings.
5. In the **Task Name** field enter a unique name or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked the **Tasks** window opens.

Releasing spare drives

You can release spare drives so they can be used as data drives.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Open the **Assign Spare Drives** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems** and the target storage system.
   b. Right click **Parity Groups**, and then select **Assign Spare Drives**.

   In Device Manager - Storage Navigator:

   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **Parity Groups**.
   c. Select the **Drive** tab.

      If desired, select one or more drive boxes that have the value **Free** in the **Usage** column.
   d. Click **Assign Spare Drives**.
2. In the **Selected Spare Drives** table, select one or more drive boxes, and then click **Remove**.

   The selected drive boxes are moved to the **Available Drives** table.
3. Click **Finish**.

   The **Confirm** window opens.
4. In the **Confirm** window verify the settings.
5. In the **Task Name** field enter a unique name or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked the **Tasks** window opens.

Editing copy-back mode

Copy-back mode determines whether data on spare drives is restored after a failed drive is recovered.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Open the **Edit Parity Groups** window.

   In Hitachi Command Suite:

   a. On the **Resources** tab, click **Storage Systems**, and then expand **All Storage Systems** and the target storage system.
   b. Click **Parity Groups**.
   c. Select one or more parity groups, and then click **Edit Copy-back Mode**.

   In Device Manager - Storage Navigator:

   a. Click **Storage Systems**, and then expand the **Storage Systems** tree.
   b. Click **Parity Groups**.
   c. On the **Parity Groups** tab, select a parity group.
   d. Click **More Actions > Edit Copy-back Mode**.
2. Select **Edit Copy-Back Mode**, and then select one of the following options:
   - **Enable**: When a failed drive is recovered, data that was copied to the spare drive is returned to the recovered drive.
   - **Disable**: When a failed drive is recovered, data that was copied to the spare drive is left on the spare drive.
3. Click **Finish**.
4. In the **Confirm** window verify the settings.
5. In the **Task Name** field enter a unique name or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked the **Tasks** window opens.

Virtual LUN functions

Virtual LUN function is used to create, configure, or delete a customized volume (LDEV).

The Virtual LUN function is an open systems function available in Open Volume Management software.

A parity group usually consists of some fixed-sized volumes (FVs) and some free space. The number of FVs is determined by the emulation type. A Virtual LUN volume usually consists of at least one FV, one or more customized volumes (CVs), and some free space.

Use the Virtual LUN function to configure variable-sized volumes that efficiently exploit the capacity of a disk. Variable-sized volumes are logical volumes that are divided into smaller than normal fixed-size volumes. This configuration is desirable when frequently accessed files are distributed across smaller multiple logical volumes. This generally improves the data accessing performance, though file access may be delayed in some instances.

The Virtual LUN function can also divide a logical volume into multiple smaller volumes to reduce unused capacity and provide a more efficient use of space for small volumes such as command devices. The Virtual LUN function can efficiently exploit the capacity of a disk by not wasting capacity using larger volumes when the extra capacity is not needed.

Virtual LUN requirements

Use of Virtual LUN on your storage system to configure variable-sized volumes requires the following:

- A license key for the Virtual LUN software product. This is available in Open Volume Management software for open systems.

For details about license key or software product installation, see the *System Administrator Guide*.

Virtual LUN specifications

RAID level for CV

RAID level	RAID configuration that can be applied to CV (including Pool-VOL)
RAID 1	2D+2D, or concatenated 2 parity groups with 2D +2D
RAID 5	• 3D+1P • 4D+1P • 6D+1P • 7D+1P, concatenated 2 parity groups with 7D +1P, or concatenated 4 parity groups with 7D +1P
RAID 6	• 6D+2P • 12D+2P • 14D+2P

RAID level	RAID configuration that can be applied to CV	RAID configuration that can be applied to pool volume
RAID 1	2D+2D, or concatenated 2 parity groups with 2D+2D	2D+2D, or concatenated 2 parity groups with 2D+2D
RAID 5	• 2D+1P • 3D+1P • 4D+1P • 5D+1P • 6D+1P • 7D+1P, concatenated 2 parity groups with 7D+1P,	• 3D+1P • 4D+1P • 6D+1P • 7D+1P, concatenated 2 parity groups with 7D+1P, or concatenated 4 parity groups with 7D+1P

RAID level	RAID configuration that can be applied to CV	RAID configuration that can be applied to pool volume
	or concatenated 4 parity groups with 7D+1P • 8D+1P	
RAID 6	• 4D+2P • 6D+2P • 8D+2P • 10D+2P • 12D+2P • 14D+2P	• 6D+2P • 12D+2P • 14D+2P

CV capacity

Defines the minimum capacity and maximum capacity for an OPEN-V volume (internal and external).

Emulation type*	Minimum CV capacity	Maximum CV capacity	Number of control cylinders
OPEN-V	48,000 KB (96,000 blocks)	• Internal volume*: 3,221,159,680 KB (2.99 TB, 6,442,319,360 blocks) • External volume: 4,294,967,296 KB (4 TB, 8,589,934,592 blocks)	None
*If the parity group is 2D+1P or 4D+2P, the maximum CV capacity is 2 TB, which is 4,294,967,296 blocks.			

Virtual LUN size calculations

When creating a CV, you can specify the capacity of each CV. However, rounding will produce different values for the user-specified CV capacity and the actual entire CV capacity. To estimate the actual capacity of a CV, use a mathematical formula. The following topics explain how to calculate the user area capacity and the entire capacity of a CV.

The capacity of a CV or an LDEV consists of two types of capacity. One type is the user area capacity that stores the user data. The second type is the capacities of all areas that are necessary for an LDEV implementation including control information. The sum of these two types of capacities is called the entire capacity.

Implemented LDEVs consume the entire capacity from the parity group capacity. Therefore, even if the sum of user areas of multiple CVs and the user area of one CV are the same size, the remaining free space generated

when multiple CVs are created may be smaller than the free space in the parity group when one CV is created.

When using CCI, the specified size of CVs is created regardless of the capacity calculation. Therefore, even if the same capacity size (for example, 1 TB) appears, the actual capacity size might be different between the CVs created by CCI and the CVs created by Hitachi Device Manager - Storage Navigator.

When you create an LDEV using the **Create LDEVs** window, depending on the Capacity Compatibility Mode (Offset boundary) option, the capacity of LDEV differs even if the specified value is the same. If the Capacity Compatibility Mode (Offset boundary) option is selected, the specified LDEV capacity is offset by conforming to the prescribed boundary values, and an LDEV is created. For details about the prescribed boundary values, see Calculating fixed-size volume size (CV capacity unit is MB) on page 111, Calculating fixed-size volume size (CV capacity unit is blocks) on page 112, Calculating volume size (CV capacity unit is MB) on page 110, or Calculating volume size (CV capacity unit is blocks) on page 111.

If the Capacity Compatibility Mode (Offset boundary) option is not selected, the capacity of the LDEV is created with the specified size. In the storage system, data is managed based on a slot, and the data protection is performed based on a parity stripe unit. For an LDEV with capacity offset by a boundary, the efficiency of the drive capacity is improved because the capacity of LDEV is offset by the unit of the data management. If you want to create copy pairs with VSP, HUS VM, or previous storage system, exactly the same LDEV capacity must be used for the volumes in a pair. If there is an emphasis on the efficiency of the drive capacity, select the Capacity Compatibility Mode (Offset boundary) option when creating LDEVs. If you want the LDEV capacity to be a specific size, do not select the Capacity Compatibility Mode (Offset boundary) option when creating LDEVs.

Calculating volume size (CV capacity unit is MB)

The methods for calculating the user area capacity and the entire capacity of a CV vary depending on the CV capacity unit that is specified when creating the CV.

To calculate the user area capacity of a CV whose capacity unit is defined as megabytes:

```
ceil(ceil(user-specified-CV-capacity * 1024 / 64) / 15) * 64 * 15
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-specified-CV-capacity* is expressed in megabytes.
- The resulting *user area capacity* is expressed in kilobytes.

To calculate the entire capacity of a CV:

```
ceil(user-area-capacity / boundary-value) * boundary-value / 1024
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-area-capacity* is expressed in kilobytes
- *boundary value* is expressed in kilobytes. The boundary value depends on volume emulation types and RAID levels (see Boundary values of volumes on page 113).
- The resulting entire capacity is expressed in megabytes.

Calculating volume size (CV capacity unit is blocks)

To calculate the user area capacity of a CV whose capacity unit is defined as blocks:

```
ceil(user-specified-CV-capacity / 2)
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-specified-CV-capacity* is expressed in blocks.
- The resulting *user area capacity* is expressed in kilobytes.

To calculate the entire capacity of a CV:

```
ceil(user-specified-CV-capacity / (boundary-value * 2)) *
(boundary-value * 2)
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-specified-CV-capacity* is expressed in blocks.
- *boundary-value* is expressed in kilobytes. The boundary value depends on volume emulation types and RAID levels (see Boundary values of volumes on page 113).
- The resulting entire capacity is expressed in blocks. To convert the resulting entire capacity into megabytes, divide this capacity by 2,048.

Calculating fixed-size volume size (CV capacity unit is MB)

To calculate the user area capacity of a CV whose capacity unit is defined as megabytes:

```
ceil(ceil(user-specified-CV-capacity * 1024 /
capacity-of-a-slot) / 15) * capacity-of-a-slot * 15
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-specified-CV-capacity* is expressed in megabytes.
- *capacity-of-a-slot* is expressed in kilobytes (256 KB for OPEN-V).
- The resulting *user area capacity* is expressed in kilobytes.

To calculate the entire capacity of a CV:

```
ceil((user-area-capacity + management-area-capacity) /
boundary-value) * boundary-value / 1024
```

where

- The value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-area-capacity* is expressed in kilobytes.
- *management-area-capacity* is expressed in kilobytes. The management area capacity depends on the device emulation type (0 KB for OPEN-V).
- *boundary-value* is expressed in kilobytes. The boundary value depends on the device emulation type and RAID level (see Boundary values of volumes on page 113).
- The resulting entire capacity is expressed in megabytes.

Calculating fixed-size volume size (CV capacity unit is blocks)

To calculate the user area capacity of a CV whose capacity unit is defined as blocks:

```
user-specified-CV-capacity / 2
```

where

- *user-specified-CV-capacity* is expressed in blocks.
- The resulting *user area capacity* is expressed in kilobytes.

To calculate the entire capacity of a CV:

```
ceil((user-specified-CV-capacity + management-area-capacity * 2)
/ (boundary-value * 2)) * (boundary-value * 2)
```

where

- the value enclosed in `ceil( )` must be rounded up to the nearest whole number.
- *user-specified-CV-capacity* is expressed in blocks.
- *management-area-capacity* is expressed in kilobytes. The management area capacity depends on volume emulation types (see Management area capacity of a volume on page 113).

- *boundary-value* is expressed in kilobytes. The boundary value depends on volume emulation types and RAID levels (see Boundary values of volumes on page 113).
- The CV capacity recognized by hosts is the same as the CV capacity calculated by the above formula.
- If block is selected as the LDEV capacity unit in the **Create LDEVs** window and dialog boxes, the window and dialog boxes correctly show the calculated LDEV capacity. However, if MB, GB, or TB is selected as the LDEV capacity unit in the **Create LDEVs** window and dialog boxes, the capacity values shown might have a margin of error due to unit conversion reasons. If you need to know the exact LDEV capacity, select block as the capacity unit.
- The resulting entire capacity is expressed in blocks. To convert the resulting entire capacity into megabytes, divide this capacity by 2,048:

Management area capacity of a volume

Emulation type	Management area capacity (KB)
OPEN-V	0

Boundary values of volumes

The following table provides the boundary values (expressed as kilobytes) for internal volumes. The boundary value for an external volume is always one kilobyte, regardless of RAID level.

RAID level		Boundary value (KB)
RAID 1	(2D+2D)	1,024
RAID 5	(3D+1P)	1,536
	(4D+1P)	2,048
	(6D+1P)	3,072
	(7D+1P)	3,584
RAID 6	(6D+2P)	3,072
	(12D+2P)	6,144
	(14D+2P)	7,168

Capacity of a slot

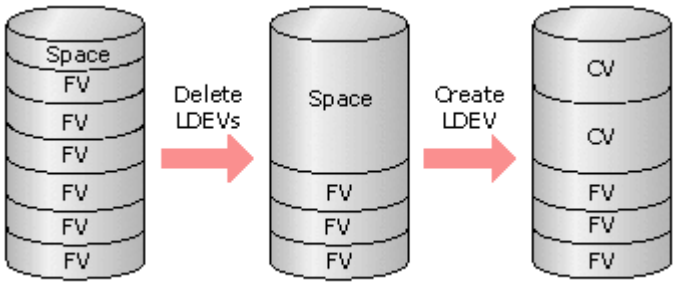
Emulation type	Capacity of a slot
OPEN-V	256 KB
Note: Slot capacity is expressed in kilobytes.	

Configuring volumes in a parity group

The Virtual LUN functions of Delete LDEVs and Create LDEVs are performed on each parity group. Parity groups are also separated from each other by boundary limitations. Therefore, you cannot define a volume across two or more parity groups beyond these boundaries.

As the result of the Virtual LUN operations, a parity group contains FVs, CVs, and free spaces that are delimited in logical cylinders. Sequential free spaces are combined into a single free space.

The following depicts an example of configuring volumes in a parity group:



Enabling accelerated compression

Use this procedure to enable accelerated compression on a parity group.

Before you begin

- You must have the Storage Administrator role.
- The drive type of the target parity group must be FMC.
- The emulation type of the target parity group must be OPEN-V.
- The RAID level and drive configuration of the target parity group must be accessible for use for pool volumes.
- The target parity group must be an internal parity group, block, or file. Parity groups for the embedded NAS module are supported.
- The status of LDEVs in the target parity group must be **Normal** or **Blocked**.
- All LDEVs in the parity group must already be added to the same pool.
- The capacity of the defined internal volumes must be 8 GB or more. (The capacity is equal to or greater than the minimum capacity of a pool volume.)
- If the defined internal volumes are used as pool volumes, those pool volumes belong to the same Dynamic Provisioning pool or Thin Image pool.
- The defined internal volumes must have no LUN path definitions.

- The defined internal volumes must not be used by Volume Migration.
- The defined internal volumes must not be reserved by the Data Retention Utility.
- The defined internal volumes must not have the Protect, Read Only, or S-VOL Disable attribute of Data Retention Utility.
- The encryption setting of the parity group must be disabled.
- There must not be any DP-VOL page reserved areas.

Procedure

1. In the Device Manager - Storage Navigator **Explorer** pane, select **Storage Systems**, and then expand the tree for the storage system.
2. Display the parity group for which you want to enable accelerated compression.
   - To display all parity groups in the storage system, click **Parity Groups**.
   - To display only internal parity groups, expand **Parity Groups**, and then click **Internal**.
3. Select the desired parity group, and then click **More Actions > Edit Parity Groups**.
4. In **Accelerated Compression**, check **Enable**.

   Caution: When you enable accelerated compression, confirm if the data reduction efficiency can be achieved. For details, see Guidelines for pools when accelerated compression is enabled on page 417.

5. Click **Finish**.
6. In the **Confirm** window, confirm the settings. In **Task Name**, type a unique name for this task or accept the default, and then click **Apply**. If **Go to tasks** window for status is checked, the **Tasks** window opens.

Disabling accelerated compression

Before you begin

- You must have the Storage Administrator (Provisioning) role.
- Set the parity group drive type to FMC.
- You should format the parity group.
- The emulation type of the target parity group must be OPEN-V.
- The target parity group must be an internal parity group.
- The RAID level and drive configuration of the target parity group must be accessible for use for pool volumes.
- The status of LDEVs in the target parity group must be **Normal** or **Blocked**.

- The Expanded Spaced Used column for the parity group must be No.

Procedure

1. Format the parity group.

   Caution: Before you can disable accelerated compression, the parity group must be formatted.

2. In the Device Manager - Storage Navigator **Explorer** pane, select **Storage Systems**, and then expand the tree for the storage system.
3. Display the parity group for which you want to disable accelerated compression.
   - To display all parity groups in the storage system, click **Parity Groups**.
   - To display only internal parity groups, expand **Parity Groups**, and then click **Internal**.
4. Select the parity group, and click **More Actions > Edit Parity Groups**.
5. In the **Accelerated Compression** setting, check **Disable**.
6. Click **Finish**.
7. In the **Confirm** window, confirm the settings. In **Task Name**, type a unique name for this task or accept the default, then click **Apply**. If **Go to tasks window for status** is checked, the **Tasks** window opens.

Parity groups and volumes

When adding drives to increase LDEV free space, the free space can be increased in the storage system by configuring RAID. The VSP G200, G400, G600, G800 and VSP F400, F600, F800 storage systems support RAID 1, RAID 5, and RAID 6.

In one parity group, a maximum of 2,048 fixed-size volumes (FVs) and some free space is available. The maximum number of LDEVs in each storage system model is:

- VSP G800: maximum 16,384 LDEVs
- VSP G400, G600 or VSP F400, F600: maximum 4,096 LDEVs
- VSP G200: maximum 2,048 LDEVs

Configuration of interleaved parity groups

If RAID configurations are RAID1 (2D+2D) or RAID5 (7D+1P), the interleaved parity group can be created by concatenating multiple of parity groups. The following table lists the RAID configurations and the number of parity groups that can be concatenated.

RAID configuration	2 concatenating	4 concatenating
RAID1 (2D+2D)	Available	Not Available
RAID5 (7D+1P)	Available	Available

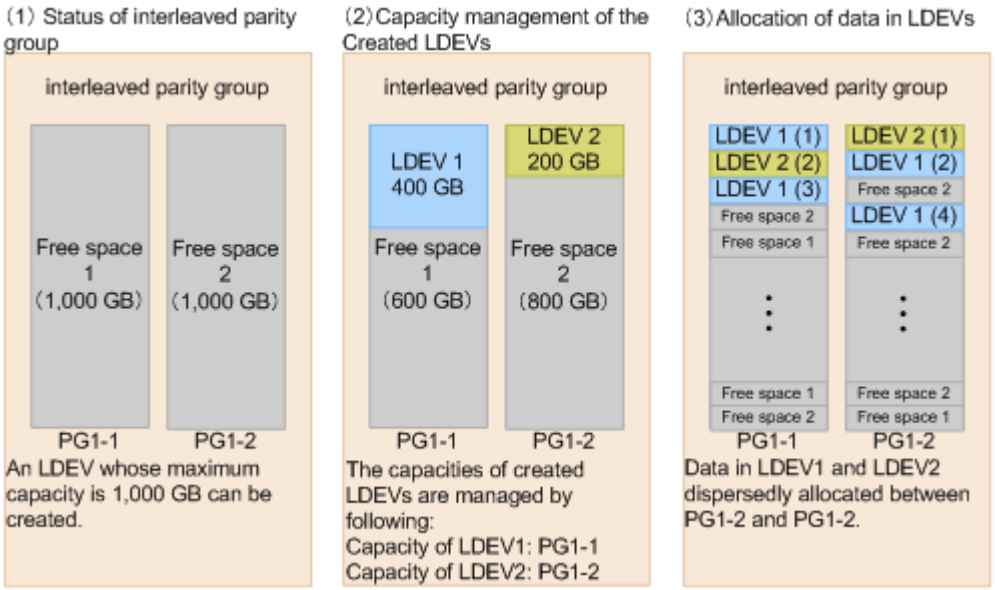
When concatenating parity groups, data in LDEVs that are FV or CV is allocated between the interleaved parity groups. Therefore, loads are dispersed because of the parity group concatenation, and the LDEV performance is improved.

The capacity of the created LDEV is managed by each of the parity groups that are in the interleaved parity group. The maximum capacity of an LDEV is the same as the capacity of the interleaved parity group.

Note: Even if the parity groups are concatenated, the total capacity of the interleaved parity group is not large.

See the following examples:

- Creating the interleaved parity group by concatenating of parity groups of PG1-1 and PG1-2.
- Creating LDEVs in each parity group that are in the interleaved parity group.
  - LDEV 1 in PG1-1
  - LDEV 2 in PG1-2



Managing parity groups

Describes the procedures for creating, formatting, and deleting parity groups.

Create parity groups by selecting drives manually

Use this procedure to create parity groups by selecting drives manually.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Parity Groups**.
3. On the **Parity Groups** tab, select **Create Parity Groups**.
4. Select a drive from the **Drive Type/RPM/Capacity** list.
5. Select a RAID level from the **RAID Level** list.
6. Select **Manual** from the **Drive Selection** field.
7. In the **Available Drives** table, select drives. Drives must be selected up to the number displayed in **The number you have to select**.
8. Click **Options**.
9. In the **Initial Parity Group ID** text box, type the number of the initial parity group ID.

   The smallest available number is displayed in the text box by default. When you specify a parity group ID that was already registered, the smallest available ID is displayed. If a parity group ID is unavailable, no number is displayed.
10. Select the CLPR number from the **Cache Partition** list.
11. In the **Encryption** field, select **Enable** or **Disable**.
12. In the **accelerated compression** field, select **Enable** or **Disable**.

    If **Enable** is selected in the **Encryption** field, you cannot select **Enable** in the **accelerated compression**.

    Tip: To use accelerated compression-enabled parity group, if you change the accelerated compression from enable to disable, you must format the parity group. Therefore, we recommend that the accelerated compressionmust be enabled only when the data reduction efficiency can be surely performed.
13. In the **Copy-Back Mode** field, select **Enable** or **Disable**.
14. Click **Add**.

    The created parity group is added to the **Selected Parity Groups** table. If invalid values are set, an error message appears.

Tip:
- When you select multiple rows and click **Concatenate**, click **OK**. If selected parity groups cannot be concatenated, an error message appears.
- If you select a row and click **Change Settings**, the **Change Settings** window appears. After you change parity group settings, click **OK**.
- If you select a row and click **Detail**, the **Parity Group Properties** window appears.
- When you select a row and click **Remove**, click **OK**.

15. Click **Next**.
    The **Create LDEVs** window appears.
16. Click **Finish**. The **Confirm** window appears.
17. In the **Confirm** window, click **Apply** to register the setting in the task. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Creating parity groups by selecting drives automatically

Use this procedure to create parity groups by selecting drives automatically.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Parity Groups**.
3. On the **Parity Groups** tab, select **Create Parity Groups**.
4. Select a drive from the **Drive Type/RPM/Capacity** list.
5. Select a RAID level from the **RAID Level** list.
6. Select **Auto** from the **Drive Selection** field.
7. In the **Number of Parity Groups** text box, enter the number you want to create.
8. Click **Options**.
9. In the **Initial Parity Group ID** text box, type the number of the initial parity group ID.

   The smallest available number is displayed in the text box by default. When you specify a parity group ID that was already registered, the smallest available ID is displayed. If a parity group ID is unavailable, no number is displayed.
10. Select a drive box type from the **Drive Box Type** list.
11. Select a drive box from the **Initial Drive Box** list.
12. In the **Drive Select Type** field, select **Disperse** or **Linear**.

Tip: This item is not available with Virtual Storage Platform G200. If this storage system is used, only **Linear** is available.

13. Select the CLPR number from the **Cache Partition** list.
14. In the **Encryption** field, select **Enable** or **Disable**.
15. In the **accelerated compression** field, select **Enable** or **Disable**.

    If **Enable** is selected in the **Encryption** field, you cannot select **Enable** in the **accelerated compression**.

Tip: If you have enabled accelerated compression on a parity group and then later you want to disable accelerated compression on that parity group, you must format the parity group. Therefore, we recommend that you enable accelerated compression only when the data reduction efficiency can be surely performed.

16. In the **Copy-Back Mode** field, select **Enable** or **Disable**.
17. Click **Add**.

    The created parity group is added to the **Selected Parity Groups** table. If invalid values are set, an error message appears.

Tip:

- When you select multiple rows and click **Concatenate**, click **OK**. If selected parity groups cannot be concatenated, an error message appears.
- If you select a row and click **Change Settings**, the **Change Settings** window appears. After you change parity group settings, click **OK**.
- If you select a row and click **Detail**, the **Parity Group Properties** window appears.
- When you select a row and click **Remove**, click **OK**.

18. Click **Next**.
    The **Create LDEVs** window appears.
19. Click **Finish**. The **Confirm** window appears.
20. In the **Confirm** window, click **Apply** to register the setting in the task. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Formatting parity groups

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Block all LDEVs in the target parity groups. For instructions, see Blocking LDEVs on page 128.
2. Perform one of the following to display the **Format Parity Groups** window.
   - Click **Format Parity Groups**.
   - Click **Actions > Parity Group > Format Parity Groups** to open the window.
3. In the **Format Parity Groups** window, in **Task Name** type a unique name for this task or accept the default, then click **Apply**.
   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Deleting parity groups

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

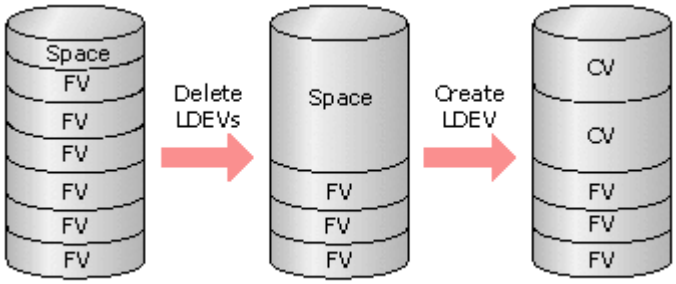
Procedure

1. Perform one of the following to display the **Delete Parity Groups** window.
   - Click **More Actions > Delete Parity Groups**.
   - Click **Actions > Parity Group > Delete Parity Groups** to open the window.
2. In the **Confirm** window, , confirm the settings. In **Task Name** type a unique name for this task or accept the default, then click **Apply**.
   A message appears asking whether you want to delete the selected parity group or parity groups. To remove the row, click **Apply**. If **Go to tasks window for status** is checked, the **Tasks** window opens.

Create LDEV function

Use the Create LDEV function of Virtual LUN to create a custom-size volume (CV).

The following diagram shows how custom-size volumes (CVs) are created. First you delete fixed-size volumes (FVs) to create free space, and then you can create one or more CVs of any size in that free space.



Creating an LDEV

Use this procedure to create one or more internal or external logical volumes (LDEVs) in a selected storage system. You can create multiple LDEVs at once, for example, when you are setting up your storage system. After the storage system is set up, you can add LDEVs as needed.

Before you can create an LDEV in a storage system, you might need to create free space. Before deleting volumes to create free space, remove the LU paths to the open-system volumes.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- You can create LDEVs using any of the following tabs in Hitachi Device Manager - Storage Navigator:
  - Parity Groups tab when selecting Parity Groups.
    You can create multiple LDEVs in the specified free space by setting the necessary items collectively. If multiple free spaces are in one parity group, the number of free spaces appears in Total Selected Free Space in the Parity Group Selection section on the Create LDEVs window. Confirm the number of free spaces, and then create the LDEVs accordingly.
    For example, if you are creating LDEVs in parity group PG1-1 and it contains two free spaces, 2 appears in Total Selected Free Space. In this case, if you specify 1 in Number of LDEVs per Free Space, and continue to create the LDEV, two LDEVs are created because one LDEV is created for each free space.
    When you select parity groups in the **Parity Groups** window or the **Internal/External** window, and open the **Create LDEVs** window, all free spaces in the parity groups are selected in the initial setting of the **Select Free Spaces** window. When you select the interleaved (concatenated) parity group in the **Parity Groups** window or the **Internal/External** window, and open the **Create LDEVs** window, all free spaces in every parity groups are selected in the initial setting of the **Select Free Spaces** window.

In this case, if LDEVs are created by the initial setting without confirming the number of free spaces, more LDEVs than necessary can be created. When you create LDEVs, confirm the number of free spaces displayed on the **Select Free Spaces** window in the **Create LDEVs** window

- LDEVs tab when selecting any parity group in Parity Groups.
- LDEVs tab when selecting Logical Devices.

Procedure

1. In the Device Manager - Storage Navigator **Explorer** pane, click **Storage Systems**, expand the target storage system, and then click **Logical Devices**.
2. In the **LDEVs** tab, click **Create LDEVs**.
3. In the **Create LDEVs** window, from the **Provisioning Type** list, select the provisioning type for the LDEV to be created.
4. If creating an internal volume, select the parity group, and then do the following:
   a. From the **Drive Type/RPM** list in **Parity Group Selection**, select the drive type and RPM.
   b. From the RAID level list in **Parity Group Selection**, select the RAID level.
   c. Click **Select Free Spaces**.
   d. In the **Select Free Spaces** window, in the **Available Free Spaces** table, select the free spaces to be assigned to the volumes.

      Do the following, if necessary:

      - To specify the conditions and show the free space, click **Filter**, specify the conditions, and then click **Apply**.

      - To specify the unit for capacity and the number of rows to view, click **Options**.
   e. Click **View Physical Location**.
   f. In the **View Physical Location** window, confirm where the selected free space is physically located, and then click **Close**.
   g. In the **Select Free Spaces** window, if the selected free spaces have no issues, click **OK**.
5. Otherwise, if creating an external volume, select the external volume, and then do the following:
   a. Click **Select Free Spaces**.
   b. In the **Select Free Spaces** window, in the **Available Free Spaces** table, select the free space to be assigned to the volumes.

      Do the following, if necessary:

      - To specify the conditions and show the free space, click **Filter**, specify the conditions, and then click **Apply**.

- To specify the unit for capacity and the number of rows to view, click **Options**.

c. Click **View Physical Location**.

d. In the **View Physical Location** window, confirm where the selected free space is physically located, and then click **Close**.

e. In the **Select Free Spaces** window, if the selected free spaces have no issues, click **OK**.

6. If you want to offset the specified LDEV capacity by boundary, set the **Capacity Compatibility Mode (Offset boundary)** to **ON**. Capacity Compatibility Mode (Offset boundary) is set to **OFF** by default.

7. In **LDEV Capacity**, type the amount of LDEV capacity to be created and select a capacity unit from the list.

   Enter the capacity within the range of figures displayed below the text box. You can enter the number with 2 digits after decimal point. You can change the capacity unit from the list.

8. In **Number of LDEVs**, type the number of LDEVs to be created.

   - If you create internal volume, **Number of LDEVs per Free Space** appears.
   - If you create external volume, **Number of LDEVs per External Volume** appears.

   Caution: If creating LDEVs in the free space of the parity group with accelerated compression enabled, estimate the LDEV capacity and the number of LDEVs. For details, see Guidelines for pools when accelerated compression is enabled on page 417.

9. In **LDEV Name**, specify a name for this LDEV.

   a. In **Prefix**, type the characters that will become the fixed characters for the beginning of the LDEV name. The characters are case-sensitive.

   b. In **Initial Number**, type the initial number that will follow the prefix name.

10. In **Format Type**, select the format type for the LDEV from the list.

    - For an internal volume, select **Normal Format**, **Quick Format**, **Parity Group Format**, or **No Format**. For LDEVs in a parity group with **Accelerated Compression** enabled, **Quick Format** cannot be selected.

      If **No Format** is selected, format the volume after creating LDEVs.
    - For an external volume, if you create the LDEV, select **Normal Format** or **No Format**.

      If the external volume can be used as it is, select **No Format**. The created LDEV can be used without formatting.

      If the external volume needs to be formatted, select **No Format** and then format the volume with the external storage system, or select **Normal Format**.

- If **Quick Format** is selected while quick formatting is in progress, host I/Os may be affected. For details, see Quick Format function on page 133

11. Click **Options** to show more options.
12. In **Initial LDEV ID**, make sure that an LDEV ID is set. To confirm the used number and unavailable number, click **View LDEV IDs** to open the **View LDEV IDs** window.
    a. In **Initial LDEV ID** in the **Create LDEVs** window, click **View LDEV IDs**.

       In the **View LDEV IDs** window, the matrix vertical scale represents the second-to-last digit of the LDEV number, and the horizontal scale represents the last digit of the LDEV number. The **LDEV IDs** table shows the available, used, and disabled LDEV IDs.

       In the table, used LDEV numbers appear in blue, unavailable numbers appear in gray, and unused numbers appear in white. LDEV numbers that are unavailable may be already in use, or already assigned to another emulation group (group by 32 LDEV numbers).
    b. Click **Close**.
13. In the **Create LDEVs** window, from the **MP Unit** list, select a MP unit to be used by the LDEVs.
    - If you assign a specific MP unit, select the ID of the MP unit.
    - If you can assign any MP unit, click **Auto**.
14. In **T10 PI**, select **Enable** or **Disable**.

    The T10 PI attribute can be specified when creating a Basic volume of emulation type OPEN-V.

    Caution: The T10 PI attribute can only be defined during the initial creation of LDEVs. The defined attribute cannot be removed from LDEVs on which it is already set.

15. Click **Add**.

    The created LDEVs are added to the **Selected LDEVs** table.

    The **Provisioning Type**, **Parity Group Selection**, **LDEV Capacity**, and **Number of LDEVs per Free Space** or **Number of LDEVs per External Volume** fields must be set. If these required items are not registered, you cannot click **Add**.
16. If necessary, change the following LDEV settings:
    - Click **Change LDEV Settings** to open the **Change LDEV Settings** window.
17. If necessary, delete an LDEV from the **Selected LDEVs** table.

    Select an LDEV to delete, and then click **Remove**.
18. Click **Finish**.

    The **Confirm** window appears.

To continue the operation for setting the LU path and defining a logical unit, click **Next**.

19. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

20. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Related tasks

- Changing LDEV settings on page 126
- Removing an LDEV to be registered on page 127
- Defining LU paths on page 337

Finding an LDEV ID

When creating volumes, the LDEV ID (LDKC: CU: LDEV) must be specified. Use this procedure to determine the LDEV IDs in use in the storage system so you can specify the correct LDEV.

Procedure

1. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
2. In the **Create LDEVs** window, scroll down to **Initial LDEV ID** and click **View LDEV IDs**.
3. In the **View LDEV IDs** window, review the list to confirm the LDEV IDs. The **LDEV IDs** table shows the available, used, and disabled LDEV IDs.

   The matrix vertical scale represents the second-to-last digit of the LDEV number, and the horizontal scale represents the last digit of the LDEV number.

   In the table, used LDEV numbers appear in blue, unavailable LDEV numbers appear in gray, and unused LDEV IDs appear in white. LDEV numbers that are unavailable may be already in use, or already assigned to another emulation group (group by 32 LDEV numbers).

4. Click **Close**.

   The **Create LDEVs** window opens.

Changing LDEV settings

Before registering an LDEV, you may need to change the LDEV settings.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
2. In the **Create LDEVs** window, in the **Selected LDEVs** table, select an LDEV, and then click **Change LDEV Settings**.
3. In the **Change LDEV Settings** window, change the setting of **LDEV Name**, **Initial LDEV ID**, **T10 PI**, or **MP Unit**.
   - If you change **LDEV Name**, specify the prefix characters and the initial number for this LDEV.
   - If you change **Initial LDEV ID**, specify the number of LDKC, CU, LDEV, and Interval. To confirm used LDEV IDs, click **View LDEV IDs** to confirm the used LDEV IDs in the **View LDEV IDs** window.
   - If you change **MP Unit**, click the list and specify the MP unit ID. If the specific MP unit is specified, select the MP unit ID. If any MP unit is specified, click **Auto**.
   - If you change **T10 PI**, select **Enable** or **Disable**.
4. Click **OK**.
5. Click **Finish**.

   The **Confirm** window appears.
6. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Removing an LDEV to be registered

If you do not want to register an LDEV that is scheduled to be registered, you can remove it from the registration task.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
2. In the **Selected LDEVs** pane of the **Create LDEVs** window, select an LDEV, and then click **Remove**.

   A message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.
3. Click **Finish**.
4. In the **Confirm** window, click **Apply**. The LDEV is removed from the registering task.

If **Go to tasks window for status** is checked, the **Tasks** window opens.

Blocking LDEVs

Before you format or shred a registered LDEV, the LDEV must be blocked.

Use this procedure to block internal and external volumes from any of the following tabs:

- LDEVs tab when you make a selection from Parity Groups.
- LDEVs tab when you select Logical Devices.
- Virtual Volumes tab when you select a Pool.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. If `Blocked` does not appear in the **Status** column, use the following steps to block the LDEV.

   If `Blocked` does appear in the column, skip the remaining steps.
2. From the table, select the **LDEV ID** of the LDEV you want to block.
3. Click **More Actions** and select **Block LDEVs**.
4. Note the settings in the **Confirm** window and enter a unique **Task Name** or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Blocking LDEVs in a parity group

Use this procedure to block LDEVs in a parity group from one of the following tabs:

- Parity Groups tab when you select Parity Groups from the Storage Systems tree of the Device Manager - Storage Navigator main window.
- Parity Groups tab when you select a parity group from Parity Groups in the Storage Systems tree.
- LDEVs tab when you select Logical Devices.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

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

2. Click **Parity Groups**.
3. If **Blocked** does not appear in the **Status** column, use the following steps to block the LDEV.

   If **Blocked** does appear in the column, skip the remaining steps.
4. Select the parity group.

   You can select multiple parity groups that are listed together or separately.
5. Click **More Actions** and select **Block LDEVs**.
6. Note the settings in the **Confirm** window and enter a unique **Task Name** or accept the default and click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Restoring blocked LDEVs

Use this procedure to restore LDEVs from any of the following tabs:

- LDEVs tab when you make a selection from Parity Groups.
- LDEVs tab when you select Logical Devices.
- Virtual Volumes tab when you select a Pool.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. If **Blocked** appears in the **Status** column, use the following steps to block the LDEV.

   If **Blocked** does not appear in the column, skip the remaining steps.
4. Select the LDEV.

   You can select multiple LDEVs that are listed together or separately.
5. Click **More Actions** and select **Restore LDEVs**.
6. Note the settings in the **Confirm** window and enter a unique **Task Name** or accept the default and click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Restoring blocked LDEVs in a parity group

Use this procedure to restore blocked LDEVs in a parity group from any of the following tabs:

- Parity Groups tab when you select Parity Groups from the Storage Systems tree of the Device Manager - Storage Navigator main window.

- Parity Groups tab when you select a parity group from Parity Groups in the Storage Systems tree.
- LDEVs tab when you select Logical Devices.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Parity Groups**.
3. If **Blocked** appears in the **Status** column, use the following steps to block the LDEV.

   If **Blocked** does not appear in the column, skip the remaining steps.
4. Select the parity group.

   You can select multiple parity groups that are listed together or separately.
5. Click **More Actions** and select **Restore LDEVs**.
6. Note the settings in the **Confirm** window and enter a unique **Task Name** or accept the default and click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Editing an LDEV name

Use this procedure to edit the name of a registered internal volume.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. Select the **LDEV ID** of the LDEV you want to edit.
4. Click **Edit LDEVs**.
5. In the **Edit LDEVs** window, edit the **LDEV Name**.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. In the **Confirm** window, click **Apply** to register the setting in the task.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Deleting an LDEV (converting to free space)

You can convert one or more of the LDEVs on a selected parity group into free space by deleting the LDEVs. That free space can be used to either create one or more variable-sized volumes (CVs) using the Create LDEVs function, or left as free space for future use.

Warning: Deleting LDEVs will erase your data. Back up your data before deleting LDEVs.

An LDEV cannot be deleted successfully if it is:

- In the defined path (including the pair volumes of TrueCopy, global-active device, and Universal Replicator).
- A pool-VOL.
- A journal volume.
- A remote command device.
- A volume security volume.
- A quorum disk used by global-active device.
- An LDEV that has the Read/Write access attribute.

When you delete an LDEV, the alias information contained in the LDEV is also deleted. Therefore, if you delete an LDEV related to an alias device, you should do one of the following:

- Allocate another LDEV to the alias device, and then delete the LDEV.
- Delete the LDEV first, and then allocate another LDEV to the alias device.

For information about how to delete a registered external volume, see the *Hitachi Universal Volume Manager User Guide*.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- Back up your data before deleting LDEVs.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. Select the **LDEV ID** of the LDEV you want to delete.
4. Click **More Actions** and select **Delete LDEVs**.
   The LDEV is deleted.
5. Note the settings in the **Confirm** window and enter a unique **Task Name** or accept the default, and then click **Apply**.

If **Go to tasks window for status** is checked, the **Tasks** window opens.

Formatting LDEVs

If you initialize LDEVs that are being used, you will need to format the LDEVs.

About formatting LDEVs

The LDEV formatting function, which includes Normal Format and Quick Format enables you to format volumes (LDEVs), including external volumes. Volumes must be in blocked status to be formatted.

The following table lists the formatting functions and specifies the LDEV types on which the formatting functions can be performed.

Formatting function	Corresponding volume
Normal Format	Internal volume Virtual volume External volume
Quick Format	Internal volume other than an LDEV in a parity group with accelerated compression enabled.

Note: If you format DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs might become Compression. If you format the deduplication system data volume for a pool that has DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs might become Deduplication and compression. Therefore, verify the capacity saving setting of DP-VOLs after the format operation completes.

Storage system operation when LDEVs are formatted

The storage system acts in one of two ways immediately after an LDEV is added, depending on the default settings in the storage system.

- The storage system automatically formats the added LDEV. This is the default action.
- The storage system blocks the LDEV instead of automatically formatting it.

To confirm or change the default formatting settings on the storage system, contact the administrator. Users who have the Storage Administrator (Provisioning) role can change these default formatting settings.

Quick Format function

The Quick Format function formats internal volumes in the background. While Quick Format is running in the background, you can configure your system before the formatting is completed.

Before using Quick Format to format internal volumes, ensure that the internal volumes are in blocked status.

I/O operation from a host during Quick Format are allowed. Formatting in the background might affect performance.

Because shared resources such as MP units or cache paths are used during quick format operations, all host I/Os in a storage system may be affected.

Do not start more than four quick format operations at the same time.

Quick Format specifications

Item	Description
Preparation for executing the Quick Format feature	The internal volume must be in blocked status.
Maximum number of parity groups that can undergo Quick Format	Quick Format can be performed for one or more parity groups at the same time. The number of parity groups on which Quick Format can be performed concurrently depends on the total number of entries for the parity groups. The number of entries for a parity group is based on the capacity of the drives in the parity group as follows: • One parity group consisting of drives whose capacity is 8 TB or less: 1 entry • One parity group consisting of drives whose capacity is greater than 8 TB: 2 entries The maximum number of Quick Format operations that can be performed at the same time depends on the storage system model as follows: • VSP G800 or VSP F800: 72 entries • VSP G400, G600 or VSP F400, F600: 36 entries • VSP G200: 18 entries There is no limit on the number of volumes that can undergo Quick Format concurrently.
Concurrent Quick Format operations	While one Quick Format operation is in progress, another Quick Format operation can be performed. The maximum number of concurrent Quick Format operations is determined by the number of entries for the model as specified above.
Preliminary processing	At the beginning of the Quick Format operation, preliminary processing is performed to generate management information. If a volume is undergoing preliminary processing, the status of the volume is `Preparing Quick Format`. While preliminary processing is in progress, hosts cannot perform I/O access to the volume.
Blocking and restoring of volumes	If a volume undergoing Quick Format is blocked, the storage system recognizes that the volume is undergoing Quick Format. After the volume

Item	Description
	is restored, the status of the volume changes to `Normal (Quick Format)`. The number of parity groups in which all volumes undergo Quick Format depends on the number of entries of performing of the Quick Format. To calculate the number of entries of parity groups that have not undergone but can undergo Quick Format, use the following formula for your storage system model: • VSP G800 or VSP F800: 72 - *X* - *Y* • VSP G400, G600 or VSP F400, F600: 36 - *X* - *Y* • VSP G200: 18 - *X* - *Y* Where: *X* = entries number of parity groups on which Quick Format is being performed. *Y* = entries number of parity groups for which all volumes are blocked during Quick Format.
Storage system is powered off and back on	The Quick Format operation resumes when power is turned back on.
Restrictions	• Quick Format cannot be executed on LDEV in the parity group with Accelerated Compression enabled, external volumes, virtual volumes, or journal volumes of Universal Replicator. • The volume migration feature or the QuickRestore feature cannot be applied to volumes undergoing Quick Format. When you use Command Control Interface to execute the volume migration operation or the QuickRestore operation on volumes undergoing Quick Format, `EX_CMDRJE` will be reported to Command Control Interface. In this case, check the volume status. • Quick format cannot be performed on a deduplication system data volume.
SIM which is output when finishing of the quick format	If a quick format is performed, SIM=0x410100 is output when the format processing is finished. If multiple quick formats are performed, SIM=0x410100 is output when all format processing is finished.

Formatting a specific LDEV

Use this procedure to perform Normal formatting on a volume.

Note:

- Formatting DP-VOLs with deduplication and compression enabled might take a while to complete. Also, the pool usage might increase by the format processing. Once the format processing starts, it cannot be stopped.

  If you want to format all DP-VOLs in a pool that have the capacity saving setting enabled, first block and then format the deduplication system data volume, and then format the DP-VOLs. Blocking and formatting the deduplication system data volume first can reduce the DP-VOL format processing time and prevent the increase in pool usage.
- If you format DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs

might become Compression. If you format the deduplication system data volume for a pool that has DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs might become Deduplication and compression. Therefore, verify the capacity saving setting of DP-VOLs after the format operation completes.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **Logical Devices** window, select the **LDEV ID** of the LDEV you want to format.

   Note: When you format a deduplication system data volume, you must select only the (one) deduplication system data volume. Do not select any other volumes.

4. Block the LDEV to be formatted.

   For information about blocking internal volumes, see Blocking LDEVs on page 128. For information about blocking external volumes, see the *Hitachi Universal Volume Manager User Guide.*
5. Click **More Actions**, and select **Format LDEVs**.
6. In the **Format LDEVs** window, select the format type from the **Format Type** list, and then click **Finish**.
7. Note the settings in the **Confirm** window, enter a unique **Task Name** or accept the default, and click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Formatting all LDEVs in a parity group

Use this procedure to perform Normal formatting on all of the volumes (LDEVs) in the parity group you select.

When formatting all LDEVs in a parity group do the following:

- Specify a parity group
- Format the LDEV

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Before you format the LDEVs in the selected parity group, make sure that all the LDEVs in the parity group have been blocked. See Blocking LDEVs on page 128 for blocking an internal volume. See the *Hitachi Universal Volume Manager User Guide* for blocking an external volume.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Parity Groups**.
3. In the **Parity Groups** window, select a **Parity Group ID** of parity group with the LDEVs you want to format.

   You can select multiple parity groups that are listed together or separately.
4. Block the LDEV to be formatted.

   For information about blocking internal volumes, see Blocking LDEVs on page 128. For information about blocking external volumes, see the *Hitachi Universal Volume Manager User Guide*.
5. Click **More Actions**, and select **Format LDEVs**.
6. In the **Format LDEVs** window, select the format type from the **Format Type** list, and then click **Finish**.

   In the **Confirm** window, click **Next** to go to the next operation.
7. Click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Assigning an MP unit

Assigning an MP unit to a resource

Use this procedure to assign an MP unit to a resource (logical device, external volume, and journal volume).

Before you begin

The Storage Administrator (System Resource Management) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Expand **Components**, and click the DKC that has the MP unit settings you want to change.
3. In the **MP Units** window, select the **MP Unit ID** of the MP unit with the settings you want to change.
4. Click **Edit MP Units**.
5. In the **Edit MP Units** window, disable or enable **Auto Assignment**.

The default value depends on the value set for the selected MP unit.
- Select **Enable** if the MP unit can be automatically assigned.
- Select **Disable** if the MP unit cannot be automatically assigned.

6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing the MP unit assigned to an LDEV

Before you begin
The Storage Administrator (System Resource Management) role is required to perform this task.

Caution:
- Changes to the MP unit ID of an LDEV should be made during off-peak hours when the I/O load is as low as possible. Before and after changes are made, it is recommended that the cache write-pending rate (%) for all CLPRs is lower than 50%. Do not change the MP unit ID when the I/O load is high -- for example: during initial copy of ShadowImage, TrueCopy, global-active device, or Universal Replicator.
- When you change the MP unit ID of an LDEV, you should use Performance Monitor before and after the change to check the load status of devices. Do not change several LDEV MP unit IDs during a short period of time. As a guideline, you can change 10% or less of the total number or the full workload of LDEV MP unit IDs assigned to the same MP unit ID at the same time.
- After you change the MP unit for an LDEV, wait more than 30 minutes before you try to change the ID again for the same LDEV.

Procedure

1. In the **Logical Devices** window, select the **LDEV ID** of the LDEV that has the MP unit you want to change.
2. Click **More Actions**, and then select **Assign MP Unit**.
3. In the **Assign MP Unit** window, specify the MP unit in **MP Unit**.
4. Click **Finish**.
   The **Confirm** window appears.

5. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

6. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

5

Configuring thin provisioning

Thin provisioning technology allows you to allocate virtual storage capacity based on anticipated future capacity needs, using virtual volumes instead of physical disks. Thin provisioning is an optional provisioning strategy for your storage systems. Thin provisioning is implemented by creating one or more Dynamic Provisioning pools (DP pools) of physical storage space.

- Working with SIMs
- Managing pools and DP-VOLs
- Starting pool monitoring manually
- Stopping pool monitoring manually
- Starting tier relocation manually
- Stopping tier relocation manually
- Enabling data direct mapping for external volumes, pools, and DP-VOLs

Dynamic Provisioning overview

Dynamic Provisioning is an advanced thin-provisioning software product that allows you to save money on storage purchases and reduce storage management expenses.

You can operate Dynamic Provisioning using both Hitachi Device Manager - Storage Navigator software and the Command Control Interface.

Dynamic Tiering overview

Dynamic Tiering is a software that helps you reduce storage costs and increase storage performance by supporting a volume configured with different storage media of different cost and performance capabilities. This support allows you to allocate data areas with heavy I/O loads to higher-speed media and to allocate data areas with low I/O loads to lower-speed media. In this way, you can make the best use of the capabilities of installed storage media. Up to three storage tiers consisting of different types of data drives are supported in a single pool of storage.

Active flash overview

The active flash feature of Dynamic Tiering automatically promotes pages when their access frequency suddenly becomes high.

Based on functions for Dynamic Tiering, active flash can promote pages to Tier 1 if their latest access frequency suddenly becomes high. The active flash feature can improve Tier 1 I/O performance by reallocating Tier 2 pages if their I/O loads have increased suddenly.

Thin provisioning requirements

License requirements

Before you use Dynamic Provisioning, the Dynamic Provisioning must be installed on the storage system. For this, you will need to purchase the Storage Virtualization Operating System (SVOS) license.

Before you use the capacity saving function, Dynamic Provisioning and dedupe and compression must be installed on the storage system. For this, you will need to purchase the Storage Virtualization Operating System (SVOS) license and the dedupe and compression license.

Before you use Dynamic Tiering, Dynamic Provisioning and Dynamic Tiering must be installed on the storage system. For this, you will need to purchase

the Storage Virtualization Operating System (SVOS) license and the Dynamic Tiering license.

You need the Dynamic Tiering license to access the total capacity of the pool with the tier function enabled.

For Dynamic Provisioning, Dynamic Tiering, and active flash, the same license capacity as the pool capacity is required. If you are using a pool comprised of pool volumes from the accelerated compression-enabled parity group, you must purchase the license for physical capacity.

For Dynamic Tiering, and active flash, the same license capacity as the pool capacity is required. If you are using a pool comprised of pool volumes from the accelerated compression-enabled parity group, you must purchase the license for physical capacity.

For active flash, the same license capacity as the pool capacity is required. If you are using a pool comprised of pool volumes from the accelerated compression-enabled parity group, you must purchase the license for physical capacity.

Before you use active flash, the Dynamic Provisioning, and Dynamic Tiering software must be installed on the storage system.

If the DP-VOLs of Dynamic Provisioning or Dynamic Tiering are used for the primary volumes and secondary volumes of ShadowImage, TrueCopy, Universal Replicator, Volume Migration, global-active device, or Thin Image, you will need the ShadowImage, TrueCopy, Universal Replicator, Volume Migration, global-active device, and Thin Image licenses for the total pool capacity in use. If you are using a pool comprised of pool volumes from the accelerated compression-enabled parity group, you must purchase the license for physical capacity.

If you exceed the licensed capacity, you will be able to use the additional unlicensed capacity for 30 days. For more information about temporary license capacity, see the *System Administrator Guide*.

Pool requirements

A pool is a set of volumes reserved for storing Dynamic Provisioning write data.

Items	Requirements
Pool capacity	Calculate pool capacity using the following formula: `The capacity of the pool (MB) = Total number of pages * 42 - 4200.` 4200 in the formula is the management area size of the pool-VOL with System Area.

Items	Requirements
	`Total Number of pages = Σ(floor(floor(pool-VOL number of blocks ÷ 512) ÷ 168)) for each pool-VOL.` floor( ): Truncates the value calculated from the formula in parentheses after the decimal point. • VSP G800 or VSP F800: the total capacity of all pools is 6.5 PB if shared memory is installed. • VSP G400, G600 or VSP F400, F600: the total capacity of all pools is 6.5 PB if shared memory is installed. • VSP G200: the total capacity of all pools is 3.5 PB if shared memory is installed.
Max number of pool-VOLs	From 1 to 1,024 volumes (per pool). A volume can be registered as a pool-VOL to one pool only.
Maximum number of pools	• VSP G800 or VSP F800: Up to a total of 128 pools per storage system. Pool numbers (0 to 127) are assigned as pool identifiers. • VSP G400, G600 or VSP F400, F600: Up to a total of 64 pools per storage system. Pool numbers (0 to 63) are assigned as pool identifiers. • VSP G200 : Up to a total of 64 pools per storage system. Pool numbers (0 to 63) are assigned as pool identifiers. The maximum number of pools includes following pool types: • Dynamic Provisioning (including Dynamic Tiering and active flash) • Thin Image
Increasing capacity	You can increase pool capacity dynamically. Best practice is to add pool-VOLs to increase capacity by one or more parity groups.
Reducing capacity	You can reduce pool capacity by removing pool-VOLs.
Deleting	You can delete pools that are not associated with any DP-VOLs.
Subscription limit	From 0 to 65534 (%). If you do not specify a value, the subscription is set to unlimited.
Thresholds	• Warning Threshold: You can set the value between 1% and 100%, in 1% increments. The default is 70%. • Depletion Threshold: You can set the value between the warning threshold and 100%, in 1% increments. The default is 80%. • Thresholds cannot be defined for a pool with data direct mapping enabled.
Data allocation unit	42 MB The 42-MB page corresponds to a 42-MB continuous area of the DP-VOL. Pages are allocated for the pool

Items	Requirements
	only when data has been written to the area of the DP-VOL.
Tier (Dynamic Tiering and active flash)	Defined based on the media type (see Drive type for a Dynamic Tiering and active flash tier, below). Maximum 3 tiers.
Maximum capacity of each tier (Dynamic Tiering and active flash)	• VSP G800 or VSP F800: 4.0 PB (Total capacity of the tiers must be within 4.0 PB and the shared memory must be installed). • VSP G400, G600 or VSP F400, F600: 4.0 PB (Total capacity of the tiers must be within 4.0 PB and the shared memory must be installed). • VSP G200: 3.5 PB (Total capacity of the tiers must be within 3.5 PB and the shared memory must be installed).

Pool-VOL requirements

Pool-VOLs make up a DP pool.

Items	Requirements
Volume type	Logical volume (LDEV) While pool-VOLs can coexist with other volumes in the same parity group, for best performance: • Pool-VOLs for a pool should not share a parity group with other volumes. • Pool-VOLs should not be located on concatenated parity groups. Pool-VOLs cannot be used for any other purpose. For instance, you cannot specify the following volumes as Dynamic Provisioning, Dynamic Tiering, and active flash pool-VOLs: • Volumes used by ShadowImage, Volume Migration, TrueCopy, global-active device, or Universal Replicator • Volumes already registered in Thin Image, Dynamic Provisioning, Dynamic Provisioning or active flash pools • Volumes used as Thin Image P-VOLs or S-VOLs • Volumes reserved by Data Retention Utility • Data Retention Utility volumes with a Protect, Read Only, or S-VOL Disable attribute • LDEVs whose status is other than Normal, Correction Access, or Copying. You cannot specify volumes in blocked status or volumes in copying process. • Command devices • Quorum disks used by global-active device The following volume cannot be specified as a pool-VOL for Dynamic Tiering: • An external volume with the data direct mapping attribute enabled. If pool-VOLs are LDEVs created from the parity group with accelerated compression enabled, these pool-VOLs must be applied to one pool.
Emulation type	OPEN-V

Items	Requirements
RAID level for a Dynamic Provisioning pool	All RAID levels of pool-VOLs can be added. Pool-VOLs of RAID 5, RAID 6, RAID 1, and external volumes can coexist in the same pool. For pool-VOLs in the same pool: • RAID 6 is the recommended RAID level for pool-VOLs, especially for a pool where the recovery time of a pool failure due to a drive failure is not acceptable. • Pool-VOLs of the same drive type with different RAID levels can coexist in the same pool. We recommend that you set one RAID level for pool-VOLs. If you register pool-VOLs with multiple RAID levels to the same pool, the I/O performance depends on the RAID levels of pool-VOLs to be registered. In that case, note the I/O performance of the drives.
RAID level for a Dynamic Tiering or active flash pool	All RAID levels of pool-VOLs can be added. Pool-VOLs of RAID 5, RAID 6, RAID 1, and external volumes can coexist in the same pool. For pool-VOLs in the same pool: • RAID 6 is the recommended RAID level for pool-VOLs, especially for a pool where the recovery time of a pool failure due to a drive failure is not acceptable. • Pool-VOLs of the same drive type with different RAID levels can coexist in the same pool. We recommend that you set one RAID level for pool-VOLs. If you register pool-VOLs with multiple RAID levels to the same pool, the I/O performance depends on the RAID levels of pool-VOLs to be registered. In that case, note the I/O performance of the drives. • Because the speed of RAID 6 is slower than other RAID levels, tiers that use other RAID levels should not be placed under a tier that uses RAID 6.
Data drive type for a Dynamic Provisioning pool	SSD*, SAS15K, SAS10K, SAS7.2K, and external volumes can be used as the data drive type. These data drive types can coexist in the same pool. **Cautions**: • Best practice is for drives of different types not to coexist in the same pool. If multiple pool-VOLs with different drive types are registered in the same pool, the I/O performance depends on the drive type of the pool-VOL to which the page is assigned. Therefore, if different drive types are registered in the same pool, ensure that the required I/O performance is not degraded by using less desirable drive types. • If multiple data drives coexist in the same pool, we recommend not using data drives that are the same types and different capacities.
Data drive type for a Dynamic Tiering or active flash pool	SAS15K, SAS10K, SAS7.2K, SSD*, and external volumes can be used as the data drive type. These data drive types can coexist in the same pool. If active flash is used, SSD must be installed in advance. **Cautions**: • If multiple data drives coexist in the same pool, we recommend not using data drives that are the same types and different capacity sizes.
Volume capacity	Internal volume: From 8 GB to 2.9 TB External volume: From 8 GB to 4 TB External volume with the data direct mapping attribute: From 8 GB to 256 TB

Items	Requirements
LDEV format	The LDEV format operation can be performed on pool-VOLs if one of these conditions is satisfied: • The DP-VOL defined for the pool does not exist. • All DP-VOLs defined for the pool are blocked.
Path definition	You cannot specify a volume with a path definition as a pool-VOL.
* Includes FMC, FMD, and MLC. VSP Fx00 models only SSD can be specified.	

DP-VOL requirements

Items	Requirements
Volume type	DP-VOL (V-VOL) The LDEV number is handled in the same way as for normal volumes.
Maximum number of DP-VOLs	For VSP Fx00 models, only SSD can be specified. For VSP G800 or VSP F800: • Up to 14,080 per pool (For a pool with data direct mapping enabled, up to 1,023 per pool). Any number of available DP-VOLs can be associated with a pool. • For a pool with Deduplication enabled, the maximum number of DP-VOLs with Compression or Deduplication and Compression enabled is 14,080. • For a pool with Deduplication disabled, the maximum number of DP-VOLs with Compression enabled is 14,080. • Up to 14,080 volumes per system. If external volumes and V-VOLs are used, the total number of external volumes and V-VOLs must be 14,080 or fewer. For VSP G400, G600 and VSP F400, F600: • Up to 4,095 per pool (For a pool with data direct mapping enabled, up to 1,023 per pool). Any number of available DP-VOLs can be associated with a pool. • For a pool with Deduplication enabled, the maximum number of DP-VOLs with Compression or Deduplication and Compression enabled is 3,960. • For a pool with Deduplication disabled, the maximum number of DP-VOLs with Compression enabled is 3,967. • Up to 4,095 volumes per system. If external volumes and V-VOLs are used, the total number of external volumes and V-VOLs must be 4,095 or fewer. For VSP G200: • Up to 2,047 per pool (For a pool with data direct mapping enabled, up to 1,023 per pool). Any number of available DP-VOLs can be associated with a pool. • For a pool with Deduplication enabled, the maximum number of DP-VOLs with Compression or Deduplication and Compression enabled is 1,912. • For a pool with Deduplication disabled, the maximum number of DP-VOLs with Compression enabled is 1,919. • Up to 2,047 volumes per system. If external volumes and V-VOLs are used, the total number of external volumes and V-VOLs must be 2,047 or fewer.
Volume capacity	Volume capacity from 46.87 MB to 256 TB per volume. • TB: 0.01 to 256 • GB: 0.04 to 262,144 • MB: 46.87 to 268,435,456 • Blocks: 96,000 to 549,755,813,888

Items	Requirements
	Total maximum volume capacity is as follows: • VSP G800 or VSP F800: 6.5 PB (the shared memory must be installed) • VSP G400, G600 or VSP F400, F600: 6.5 PB (the shared memory must be installed) • VSP G200: 3.5 PB (the shared memory must be installed)
Path definition	Available.
LDEV format	Available. Quick Format is not available. System option mode (SOM) 867 ON: When you format an LDEV on a DP-VOL, the capacity mapped to the DP-VOL is released to the pool as free space. When you format a DP-VOL, the storage system releases the allocated page area in the DP-VOL. The quick format operation cannot be performed. If the LDEV format is applied to V-VOLs that are enabled for full allocation, the used capacity of the pool is not changed before the LDEV format is applied. Caution: • For a DP-VOL with deduplication and compression enabled, a deduplication system data volume whose LDEV status is Blocked cannot be formatted. • For a DP-VOL with deduplication and compression enabled, a deduplication system data volume whose capacity saving status is Failed cannot be formatted.

Deduplication system data volume requirements

When you enable deduplication on a pool, the deduplication system data volume (DSD volume) for the pool is created. The deduplication system data volume is used exclusively by the storage system to manage the data deduplication function. The deduplication system data volume for a pool is deleted automatically when you disable the Capacity Saving setting for the pool or delete the pool.

The following table lists the requirements for the deduplication system data volume.

Items	Requirements
Volume type	DP-VOL (V-VOL)
Emulation type	OPEN-V
Number per pool	One deduplication system data volume per pool (fixed)
Volume capacity	40 TB (fixed)
Path definition	Not available
LDEV format	Available **Warning:** Format a deduplication system data volume only when you want to delete all deduplication-enabled DP-VOLs in the associated pool. After the deduplication system data volume has been formatted, all deduplication-enabled DP-VOLs assigned to the pool are not usable and must be formatted and deleted.

Items	Requirements
	When you format a deduplication system data volume, you must specify only one deduplication system data volume and no other volumes in the Format LDEVs window.
Resource group	A deduplication system data volume and its associated pool volumes must be in the same resource group.
Cache management devices	Each deduplication system data volume uses 14 cache management devices.

Pool capacity consumed by metadata

When you use the capacity saving function, the following two kinds of capacities are consumed for the pool capacity:

- Used capacity of the pool consumed by user data
- Used capacity of the pool consumed by metadata

Metadata for the compression function. When the compression function is enabled, 2% of the total used capacity of the compression-enabled DP-VOLs is consumed as the metadata for the compression function. The capacity of the metadata for the compression function is added to the used capacity of the pool. To view the used capacity of the pool, see **Pool Capacity (Used/Total)** in the Pools window.

Metadata for the deduplication function. When the deduplication function is enabled, the capacity of the metadata of the deduplication function depends on the total used capacity of the deduplication-enabled DP-VOLs. The metadata of the deduplication function is stored in the deduplication system data volume. To view the capacity of the metadata for the deduplication function, see the capacity of the deduplication system data volume displayed on the Edit Deduplication System Data Volume window. The capacity of the metadata of the deduplication function is added to the used capacity of the pool. To view the used capacity of the pool, see **Pool Capacity (Used/Total)** in the Pools window.

The following table shows the relationship between the total used capacity of deduplication-enabled DP-VOLs and the capacity of the metadata of the deduplication function.

Total used capacity of DP-VOLs to be deduplicated	Capacity of the metadata of the deduplication function
Less than 32 GB	Up to 4.0 GB
64 GB	4.1 GB
100 GB	4.2 GB

Total used capacity of DP-VOLs to be deduplicated	Capacity of the metadata of the deduplication function
256 GB	4.9 GB
512 GB	5.9 GB
1,024 GB	7.9 GB
2,048 GB	11.9 GB
4,096 GB or more	19.9 GB or more

Requirements for increasing DP-VOL capacity

You can increase the capacity of a DP-VOL up to 59.9 TB.

To notify the host that the DP-VOL capacity has been increased, make sure host mode option 40 is enabled. Processing differs as follows, depending on the value of host mode option 40:

- When host mode option 40 is not enabled, the host will not be notified that the DP-VOL capacity has been increased. Therefore, the DP-VOL data has to be read again by the host after the capacity is increased.
- When host mode option 40 is enabled, the host is notified that the DP-VOL capacity has increased. If the operating system cannot recognize the value of capacity that was increased, the DP-VOL data has to be read again by your storage system.

The following requirements are important when increasing the DP-VOL capacity:

- The DP-VOL to be increased is not shared with a software product that does not allow increasing the volume capacity (see Increasing DP-VOL capacity on page 281).
- The DP-VOL is not undergoing LDEV formatting.
- The DP-VOL does not have data direct mapping enabled.
- The DP-VOL is not a deduplication system data volume.
- The capacity to be added to the DP-VOL must be specified within the range indicated below LDEV Capacity in the **Expand V-VOLs** window.
- The pool related to the DP-VOLs to be increased is in any one of the following statuses:
  - Normal
  - Exceeding the subscription limit threshold
  - In progress of pool capacity shrinking

Caution: When increasing DP-VOL capacity, do not perform the following operations. When you perform these operations, do not increase DP-VOL capacity.

- Operations using Virtual LUN

- Creating DP-VOLs
- Restoring pools
- Deleting DP-VOLs
- Operations to increase the DP-VOL capacity in another instance of CCI
- Maintenance of your storage system

After increasing DP-VOL capacity, refresh the display and confirm that the DP-VOL is increased. If the DP-VOL capacity is not increased, wait a while, refresh the display again, and confirm that the DP-VOL is increased. If you perform an operation without making sure that the DP-VOL is increased, operations from Device Manager - Storage Navigator may fail.

If one of the following operations is being performed, the DP-VOL capacity might not be increased:

- Volume Migration
- Configuration change of journal used by Universal Replicator
- Quick Restore by ShadowImage

V-VOL page reservation requirement

The V-VOL full allocation is performed in a range less than the depletion threshold size of the pool. If the capacity of V-VOLs is larger than the depletion threshold size, the full allocation operation is rejected.

Caution: The page reservation function is not supported by the following pools. To prevent data writing from being disabled due to pool overflow, you must monitor the free area of these pools frequently.

- Pools that contain pool volumes belonging to a parity group with accelerated compression enabled
- Pools with capacity saving enabled

Use the following formula to calculate the reserved page capacity for each pool. In the formula, the value enclosed in ceil ( ) must be rounded up to the nearest whole number.

```
Reserved capacity for each pool [block] =
ceil (CV capacity of V-VOL [block] / 86016) * 86016 + ceil (CV
capacity of V-VOL [block] /
6442082304) * 4 * 86016 - Used capacity of V-VOL [block]
```

Operating system and file system capacity

When initializing a DP-VOL operating systems and file systems will consume some Dynamic Provisioning pool space. Some combinations initially take up little pool space, while other combinations take as much pool space as the virtual capacity of the DP-VOL.

The following table shows the effects of some combinations of operating system and file system capacity. For more information, contact your service representative.

OS	File System	Metadata Writing	Pool Capacity Consumed
Windows Server 2003, Windows Server 2008*	NTFS	Writes metadata to first block.	Effective reduction of pool capacity: Small (one page) If file update is repeated, allocated capacity increases when files are updated (overwritten). Therefore, the effectiveness of reducing the pool capacity consumption decreases.
Linux	XFS	Writes metadata in Allocation Group Size intervals.	Effective reduction of pool capacity: Depends upon allocation group size. The amount of pool space consumed will be approximately [DP-VOL Size] × [42 MB/Allocation Group Size]
	Ext2 Ext3	Writes metadata in 128-MB increments.	Effective reduction of pool capacity: About 33% of the size of the DP-VOL. The default block size for these file systems is 4 KB. This results in 33% of the DP-VOL acquiring DP pool pages. If the file system block size is changed to 2 KB or less then the DP-VOL Page consumption becomes 100%.
Solaris	UFS	Writes metadata in 52-MB increments.	No effective reduction of pool capacity. Size of DP-VOL.
	VxFS	Writes metadata to the first block.	Effective reduction of pool capacity: Small (one page).
AIX	JFS	Writes metadata in 8-MB increments.	No effective reduction of pool capacity. Size of DP-VOL. If you change the Allocation Group Size settings when you create the file system, the metadata can be written to a maximum interval of 64 MB. Approximately 65% of the pool is used at the higher group size setting.
	JFS2	Writes metadata to the first block.	Effective reduction of pool capacity: Small (one page).
	VxFS	Writes metadata to the first block.	Effective reduction of pool capacity: Small (one page).

OS	File System	Metadata Writing	Pool Capacity Consumed
HP-UX	JFS (VxFs)	Writes metadata to the first block.	Effective reduction of pool capacity: Small (one page).
	HFS	Writes metadata in 10-MB increments.	No effective reduction of pool capacity. Size of DP-VOL.

* In a Windows environment, both Normal Format and Quick Format are commonly used. In this environment, Quick Format consumes less thin provisioning pool capacities than Normal Format:

- On Windows Server 2008, using Normal Format issues Write commands to the overall volume (for example, overall "D" drive). When Write commands are issued, pages corresponding to the overall volume are allocated, so pool capacities corresponding to the ones of the overall volume are consumed. In this case, the thin provisioning advantage of reducing capacities is lost.
- Quick Format issues Write commands only to management information (for example, index information). Therefore, pages corresponding to the management information areas are allocated, but the capacities are smaller than the ones consumed by Normal Format.

Using Dynamic Provisioning or Dynamic Tiering or active flash with other software products

Interoperability of DP-VOLs and pool-VOLs

DP-VOLs and pool-VOLs can be used in conjunction with other software products with certain limitations and restrictions. The following table lists the software products and indicates the operations that are permitted and not permitted for each product.

Software product (user guide)	Permitted	Not permitted
Thin Image (*Hitachi Thin Image User Guide*)	Using a DP-VOL as a Thin Image primary volume.	• Using a DP-VOL as a Thin Image secondary volume or pool-VOL. • Using a Dynamic Provisioning or Dynamic Tiering pool-VOL as a Thin Image primary volume, secondary volume, or pool-VOL. • Increasing the capacity of a Dynamic Provisioning, Dynamic Tiering, or active flash DP-VOL that is used as a primary volume or secondary volume of a Thin Image pair. • Reclaiming zero pages of Thin Image secondary volumes with the cascade attribute disabled. • Reclaiming zero pages of Thin Image secondary volumes with the cascade and clone attributes enabled. Reclaiming zero pages can be performed for Thin Image secondary volumes with the

Software product (user guide)	Permitted	Not permitted
		cascade and snapshot attributes enabled. • Using an external volume with data direct mapping enabled as a Thin Image primary volume, secondary volume, or pool-VOL. • Using an LDEV with accelerated compression enabled as a primary volume or secondary volume of a Thin Image pair. • Using a deduplication system data volume as a primary volume or secondary volume of a Thin Image pair.
Data Retention Utility (Provisioning Guide)	Performing operations on DP-VOLs.	• Performing operations on DP pool-VOLs. • Performing operations on an external volume with data direct mapping enabled. • Performing operations on LDEVs with accelerated compression enabled. • Performing operations on a deduplication system data volume.
global-active device (*Global-Active Device User Guide*)	Using a DP-VOL as a global-active device primary volume (P-VOL) or secondary volume (S-VOL).	• Using a DP-VOL as a quorum disk. • Using a pool-VOL as a global-active device P-VOL or S-VOL. • Increasing the capacity of a DP-VOL used by global-active device. • Using an external volume with data direct mapping enabled as a quorum disk. • Using a DP-VOL with data direct mapping enabled as a quorum disk. • Using a deduplication system data volume as a global-active device P-VOL or S-VOL.
LUN Manager (Provisioning Guide) LUN Security (Provisioning Guide)	Performing operations on DP-VOLs.	• Performing operations on DP pool-VOLs. • Performing operations on an external volume with data direct mapping enabled. • Performing operations on LDEVs with accelerated compression enabled. • Performing operations on a deduplication system data volume.
ShadowImage (*Hitachi ShadowImage® User Guide*)	Using a DP-VOL as a ShadowImage primary volume (P-VOL) or secondary volume (S-VOL).	• Using a pool-VOL as a ShadowImage P-VOL or S-VOL. • Increasing the capacity of a DP-VOL used by ShadowImage.

Software product (user guide)	Permitted	Not permitted
	If a pool contains both the P-VOL and S-VOL of a pair and deduplication is enabled for the pool, only one copy of the P-VOL data is saved physically due to deduplication of the P-VOL and S-VOL data. If you want to protect the P-VOL data, use separate pools for the P-VOL and S-VOL.	• Reclaiming zero pages of a DP-VOL is determined by the pair status. For details, see ShadowImage pair status for reclaiming zero pages on page 155. • Using a deduplication system data volume as a ShadowImage P-VOL or S-VOL.
TrueCopy (*Hitachi TrueCopy® User Guide*)	Using a DP-VOL as a TrueCopy primary volume (P-VOL) or secondary volume (S-VOL). For disaster recovery (DR) operations, apply the same capacity saving setting to the P-VOL and S-VOL of the pair by assuming failover.	• Using a pool-VOL as a TrueCopy P-VOL or S-VOL. • Increasing the capacity of DP-VOL used as a P-VOL or S-VOL of a TrueCopy pair. • Using a deduplication system data volume as a TrueCopy P-VOL or S-VOL.
Universal Replicator (*Hitachi Universal Replicator User Guide*)	Using a DP-VOL as a Universal Replicator primary volume (P-VOL), secondary volume (S-VOL), or journal volume. However, the journal volume must be a DP-VOL that has OPEN-V emulation type. For disaster recovery (DR) operations, apply the same capacity saving setting to the P-VOL and S-VOL of the pair by assuming failover.	• Using a DP pool-VOL as a Universal Replicator P-VOL, S-VOL, or journal volume. • Increasing the capacity of a DP-VOL used as a P-VOL or S-VOL of a Universal Replicator pair. • Reclaiming zero pages of a DP-VOL used by a journal volume. • Using an external volume with data direct mapping enabled as a journal volume. • Using a DP-VOL with data direct mapping enabled as a journal volume. • Using a DP-VOL with capacity saving enabled (DRD volume) as a journal volume. • Using a deduplication system data volume (DSD volume) as a Universal Replicator P-VOL or S-VOL.
Universal Volume Manager (*Hitachi Universal Volume Manager User Guide*)	Using Universal Volume Manager volumes as pool-VOLs.	• Increasing the capacity of a DP-VOL that is mapped to the Universal Volume Manager. If you try to increase the capacity of a DP-VOL with the conventional LDEV operation, the capacity of the DP-VOL will not be changed. In this case, remove the mapping between the DP-VOL and Universal Volume Manager, increase the capacity of the external volume used as a pool-VOL, and then perform the mapping between the DP-VOL and Universal Volume Manager again.

Software product (user guide)	Permitted	Not permitted
		• Setting the data direct mapping attribute on a DP-VOL with capacity saving enabled (DRD volume). • Setting the data direct mapping attribute on a deduplication system data volume (DSD volume). • Enabling capacity saving on a DP-VOL from a pool with Universal Volume Manager pool-VOLs.
Virtual LUN (Provisioning Guide)	Registering Virtual LUN volumes in Dynamic Provisioning pools.	• Performing Virtual LUN operations on volumes that are already registered in a DP pool.
Virtual Partition Manager (*Performance Guide*)	Performing operations on DP-VOLs and pool-VOLs.	Not applicable
Volume Migration (For details, contact customer support.)	Using a DP-VOL as a migration source or a migration target. The maximum capacity of a DP-VOL used as a migration source or target is the same as the maximum capacity of a DP-VOL.	• Using on pool-VOLs. • Increasing the capacity of DP-VOL used by Volume Migration. • Reclaiming zero pages of V-VOL used by Volume Migration. • Using on a deduplication system data volume.
Volume Shredder (*Hitachi Volume Shredder User Guide*)	Use on DP-VOLs.	• Using on pool-VOLs. • Performing operations on an LDEV that has accelerated compression enabled. • Increasing the capacity of DP-VOL used by Volume Shredder. • Reclaiming zero pages of V-VOL used by Volume Shredder. • Performing operations on a DP-VOL with capacity saving enabled (DRD volume). • Performing operations on a deduplication system data volume.

ShadowImage pair status for reclaiming zero pages

You can use this table to determine whether reclaiming zero pages is possible for a particular pair status

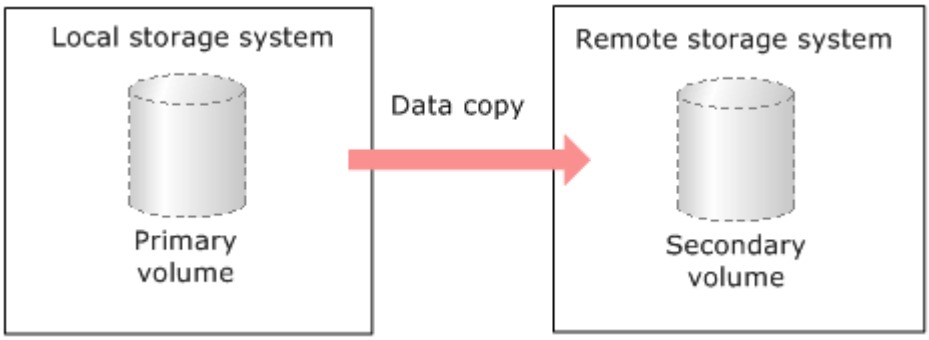
Pair status	Reclaim zero pages from Hitachi Device Manager - Storage Navigator	Reclaim zero pages from Command Control Interface
SMPL, status of an unpaired volume	Enabled	Enabled
COPY(PD)/COPY	Disabled	Disabled

Pair status	Reclaim zero pages from Hitachi Device Manager - Storage Navigator	Reclaim zero pages from Command Control Interface
PAIR	Disabled	Disabled
COPY(SP)	Disabled	Disabled
PSUS(SP)/PSUS	Disabled	Disabled
PSUS	Enabled	Enabled
COPY(RS)/COPY	Disabled	Disabled
COPY(RS-R)/RCPY	Disabled	Disabled
PSUE	Disabled	Disabled

TrueCopy

You can use Dynamic Provisioning, Dynamic Tiering, or active flash in combination with TrueCopy to replicate V-VOLs.

The following figure illustrates the interaction when the TrueCopy primary volume and secondary volume are also V-VOLs.



TrueCopy P-VOL	TrueCopy S-VOL	Explanation
DP-VOLs	DP-VOLs	Supported.
DP-VOLs	Normal (ordinary) volumes[1]	Supported.
Normal (ordinary) volumes[1]	DP-VOLs	Supported. Note, however, that this combination consumes the same amount of pool capacity as the original normal volume (primary volume).

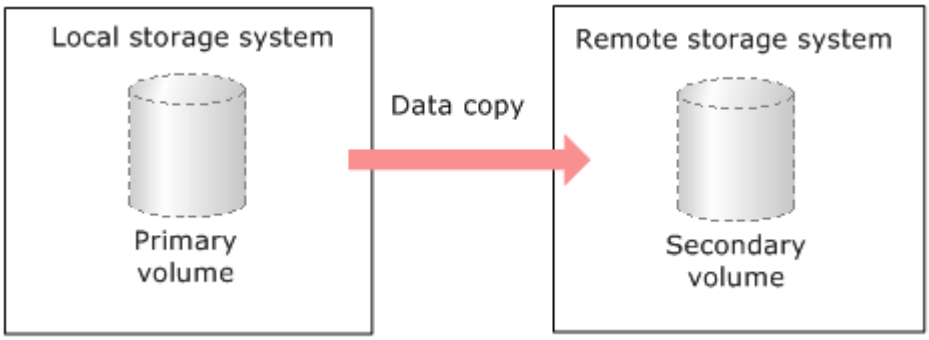
Note:

1. Normal volumes include the internal volumes and external volumes that are mapped to the volumes of the external storage system using Universal Volume Manager. For more information about external volumes, see the *Hitachi Universal Volume Manager User Guide.*

You cannot specify a Dynamic Provisioning, Dynamic Tiering, or active flash pool-VOL as a primary volume or secondary volume.

Global-active device

You can use Dynamic Provisioning, Dynamic Tiering, or active flash in combination with global-active device to replicate V-VOLs. The following figure illustrates the interaction when the global-active device primary volume and secondary volume are also V-VOLs.



Global-active device P-VOL	Global-active device S-VOL	Explanation
DP-VOLs	DP-VOLs	Supported.
DP-VOLs	Normal (ordinary) volumes[1]	Not supported.
Normal (ordinary) volumes[1]	DP-VOLs	Not supported.

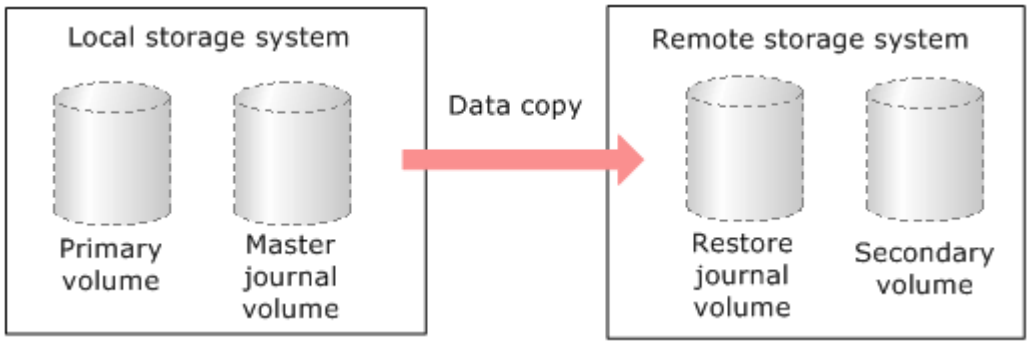
Note:

1. Normal volumes include the internal volumes and external volumes that are mapped to the volumes of the external storage system using by Universal Volume Manager. For more information about external volumes, see the *Hitachi Universal Volume Manager User Guide*.

You cannot specify a Dynamic Provisioning, Dynamic Tiering, or active flash pool-VOL as a primary volume or secondary volume. For more information, see the *Global-Active Device User Guide*.

Universal Replicator

You can use Dynamic Provisioning, Dynamic Tiering, or active flash in combination with Universal Replicator to replicate DP-VOLs.



The following table lists the supported Universal Replicator and Dynamic Provisioning, Dynamic Tiering or active flash volume combinations.

Universal Replicator P-VOL	Universal Replicator S-VOL	Universal Replicator journal volume	Explanation
DP-VOLs	DP-VOLs	DP-VOL that has the OPEN-V emulation type	Supported.
DP-VOLs	Normal (ordinary) volumes[1]	DP-VOL that has the OPEN-V emulation type	Supported.
Normal (ordinary) volumes[1]	DP-VOLs	DP-VOL that has the OPEN-V emulation type	Supported. Note, however, that this combination consumes the same amount of pool capacity as the original normal volume (primary volume).

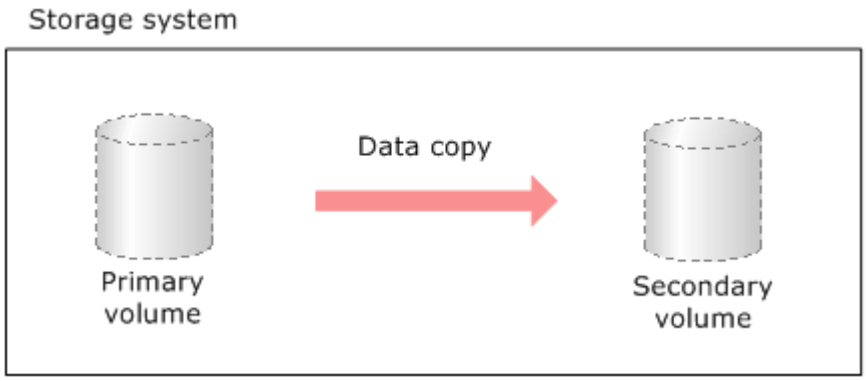
Notes:

1. Normal volumes include the internal volumes and external volumes that are mapped to the volumes of the external storage system using Universal Volume Manager. For more information about external volumes, see the *Hitachi Universal Volume Manager User Guide.*

You cannot specify a Dynamic Provisioning, Dynamic Tiering, or active flash pool-VOL as a primary volume, secondary volume, or journal volume.

ShadowImage

You can use Dynamic Provisioning, Dynamic Tiering, or active flash in combination with ShadowImage to replicate DP-VOLs.



The following table lists the interaction when the ShadowImage primary volume and secondary volume are also DP-VOLs.

ShadowImage P-VOL	ShadowImage S-VOL	Explanation
DP-VOLs	DP-VOLs	Supported.

ShadowImage P-VOL	ShadowImage S-VOL	Explanation
DP-VOLs	Normal (ordinary) volumes[1]	Supported. The Quick Restore function is unavailable.
Normal (ordinary) volumes[1]	DP-VOLs	Supported. Note, however, that this combination consumes the same amount of pool capacity as the normal volume. The Quick Restore function is unavailable.

Note:

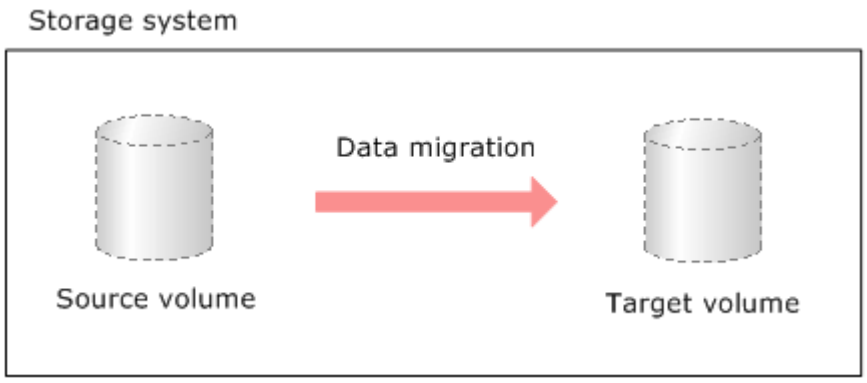
1. Normal volumes include the internal volumes and external volumes that are mapped to the volumes of the external storage system using Universal Volume Manager. For more information about external volumes, see the *Hitachi Universal Volume Manager User Guide*.

You cannot specify a Dynamic Provisioning, Dynamic Tiering or active flash pool-VOL as a primary volume or secondary volume.

Volume Migration

You can use Dynamic Provisioning or Dynamic Tiering in combination with Volume Migration to migrate DP-VOLs.

The following shows the interaction when the Volume Migration source volume and target volume are also DP-VOLs.



Volume Migration source volume	Volume Migration target volume	Explanation
DP-VOLs	DP-VOLs	Supported.
DP-VOLs	Normal (ordinary) volumes*	Supported.
Normal (ordinary) volumes*	DP-VOLs	Supported. Note, however, that this combination consumes the same amount of pool capacity as the normal volume.

Volume Migration source volume	Volume Migration target volume	Explanation
*Normal volumes include the internal volumes and external volumes that are mapped to the volumes of the external storage system by Universal Volume Manager. For more information about external volumes, see the *Hitachi Universal Volume Manager User Guide*.		

You cannot specify a Dynamic Provisioning or Dynamic Tiering pool-VOL as a Volume Migration source volume and target volume.

If you specify the DP-VOL as the source volume, you must not specify the DP-VOL that uses the same pool of the source volume.

For details about the migration of DP-VOLs used in the following pairs, see *Hitachi Volume Migration User Guide*.

- ShadowImage
- Universal Replicator

Interoperability restrictions for Thin Image

When you are using Thin Image and Dynamic Provisioning, Dynamic Tiering, or active flash in the same storage system, the following interoperability restrictions apply.

- A Thin Image pool cannot be used in conjunction with Dynamic Provisioning.
- The maximum total number of pools per storage system, including Thin Image, Dynamic Provisioning, Dynamic Tiering, and active flash pools, is 128.
- A Thin Image pool-VOL cannot be shared with Dynamic Provisioning, Dynamic Tiering, or active flash.

Virtual Partition Manager CLPR setting

If DP-VOL and pool-VOLs related to the same pool are assigned to CLPR, HDS recommends assigning DP-VOL and pool-VOLs in the same pool to the same CLPR.

For detailed information about CLPRs, see the *Performance Guide*.

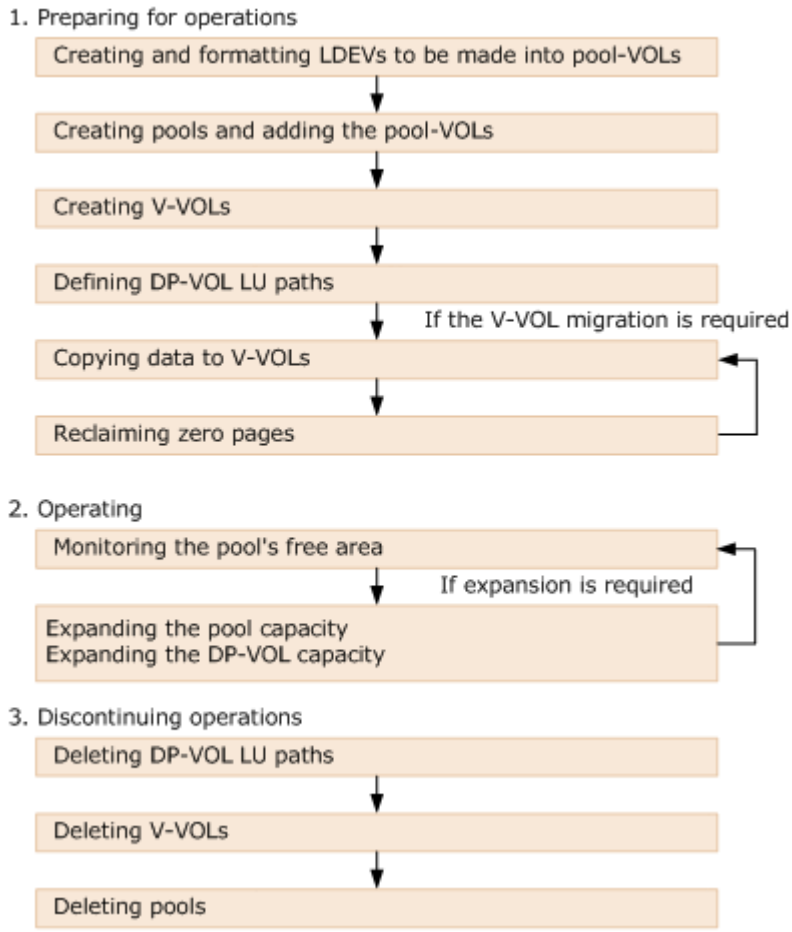
Resource Partition Manager

See Resource group rules, restrictions, and guidelines on page 87 for the conditions of resources that are necessary in the operation of other software products and the precautions required when using Resource Partition Manager.

Dynamic Provisioning workflow

The following diagram shows the workflow for setting up Dynamic Provisioning on the storage system.

Use Device Manager - Storage Navigator or Command Control Interface to create pools and DP-VOLs.



Caution: If you delete a pool, its pool-VOLs (LDEVs) will be blocked. Blocked volumes must be formatted before use.

Caution: If the V-VOL data is migrated through the host, unallocated areas of the volume might be copied as well. The used capacity of the pool increases after the data migration because the areas that were unallocated before the data migration have become allocated areas due to the migration.

To migrate the V-VOL data:

1. Copy all data of V-VOLs from the source to the target.
2. Perform the operation to reclaim zero pages.

Perform this procedure for each V-VOL. When data migration is done on a file-by-file basis, perform the operation to reclaim zero pages if necessary.

To restore the backup data:

1. Restore the V-VOL data.
2. Perform the operation to reclaim zero pages.

Perform this procedure for each V-VOL.

Dynamic Tiering and active flash

About tiered storage

In a tiered storage environment, storage tiers can be configured to accommodate different categories of data. A tier is a group of storage media (pool volumes) in a DP pool. Tiers are determined by a single storage media type. A storage tier can be one type of data drive, including SSD, SAS, or external volumes. Media of high-speed performance make up the upper tiers. Media of low-speed response become the lower tiers. Up to a maximum of three tiers can coexist in each Dynamic Tiering pool.

Categories of data may be based on levels of protection needed, performance requirements, frequency of use, and other considerations. Using different types of storage tiers helps reduce storage costs and improve performance.

Because assigning data to particular media may be an ongoing and complex activity, Dynamic Tiering software automatically manages the process based on user-defined policies.

As an example of the additional implementation of tiered storage, tier 1 data (such as mission-critical or recently accessed data) might be stored on expensive and high-quality media such as double-parity RAIDs (redundant arrays of independent disks). Tier 2 data (such as financial or seldom-used data) might be stored on less expensive storage media.

Tier monitoring and data relocation

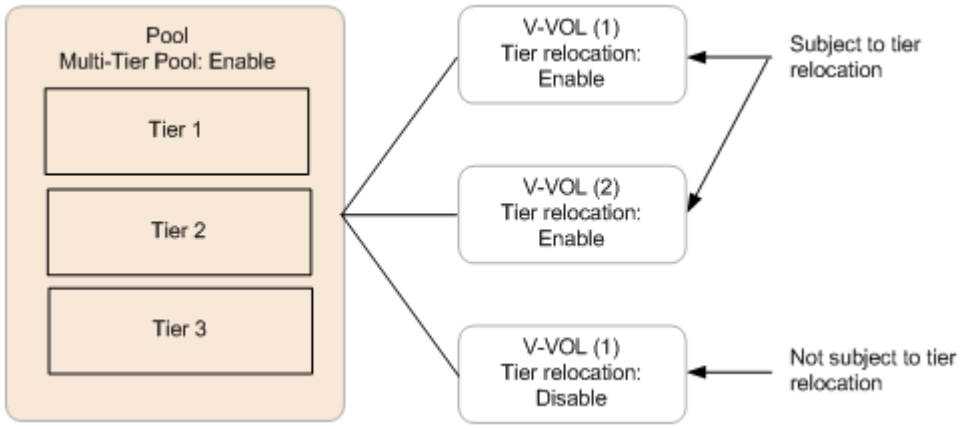
Dynamic Tiering uses tiers to manage data storage. It classifies the specified drives in the pool into tiers (storage hierarchy). Up to three tiers can be defined in a pool depending on the processing capacity of the data drives. Tiering allocates more frequently accessed data to the upper tier and less frequently accessed data, stored for a long period of time, to the lower tier.

Multi-tier pool

With Dynamic Tiering, you can enable the Multi-Tier pool option for an existing pool. The default is to allow tier relocation for each DP-VOL. Only the

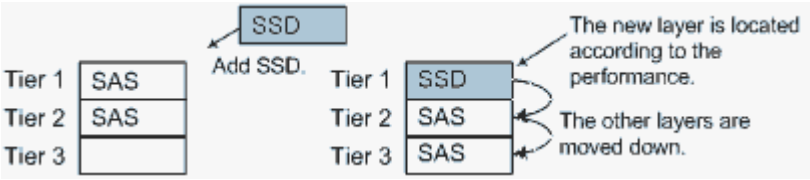
DP-VOLs for which tier relocation is enabled are subject to calculation of the tier range value, and tier relocation will be performed on them. If tier relocation is disabled for all DP-VOLs in a pool, tier relocation is not performed.

The following figure illustrates the relationship between multi-tier pool and tier relocation.



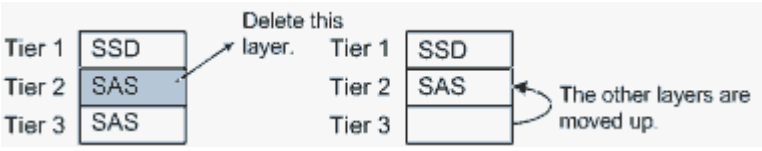
Example of adding a tier

If the added pool-VOL is a different media type, then a new tier is created in the pool. The tier is added to the appropriate position according to its performance. The following figure illustrates the process of adding a tier.



Example of deleting a tier

If a tier no longer has any pool-VOLs when you delete them, the tier is deleted from the pool. The following figure illustrates deleting a tier.



Tier monitoring and relocation cycles

Performance monitoring and tier relocation can be set to execute in one of two execution modes: Auto and Manual. You can set up execution modes, or switch between modes by using either Hitachi Device Manager - Storage Navigator or Command Control Interface.

In Auto execution mode, monitoring and relocation are continuous and automatically scheduled. In Manual execution mode, the following operations are initiated manually.

- Start monitoring
- Stop monitoring and recalculate tier range values
- Start relocation
- Stop relocation

In both execution modes, relocation of data is automatically determined based on monitoring results. The settings for these execution modes can be changed nondisruptively while the pool is in use.

Auto execution mode

Auto execution mode performs monitoring and tier relocation based on information collected by monitoring at a specified constant frequency: every 0.5, 1, 2, 4, or 8 hours. All auto execution mode cycle frequencies have a starting point at midnight (00:00). For example, if you select a 1 hour monitoring period, the starting times would be 00:00, 01:00, 02:00, 03:00, and so on.

As shown in the following table, the 24-hour monitoring cycle allows you to specify the times of day to start and stop performance monitoring. The 24-hour monitoring cycle does not have to start at midnight. Tier relocation begins at the end of each cycle.

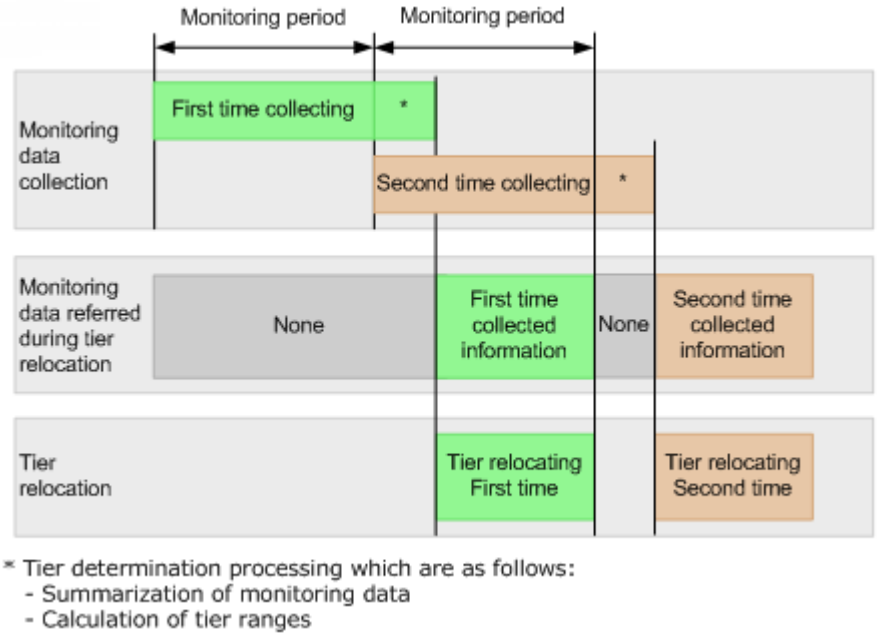
Monitoring cycle (hours)	Start Times	Finish Times
0.5	0.5 hours from 00:00 AM. For example 00:00, 00:30, and 01:00	0.5 hours after the start time
1	1 hour from 00:00 AM. For example 00:00, 01:00, and 02:00	1 hour after the start time
2	2 hours from 00:00 AM. For example 00:00, 02:00, and 04:00	2 hours after the start time
4	4 hours from 00:00 AM. For example 00:00, 04:00, and 08:00	4 hours after the start time
8	8 hours from 00:00 AM. For example 00:00, 08:00, and 16:00	8 hours after the start time
24 (monitoring time period can be specified)	Specified time	Specified time

If the setting of the monitoring cycle is changed, performance monitoring begins at the new start time. The collection of monitoring information and tier relocation operations already in progress are not interrupted when the setting is changed.

Example 1: If the monitoring cycle is changed from 1 hour to 4 hours at 01:30 AM, the collection of monitoring information and tier relocation in progress at 01:30 AM continues. At 02:00 AM and 03:00 AM, however,

monitoring information is not collected and tier relocation is not performed. From 04:00 AM, the collection of monitoring information and tier relocation operations are started again. These operations are then performed at 4-hour intervals.

Example 2: If the monitoring cycle is changed from 4 hours to 1 hour at 01:30 AM, the collection of monitoring information and tier relocation in progress at 01:30 AM continues. From 04:00 AM, the collection of monitoring information and tier relocation operations are started again. These operations are then performed at 1-hour intervals.



In auto execution mode, the collection of monitoring data and tier relocation operations are performed in parallel in the next cycle. Data from these parallel processes are stored in two separate fields.

- Data while monitoring is in progress in the next cycle.
- Fixed monitoring information used in the tier relocation.

Manual execution mode

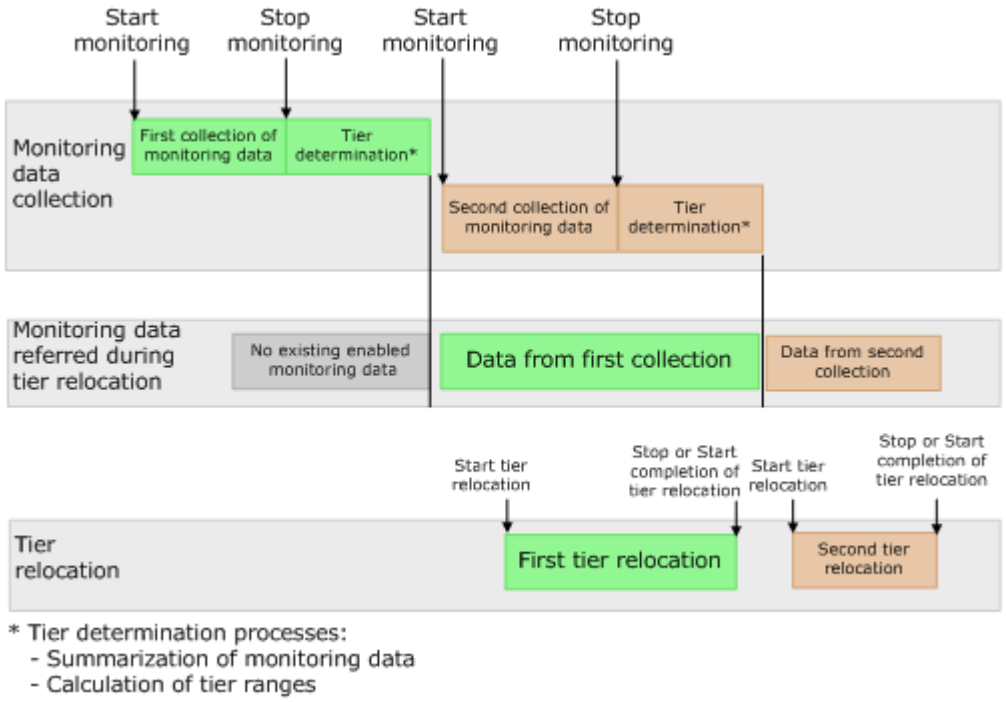
You can start and stop performance monitoring and tier relocation at any time. You should keep the duration of performance monitoring to less than 7 days (168 hours). If performance monitoring exceeds 7 days, then monitoring stops automatically.

Manual execution mode starts and ends monitoring and relocation at the time the command is issued. You can use scripts, which provide flexibility to control monitoring and relocation tasks based on a schedule for each day of the week.

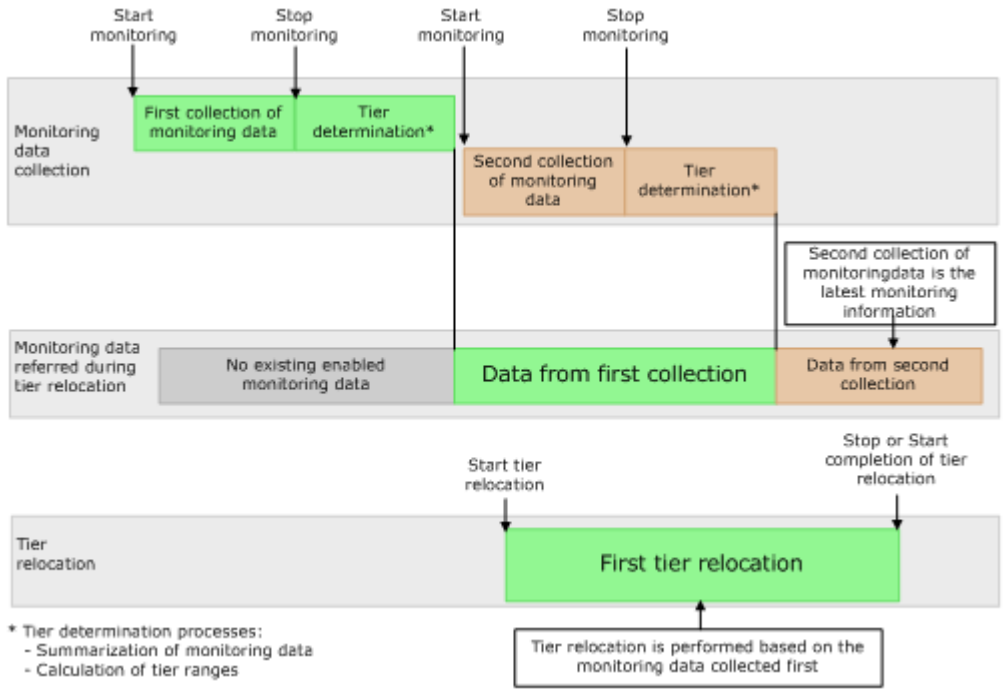
In manual execution mode, the next monitoring cycle can be started with the collection of monitoring data and tier relocation operations performed in parallel. Data from these parallel processes are stored in two separate fields.

- Data while monitoring is in progress in the next cycle.
- Fixed monitoring information used in the tier relocation.

The following figure illustrates the collection of monitoring data to tier relocation workflow in manual execution mode.



Case 1: If the second collection of the monitoring information is finished during the first tier relocation, the latest monitoring information is the second collection. In that case, the first collection of monitoring information is referenced only after the first tier relocation has completed.



Case 2: When tier relocation is performed with the first collection of monitoring information, the second collection of monitoring information can be performed. However, the third collection cannot be started. Because only two fields are used store collected monitoring information, the third collection cannot be overwritten.

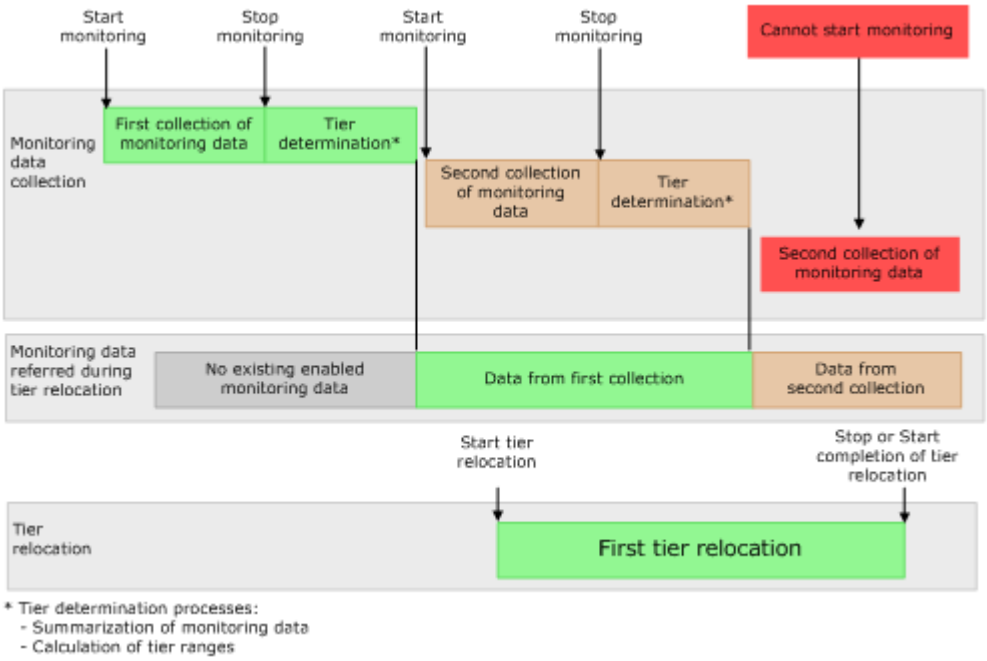
In that case, the third collection of the monitoring information is started after the first tier relocation is stopped or tier relocation has completed.

The collection of the monitoring information is not started under these conditions as well:

- When the second tier relocation is performed, the fourth collection of monitoring information cannot be started.
- When the third tier relocation is performed, the fifth collection of monitoring information cannot be started.

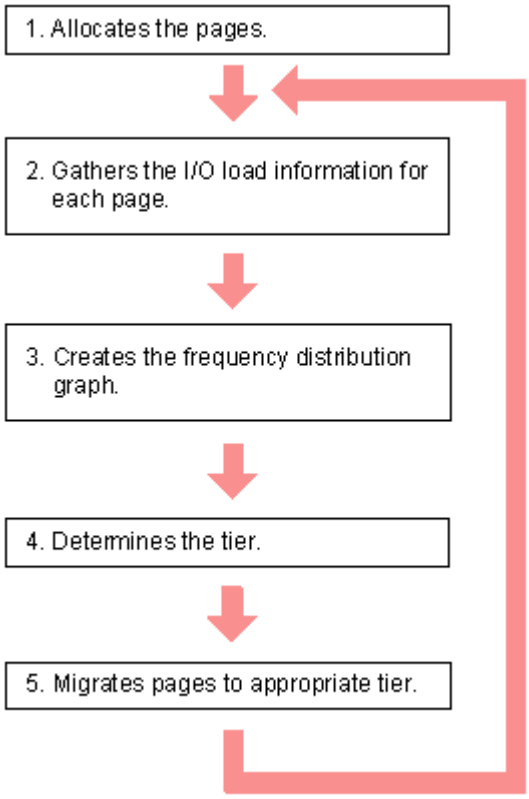
If such conditions exist, two cycles of monitoring information cannot be collected continuously while tier relocation is performed.

The following figure illustrates the third collection of monitoring information while tier relocation is performed.



Tier relocation workflow

The following shows the flow of allocating new pages and migrating them to the appropriate tier. The combination of determining the appropriate storage tier and migrating the pages to the appropriate tier is referred to as tier relocation.



Explanation of the relocation flow:

1. Allocate pages and map them to DP-VOLs
   Pages are allocated and mapped to DP-VOLs on an on-demand basis. Page allocation occurs when a write is performed to an area of any DP-VOL that does not already have a page mapped to that location. Normally, a free page is selected for allocation from an upper tier with a free page. If the capacity of the upper tier is insufficient for the allocation, the pages are allocated to the nearest lower tier. A DP-VOL set to a tier policy is assigned a new page that is based on the tier policy setting. The relative tier for new page allocations can be specified during operations to create and edit LDEVs. If the capacity of all the tiers is insufficient, an error message is sent to the host.
2. Gather I/O load information of each page
   Performance monitoring gathers monitoring information of each page in a pool to determine the physical I/O load per page in a pool. I/Os associated with page relocation, however, are not counted.
3. Create frequency distribution graph
   The frequency distribution graph, which shows the relationship between I/O counts (I/O load) and capacity (total number of pages), is created. You can use the **View Tier Properties** window to view this graph. The vertical scale of the graph indicates ranges of I/Os per hour and the horizontal scale indicates a capacity that received the I/O level. Note that the horizontal scale is accumulative.

Caution: When the number of I/Os is counted, the number of I/Os satisfied by cache hits are not counted. Therefore, the number of I/Os counted by Performance Monitoring is different from the number of I/Os from the host. The number of I/Os per hour is shown in the graph. If the monitoring time is less than an hour, the number of I/Os shown in the graph might be higher than the actual number of I/Os.

Monitoring mode settings of Period or Continuous influences the values shown on the performance graph. Period mode will report the most recent completed monitor cycle I/O data on the performance graph. Continuous mode will report a weighted average of I/O data that uses recent monitor cycle data, along with historical data on the performance graph.

4. Determine the tier range values

   The page is allocated to the appropriate tier according to performance monitoring information. The tier is determined as follows.

   a. Determine the tier boundary

      The tier range value of a tier is calculated using the frequency distribution graph. This acts as a boundary value that separates tiers.

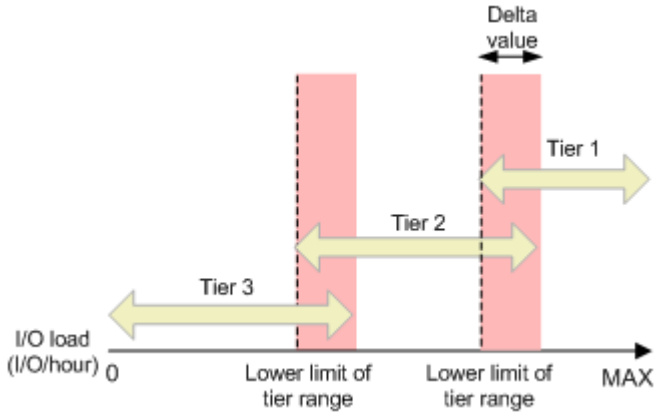
      The pages of higher I/O load are allocated to the upper tier in sequence. Tier range is defined as the lowest I/Os per hour (IOPH) value at which the total number of stored pages matches the capacity of the target tier (less some buffer percentage) or the IOPH value that will reach the maximum I/O load that the tier should process. The maximum I/O load that should be targeted to a tier is the limit performance value, and the rate of I/O to the limit performance value of a tier is called the performance utilization percent. A performance utilization of 100% indicates that the target I/O load to a tier is beyond the forecasted limit performance value.

      Caution: The limit performance value is proportional to the capacity of the pool volumes used in the tier. The total capacity of the parity group should be used for a pool to further improve the limit performance.

   b. Determine the tier delta values

      The tier range values are set as the lower limit boundary of each tier. The delta values are set above and below the tier boundaries (+10 to 20%) to prevent pages from being migrated unnecessarily. If all pages subject to tier relocation can be contained in the upper tier,

both the tier range value (lower limit) and the delta value will be zero.



c. Determine the target tier of a page for relocation.
The IOPH recorded for the page is compared against the tier range value to determine the tier to which the page moves.

5. Migrate the pages
The pages move to the appropriate tier. After migration, the page usage rates are averaged out in all tiers. I/Os which occur in the page migration are not monitored.

Related references

- Monitoring modes on page 183

Tier relocation rules, restrictions, and guidelines

Rules

- Performance monitoring, using both Auto and Manual execution modes, observes the pages that were allocated to DP-VOLs prior to the start of the monitoring cycle and the new pages allocated during the monitoring cycle. Pages that are not allocated during performance monitoring are not candidates for tier relocation.
- Tier relocation can be performed concurrently on up to eight pools. If more than eight pools are specified, relocation of the ninth pool starts after relocation of any of the first eight pools has completed.
- If Auto execution mode is specified, performance monitoring may stop about one minute before to one minute after the beginning of the next monitor cycle start time.
- The amount of relocation varies per cycle. In some cases, the cycle may end before all relocation can be handled. If tier relocation does not finish completely within the cycle, relocation to appropriate pages is executed in the next cycle.
- Calculating the tier range values will be influenced by the capacity allocated to DP-VOLs with relocation disabled and the buffer reserve percentages.

- While a pool-VOL is being deleted, tier relocation is not performed. After the pool-VOL deletion is completed, tier relocation starts.
- Frequency distribution is unavailable when there is no data provided by performance monitoring.
- While the frequency distribution graph is being created or the tier range values are being calculated, the frequency distribution graph is not available. The time required for determining the tier range values varies depending on the number of DP-VOLs and total capacity. The maximum time is about 20 minutes.
- To balance the usage levels of all parity groups, rebalancing may be performed after several tier relocation operations. If rebalancing is in progress, the next cycle of tier relocation might be delayed.

Performance monitoring or tier relocation conditions

The following table lists monitoring and execution conditions and specifies the data collection status, fixed monitoring status, and tier relocation operations for each condition. The latest fixed monitoring information is referenced when tiers are relocated.

Monitoring information or execution conditions	Status of data collection in progress	Status of fixed monitoring information used in tier relocation	Tier relocation operations	Solutions
Unallocated pages.	Pages are not monitored.	No monitoring information about pages.	Tiers of the pages are not relocated.	Unnecessary. After the pages are allocated, monitoring and relocation are performed automatically.
Zero data is discarded during data monitoring.	Monitoring on pages is reset.	Only monitoring information about pages is invalid.	Tiers of the pages are not relocated.	Unnecessary. After the pages are allocated, monitoring and relocation are performed automatically.
V-VOL settings do not allow tier relocation.	Volume is monitored.	Monitoring information about the volume is valid.	If the tier relocation setting is being disabled at the performance monitoring finish time, tiers of the volume are not relocated.	N/A
When V-VOLs are deleted.	Volume is not monitored.	Only monitoring information about the volume is invalid.	Tier relocation of the volume is suspended.	N/A

Monitoring information or execution conditions	Status of data collection in progress	Status of fixed monitoring information used in tier relocation	Tier relocation operations	Solutions
When execution mode is changed to `Manual` from `Auto` or vice versa.	Suspended.	Monitoring information collected before suspension is valid.	Suspended.	Collect the monitoring information again if necessary.[1]
When the power switch is power ON or OFF.	Monitoring is suspended by powering OFF and is not resumed even after powering ON.[1]	Monitoring information collected during the previous cycle is continuously valid.	Tier relocation is suspended by powering OFF and is resumed after powering ON.	Collect the monitoring information again if necessary.[1]
• When Volume Migration is performed. • When Quick Restore of ShadowImage is performed.	The monitoring information of the volume is not collected at the present moment. In the next monitoring period, the monitoring information will be collected.	Monitoring information is invalid and the volumes need to be monitored.	Tier relocation to volumes is suspended.	Collect the monitoring information again if necessary.[1]
S-VOL of the following products when the initial copy operation is performed: • TrueCopy • Global-active device • Universal Replicator	Monitoring information is collected continuously, but the monitoring of the volumes is reset.[2]	No effect on the fixed monitoring information. The monitoring information collected during the previous cycle continues to be valid.	Tier relocation to volumes is suspended.	Collect the monitoring information again if necessary.[1]
• When the number of tiers increases by adding pool-VOLs. • When the pool-VOLs of the tiers are switched by adding pool-VOLs.[3] • When tier rank of the external LDEV is changed.	Continued.	Fixed monitoring information is invalid because the monitoring information was discarded. If monitoring is set to the continuous mode, weighted data calculated by using the monitoring information in past periods is also discarded.	Suspended.	Relocate tiers again.[1]
When pool-VOLs are deleted.	Continued.	Monitoring information is invalid temporarily. The monitoring	Deleting the pool-VOL stops the tier relocation. The	N/A

Monitoring information or execution conditions	Status of data collection in progress	Status of fixed monitoring information used in tier relocation	Tier relocation operations	Solutions
		information is calculated again after deleting of pool-VOLs.[4]	process resumes after the pool-VOL is deleted.	
When cache is blocked.	Continued.	No effect on the fixed monitoring information. The monitoring information collected during the previous cycle continues to be valid.	Suspended.[5]	After recovering the faulty area, relocate tiers again.[1]
When an LDEV is blocked (pool-VOL or V-VOL).	Continued.	No effect on the fixed monitoring information. The monitoring information collected during the previous cycle continues to be valid.	Suspended.[5]	After recovering the faulty area, relocate tiers again.[1]
When the depletion threshold of the pool is nearly exceeded during relocation.	Continued.	No effect on the fixed monitoring information. The monitoring information collected during the previous cycle continues to be valid.	Suspended.[5]	Add pool-VOLs, then collect monitoring information and relocate tiers again.[1]
When execution mode is `Auto` and the execution cycle ends during tier relocation.	At the end time of execution cycle, data monitoring stops.	The monitoring information collected before monitoring performance stops is valid.	Suspended.[5]	Unnecessary. The relocation is performed automatically in the next cycle.
When execution mode is `Manual` and 7 days elapse after monitoring starts.	Suspended.	The monitoring information collected before suspension is valid.	Continued.	Collect the monitoring information again if necessary.[1]

Notes:

1. The execution mode is Auto or the script is written in manual execution mode, information is monitored again, and tiers are relocated automatically.
2. All pages of the S-VOLs are not allocated, and the monitoring information of the volume is reset. After the page is allocated to the new page, the monitoring information is collected.
3. Example: Pool-VOLs of SAS15K are added to the following Configuration 1:
   - Configuration 1 (before change): Tier 1 is SSD, Tier 2 is SAS10K, and Tier 3 is SAS7.2K.
   - Configuration 2 (after change): Tier 1 is SSD, Tier 2 is SAS15K, and Tier 3 is SAS10K and SAS7.2K.

Monitoring information or execution conditions	Status of data collection in progress	Status of fixed monitoring information used in tier relocation	Tier relocation operations	Solutions
4. The monitoring information status is changed from invalid (INV) to calculating (PND). After completion of calculating, the monitor information status changes from calculating (PND) to valid (VAL). **5.** The SIM code 641xxx is displayed if "Notify an alert when tier relocation is suspended by system" is enabled on the "Edit Advanced System Settings" window.				

Buffer area of a tier

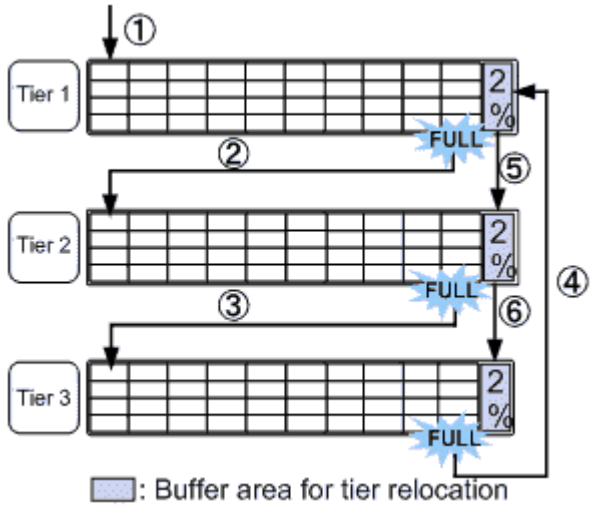
Dynamic Tiering uses buffer percentages to reserve pages for new page assignments and allow the tier relocation process. Areas necessary for processing these operations are distributed corresponding to settings used by Dynamic Tiering. The following describes how processing takes place to handle the buffer percentages.

Buffer space: The following table shows the default rates (rate to capacity of a tier) of buffer space used for tier relocation and new page assignments, listed by drive type.

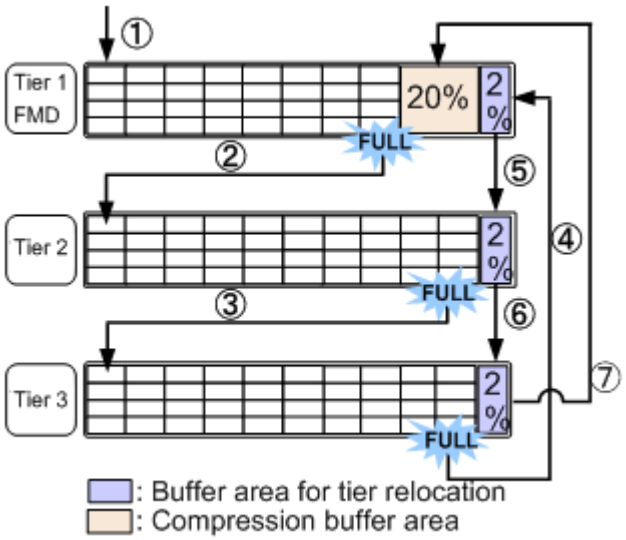
Drive type	buffer area for tier relocation	buffer area for new page assignment	Total
SSD	2%	0%	2%
Non-SSD	2%	8%	10%

New page assignment: New pages are assigned based on a number of optional settings. Pages are then assigned to the next lower tier, leaving a buffer area (2% per tier by default) for tier relocation. After 98% of capacity of all tiers is assigned, the remaining 2% of the buffer space is assigned from the upper tier. The buffer space for tier relocation is 2% in all tiers.

The following illustrates the workflow of a new page assignment.



For a pool comprised of pool volumes from parity groups with accelerated compression enabled, the capacity of the parity group equivalent to 20% of the FMC tier is used as the compression buffer area. When free space other than the FMC tier is not available, pages are assigned to this buffer area just before the capacity depletes.



Setting external volumes for each tier

If you use external volumes as pool-VOLs, you can put the external volumes in tiers by setting the External LDEV Tier Rank for the external volumes. The External LDEV Tier Rank consists of the following three types: High, Middle, and Low. The following examples describe how tiers may be configured:

Example 1: Configuring tiers by using external volumes only

Tier 1: External volumes (High)

Tier 2: External volumes (Middle)

Tier 3: External volumes (Low)

Example 2: Configuring tiers by combining internal volumes and external volumes

Tier 1: Internal volumes (SSD)

Tier 2: External volumes (High)

Tier 3: External volumes (Low)

You can set the External LDEV Tier Rank when creating the pool, changing the pool capacity, or setting the **Edit External LDEV Tier Rank** window. The following table explains the performance priority (from the top) of data drives.

Priority	Data drive type
1	SSD
2	SAS 15K rpm
3	SAS 10K rpm
4	SAS 7.2K rpm
5	External volume* (High)
6	External volume* (Middle)
7	External volume* (Low)
*Displays as External Storage in the Drive Type/RPM.	

Reserved pages for relocation operation: A small percentage of pages, normally 2, are reserved per tier to allow relocation to operate. These are the buffer spaces for tier relocation.

Tier relocation workflow: Tier relocation is performed taking advantage of the buffer space allocated for tier relocation, as mentioned previously. Tier relocation is also performed to secure the space reserved in each tier for new page assignment. The area is called the buffer space for new page assignments. When tier relocation is performed, Dynamic Tiering reserves buffer spaces for relocation and new page assignment.

During relocation, a tier may temporarily be assigned over 98% of capacity, or well under the allowance for the buffer areas.

Execution modes for tier relocation

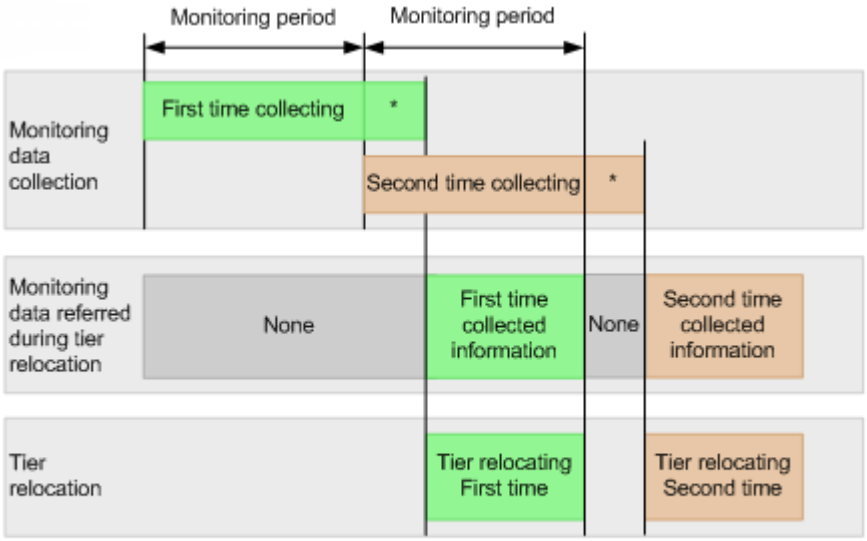
Execution modes when using Hitachi Device Manager - Storage Navigator

Dynamic Tiering performs tier relocations using one of two execution modes: Auto and Manual. You can switch between modes by using Hitachi Device Manager - Storage Navigator.

Auto execution mode

In Auto execution mode, the system automatically and periodically collects monitoring data and performs tier relocation. You can select an Auto execution cycle of 0.5, 1, 2, 4, or 8 hours, or a specified time.

The following illustrates tier relocation processing in a 2-hour Auto execution mode:



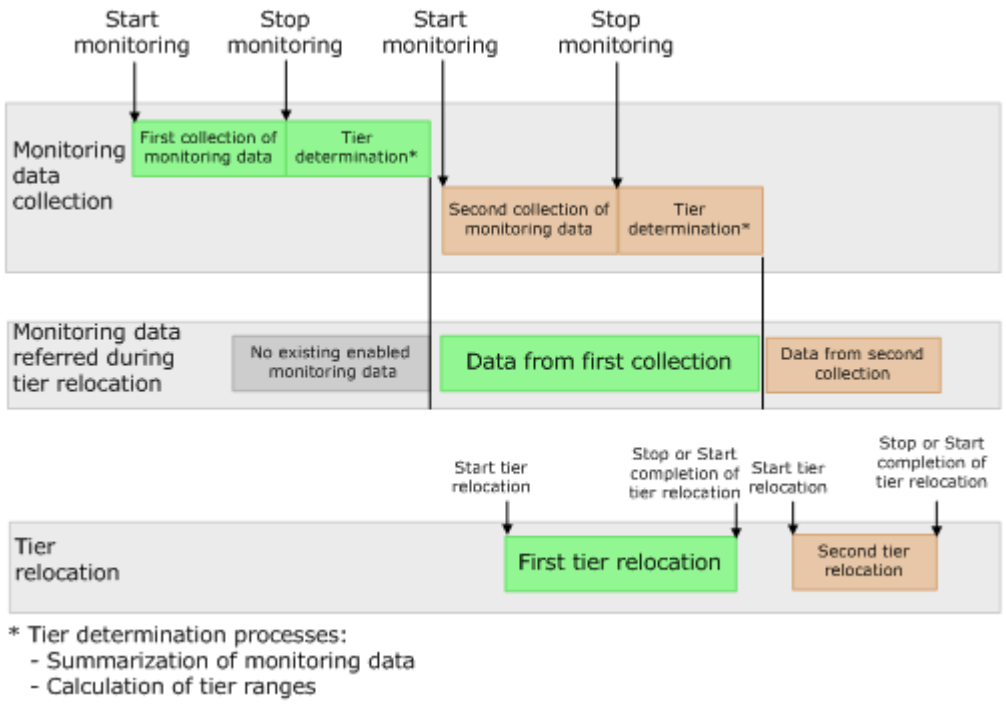
* Tier determination processing which are as follows:
  - Summarization of monitoring data
  - Calculation of tier ranges

Manual execution mode

In Manual execution mode, you can manually collect monitoring data and relocate a tier. You can issue commands to manually:

1. Start monitoring.
2. Stop monitoring.
3. Perform tier relocation.

The following illustrates tier relocation processing in Manual execution mode:



Notes on performing monitoring

- You can collect the monitoring data even while performing the relocation.
- After stopping the monitoring, the tier range is automatically calculated.
- The latest available monitoring information, which is collected just before the relocation is performed, is used for the relocation processing.
- When the relocation is performed, the status of the monitor information must be valid.

Viewing monitor and tier relocation information in HDvM - SN

Hitachi Device Manager - Storage Navigator (HDvM - SN) displays the following information about monitor and tier relocation.

Field	Windows	Details
Monitoring Status	• **Pools** window • Pool Volumes tab • **View Pool Management Status** window	Displays the status of pool monitoring. • In Progress: The monitoring is being performed. • During Computation: The calculating is being processed. Other than these cases, a hyphen (-) is displayed.
Recent Monitor Data	• **Pools** window • Pool Volumes tab	Displays the latest monitoring data. • If the monitoring data exists, the monitoring period of time is displayed.

Field	Windows	Details
		Example: 2010/11/15 00:00 - 2010/11/15 23:59 • If the monitoring data is being obtained, only the starting time is displayed. Example: 2010/11/15 00:00 - • If the latest monitoring data does not exist, a hyphen (-) is displayed.
Pool Management Task	• **Pools** window • Pool Volumes tab	Displays the pool management task being performed to the pool. • Waiting for Relocation: The tier relocation process is waiting. • Relocating: The tier relocation process is being performed. For details about the relocation progress rate, check the tier relocation log.
Pool Management Task (Status/ Progress)	**View Pool Management Status** window	Displays the status of the pool management task being performed, each V-VOL progress ratio in the pool and its average. • Waiting for Relocation: The tier relocation process is waiting. • Relocating: The tier relocation process is being performed. For details about the relocation progress rate, check the tier relocation log.
Relocation Result	• **Pools** window • Pool Volumes tab • **View Pool Management Status** window	Displays the status of the tier relocation processing. • In Progress: The status of Pool Management Task is `Waiting for Relocation` or `Relocating`. • Completed: The tier relocation operation is not in progress, or the tier relocation is complete. • Uncompleted (n% relocated): The tier relocation is suspended at the indicated percentage progression. • Hyphen (-) : The pool is not a Dynamic Tiering or Dynamic Tiering for Mainframe pool.
Relocation Speed	• **Pools** window • **View Pool Management Status** window • **Create Pools** window • **Edit Pools** window • **Start Tier Relocation** window • **Stop Tier Relocation** window	Displays the tier relocation speed settings. • 1(Slowest) • 2(Slower) • 3(Standard) • 4(Faster) • 5(Fastest)
Relocation Priority	• Pool Volumes tab	Displays the relocation priority.

Field	Windows	Details
	• **View Pool Management Status** window	• Prioritized: The priority is set to V-VOL. • Blank: The priority is not set to V-VOL. • Hyphen (-): V-VOL is not the Dynamic Tiering V-VOL or the tier relocation function is disabled.
Performance Graph	**View Tier Properties** window	The performance graph for the available monitor information is displayed in the **View Tier Properties** window.

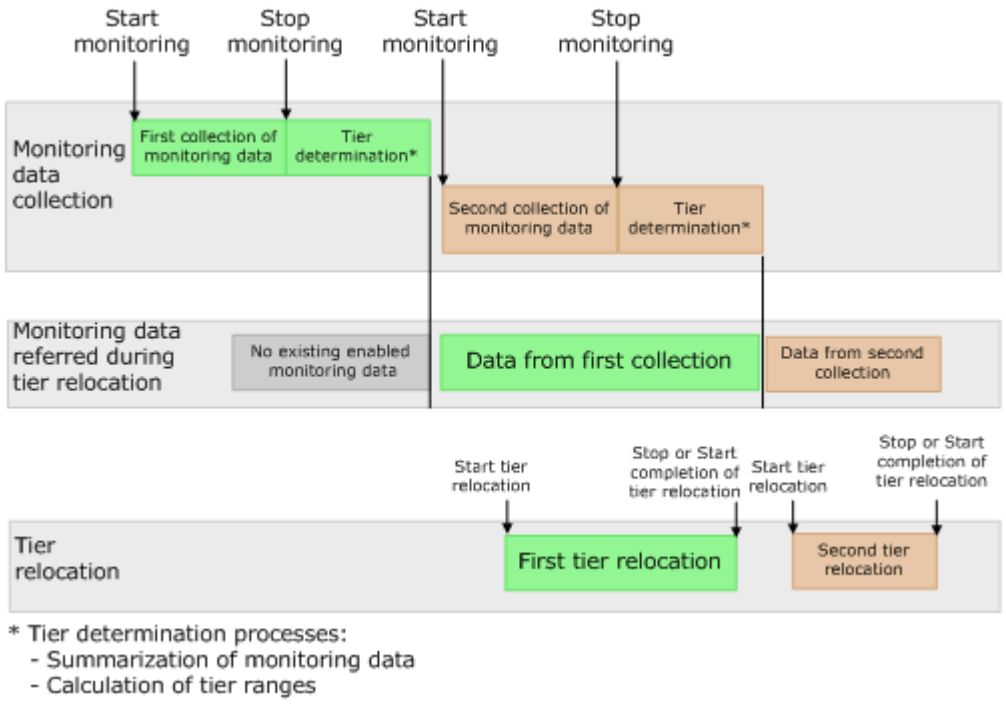
Execution modes when using Command Control Interface

Manual execution mode

In Manual execution mode, you can manually collect monitoring data and relocate a tier. You can execute commands to do the following:

1. Start monitoring.
2. Stop monitoring.
3. Perform tier relocation.

The following illustrates tier relocation processing when in Manual execution mode:



Notes on performing monitoring

- You can collect the monitoring data even while performing the relocation.
- After stopping the monitoring, the tier range is automatically calculated.
- The latest available monitoring information, which is collected just before the relocation is performed, is used for the relocation processing.
- When the relocation is performed, the status of the monitor information must be valid.

Viewing monitor and tier relocation information using CCI

To view the monitoring information and tier relocation information, execute the `raidcom get dp_pool` command with the `-key opt` option specified. For details, see the *Command Control Interface Command Reference*.

The following items are displayed:

- STS
  This item displays the operational status of the performance monitor and the tier relocation.
  - STP: The performance monitor and the tier relocation are stopped.
  - RLC: The performance monitor is stopped. The tier relocation is operating.
  - MON: The performance monitor is operating. The tier relocation is stopped.
  - RLM: The performance monitor and the tier relocation are operating.

- DAT
  This item displays the status of the monitor information.
  - VAL: Valid.
  - INV: Invalid.
  - PND: Being calculated.

- R(%)
  This item displays the progress percentage of tier relocation.
  0 to 99: Shows one of the following statuses.
  - When the value of STS is RLC or RLM: Relocation is in progress.
  - When the value of STS is STP or MON: Relocation is suspended at the indicated percentage progression.

  100: Shows if the relocation operation is not in progress, or the relocation is complete.

Relocation speed

Relocation speed: The page relocation speed can be set to 1(Slowest), 2(Slower), 3(Standard), 4(Faster), and 5(Fastest). The default is 3(Standard). If you want to perform tier relocation at high speed, use the 5(Fastest) setting. If you set a speed that is slower than 3(Standard), the load to data drives is low when tier relocation is performed.

Based on the number of the parity groups that constitute a pool, this function adjusts the number of V-VOLs for which tier relocation can be performed at one time. Tier relocation can be performed on as many as 32 V-VOLs in a storage system at once.

After changing the setting, the relocation speed does not change and the data drive load may not change in the following cases:

- The number of parity groups is very few.
- The number of V-VOLs associated with the pool is very few.
- Tier relocations are being performed on the multiple pools.

Monitoring modes

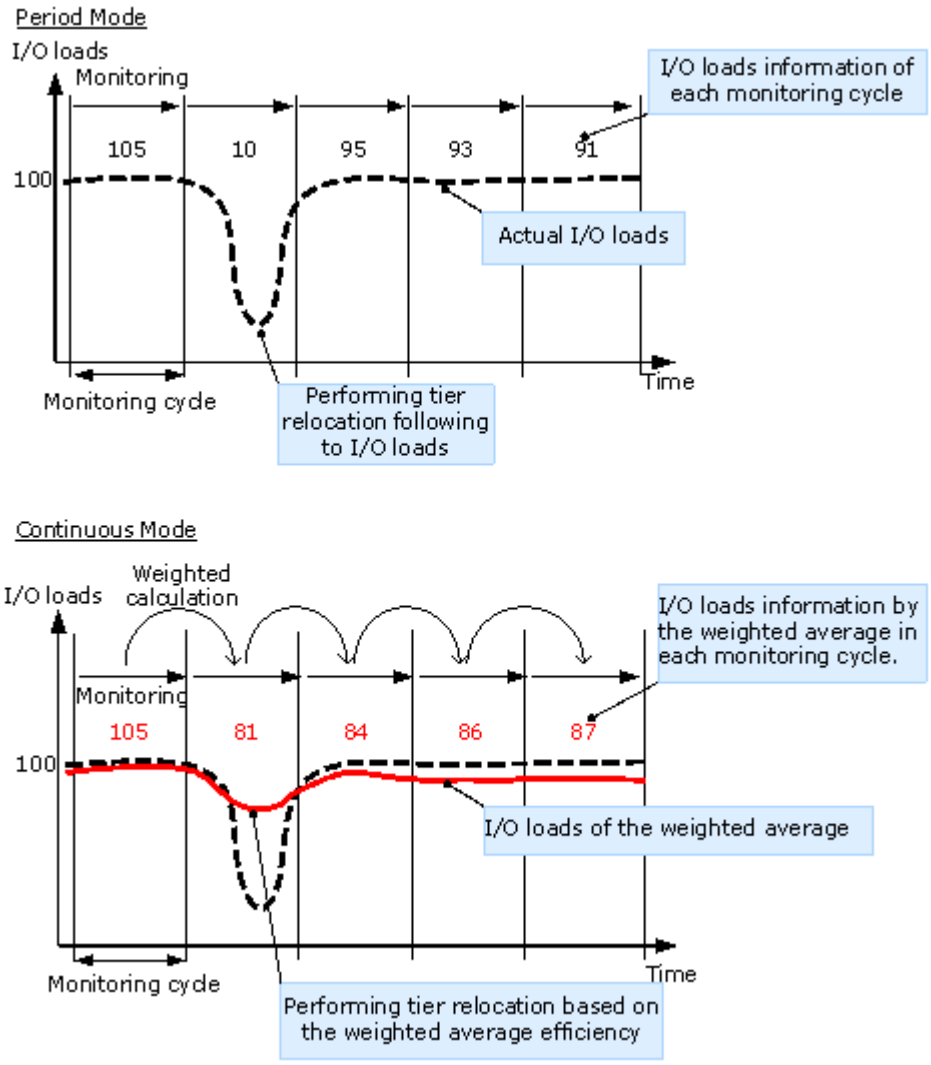
When you create or edit a pool, you set the Dynamic Tiering monitoring mode: period mode, or continuous mode. When you change the monitoring mode, the new monitoring setting becomes effective when the next monitoring period starts.

Period mode (default)

When Period mode is enabled, tier range values and page relocations are determined based solely on the monitoring data from the last complete cycle. Relocation is performed according to any changes in I/O loads. However, if the I/O loads vary greatly, relocation might not finish in one cycle.

Continuous mode

When Continuous mode is enabled, the weighted average efficiency is calculated by weighting the latest monitoring information and the collected monitoring information in the past cycles. By performing the tier relocation based on the weighted average efficiency, even if a temporary decrease or an increase of the I/O load occurs, unnecessary relocation can be avoided.



Cautions when using monitoring modes

- When Continuous monitoring mode is used, best practice is to collect monitoring information using the following execution modes:
  - Auto execution mode
  - Manual execution mode with collecting the periodic monitoring information by defining a script using CCI

  If Manual execution mode is used without scripts, Continuous monitoring mode can be set. However, in this case, unexpected results might be calculated because the weighted average efficiency is calculated based on very different duration (short and long) periods information obtained in the past cycles.
- When Continuous monitoring mode is used, the frequency distributions are displayed for each pool and V-VOL calculated by using the monitor value on which the weighted calculation is done.

These calculated values are the predictive values for the next cycle after successfully relocating all pages. Therefore, these values might differ from an actual monitoring result when they appear.
In Performance Utilization of each tier, regardless of the type of the monitoring mode setting, the monitor values that were already collected in the current cycle are displayed.
If you switch the monitoring mode from Period to Continuous or from Continuous to Period, the current cycle's monitoring data that is being collected is not discarded. However, the data calculated by using past monitor cycle information on which the weighted calculation is done will be reset.

Downloading the tier relocation log file

You can download the log file that contains the results of past tier relocations. See Tier relocation log file contents on page 185 for information about the contents of the log.

Note: For details on how to download the tier relocation file using the raidinf command, see the *System Administrator Guide*.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Select **Pools** in the **Storage Systems** tree. In the **Pools** tab, click **More Actions** and select **Export Tier Relocation Log**.
2. In the dialog box, specify a folder for the log file you download and click **Save**.
   If you change the file name from the default, make sure the file name is appended with the `.tsv` extension before saving the file.

Tier relocation log file contents

In every cycle in which tier relocation is performed, information about each pool and V-VOL is exported to the tier relocation log. The time required to incorporate the latest tier relocation results may be approximately 30 minutes. The tier relocation log file is tab-delimited and contains the following information.

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
Cycle ID	Yes	Yes	Common	ID of each cycle of a tier relocation.

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
				A common ID is allocated to pool logs and V-VOL logs that are collected in one cycle.
Log Format Version	Yes	Yes	Common	Version number of the tier relocation log format.
DKC Serial Number	Yes	Yes	Common	Serial number of the storage system.
Log Type	Yes	Yes	Common	Following log types are displayed. POOL: Log information of each pool. V-VOL: Log information of each V-VOL.
LDEV ID	No	Yes	Common	LDEV ID of a V-VOL exported to a log.
Pool ID	Yes	Yes	Common	Pool ID of a pool exported to a log.
Num of V-VOLs	Yes	No	Common	The number of V-VOLs to be processed when tier relocation is performed.
Tiering Policy	No	Yes	Tier relocation result	Value of the tiering policy. Values from All(0) to Level31(31) can be displayed. From Level6(6) to Level31(31), the names of tiering policies can be changed. If these names have changed, the new names appear.
Tier1 Total	Yes	No	Capacity information	Total pages of tier 1.
Tier2 Total	Yes	No	Capacity information	Total pages of tier 2.
Tier3 Total	Yes	No	Capacity information	Total pages of tier 3.
Tier1 Used	Yes	Yes	Capacity information	Pages assigned to tier 1 at the start of tier relocation.
Tier2 Used	Yes	Yes	Capacity information	Pages assigned to tier 2 at the start of tier relocation.
Tier3 Used	Yes	Yes	Capacity information	Pages assigned to tier 3 at the start of tier relocation.
Start Relocation Date	Yes	Yes[1]	Common	Starting date of the tier relocation.
Start Relocation Time	Yes	Yes[1]	Common	Starting time of the tier relocation.
End Relocation Date	Yes	Yes[1]	Common	Ending date of the tier relocation.
End Relocation Time	Yes	Yes[1]	Common	Ending time of the tier relocation.

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
Result Status	Yes	Yes[1]	Tier relocation result	Statuses of a tier relocation. Normal End: Tier relocation and optimization ended normally. Normal End (Optimization remains): Tier relocation ended normally, but tier optimization terminated in the middle of processing.[2] Suspend: Tier relocation suspended.
Detail Status	Yes	Yes[1]	Tier relocation result	If the Result Status is Suspend, one of following reasons is displayed. Monitor discarded: Suspended due to the discard of monitoring data.[3] End of cycle: Suspended due to incomplete tier relocation during a monitoring cycle. Requested by user: Suspended due to request by a user[2]. Threshold exceeded: Suspended because the used capacity of pools reaches a threshold due to a tier relocation. When the used capacity of a pool reaches the depletion threshold, this reason is logged. FMC threshold exceeded: Suspended because the used capacity of the physical capacity in the accelerated compression-enabled FMC parity group pool reached its full capacity. Cache blocked: Suspended because a cache memory is blocked. Volume blocked: Suspended because an LDEV which is pool-VOL or V-VOL is blocked. The tier management changed (Auto/Manual): Suspended because the tier management mode is changed from Auto to Manual, or Manual to Auto. Other reasons: Suspended for reasons other than the above, such as: • A V-VOL was specified as the secondary volume of the TrueCopy pair and an initial copy operation was performed.

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
				• A V-VOL was specified as the secondary volume of the global-active device device pair and an initial copy operation was performed • A V-VOL was specified as the secondary volume of the Universal Replicator pair, and an initial copy operation was performed.
Completed Rate (%)	Yes	Yes	Tier relocation result	Progress percentage rate at the time tier relocation ends or is suspended.
Remediation Rate (%)	Yes	Yes	Tier relocation result	IOPH (I/O per hour) remediation rate at the time tier relocation ends or is suspended. The remediation rate = ((Total IOPH of pages after the promotion[1]) / (Total IOPH of all pages to be performed of promotion[1])) * 100 1: Promotion is the page migration from a lower to higher tier.
Planned Tier1->Tier2	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 1 to tier 2.
Planned Tier1->Tier3	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 1 to tier 3.
Planned Tier2->Tier1	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 2 to tier 1.
Planned Tier2->Tier3	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 2 to tier 3.
Planned Tier3->Tier1	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 3 to tier 1.
Planned Tier3->Tier2	Yes	Yes	Tier relocation	Number of pages that are planned to move from the tier 3 to tier 2.
Moved Tier1->Tier2	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 1 to tier 2.
Moved Tier1->Tier3	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 1 to tier 3.
Moved Tier2->Tier1	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 2 to tier 1.
Moved Tier2->Tier3	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 2 to tier 3.
Moved Tier3->Tier1	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 3 to tier 1.
Moved Tier3->Tier2	Yes	Yes	Tier relocation	Number of pages that are moved from the tier 3 to tier 2.
IOPH	Yes	Yes	Monitoring result	IOPHs of all pools or V-VOLs.

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
IOPH Tier1 (%)	Yes	Yes	Monitoring result	Percentage of IOPH for tier 1.
IOPH Tier2 (%)	Yes	Yes	Monitoring result	Percentage of IOPH for tier 2.
IOPH Tier3 (%)	Yes	Yes	Monitoring result	Percentage of IOPH for tier 3.
Performance Util Tier1 (%)	Yes	No	Monitoring result	Performance utilization of tier 1. The performance utilization is the current I/O percentage based on the maximum performance of tier 1.
Performance Util Tier2 (%)	Yes	No	Monitoring result	Performance utilization of tier 2. The performance utilization is the current I/O percentage based on the maximum performance of tier 2.
Performance Util Tier3 (%)	Yes	No	Monitoring result	Performance utilization of tier 3. The performance utilization is the current I/O percentage based on the maximum performance of tier 3.
Tier1 Low Range	No	Yes	Monitoring result	Lower limit in a range for tier 1.
Tier2 High Range	No	Yes	Monitoring result	Higher limit in a range for tier 2.
Tier2 Low Range	No	Yes	Monitoring result	Lower limit in a range for tier 2.
Tier3 High Range	No	Yes	Monitoring result	Higher limit in a range for tier 3.
Reclaim Zero Page Num	Yes	Yes	Tier relocation	Number of pages processed in an operation to reclaim zero pages.
Non Compliant Tiering Policy Number	Yes	No	Monitoring result	Number of a tiering policy that does not conform to the current tier configuration. A non-compliant policy prevents tier relocation.
Realtime Moved Tier2->Tier1 (Unplanned)	Yes	Yes	Tier relocation	Number of pages moved from tier 2 to tier 1 by active flash while performing the tier relocation by Dynamic Tiering. However, the pages migration is not planned by Dynamic Tiering.
Realtime Moved Tier3->Tier1 (Unplanned)	Yes	Yes	Tier relocation	Number of pages moved from tier 3 to tier 1 by active flash while performing the tier relocation by Dynamic Tiering. However, the pages migration is not planned by Dynamic Tiering.
Realtime Moved Tier2->Tier1 (Planned)	Yes	Yes	Tier relocation	Number of pages moved from tier 2 to tier 1 by active flash while performing the tier relocation by Dynamic Tiering. The pages migration is planned by Dynamic Tiering.
Realtime Moved Tier3->Tier1 (Planned)	Yes	Yes	Tier relocation	Number of pages moved from tier 3 to tier 1 by active flash while performing the tier relocation by Dynamic Tiering. The pages

Item	Does each pool output the log information?	Does each V-VOL output the log information?	Type of information	Description
				migration is planned by Dynamic Tiering.
Realtime Moved Tier1->Tier2	Yes	Yes	Tier relocation	Number of pages moved from tier 1 to tier 2 by active flash while performing the tier relocation for Dynamic Tiering.
Realtime Moved Tier1->Tier3	Yes	Yes	Tier relocation	Number of pages moved from tier 1 to tier 3 by active flash while performing the tier relocation for Dynamic Tiering.
Realtime Moved Tier2->Tier1 (Non Compliant)	Yes	Yes	Tier relocation	In the total pages moved from tier 2 to tier 1 by active flash, the number of migrated pages that do not conform to the plan of Dynamic Tiering page migration.
Realtime Moved Tier3->Tier1 (Non Compliant)	Yes	Yes	Tier relocation	In the total pages moved from tier 3 to tier 1 by active flash, the number of migrated pages that do not conform to the plan of Dynamic Tiering page migration.
Realtime Moved Tier1->Tier2 (Non Compliant)	Yes	Yes	Tier relocation	In the total pages moved from tier 1 to tier 2 by active flash, the number of migrated pages that do not conform to the plan of Dynamic Tiering page migration.
Realtime Moved Tier1->Tier3 (Non Compliant)	Yes	Yes	Tier relocation	In the total pages moved from tier 1 to tier 3 by active flash, the number of migrated pages that do not conform to the plan of Dynamic Tiering page migration.

Notes

1. If the log file is lfv2 (Log Format Version 2) or later, the log file information of each V-VOL appears. If the log file is lfv 1, a hyphen appears.
2. If the log file is lfv5 (Log Format Version 5) or later, this information appears.
3. When deleting pool-VOLs, ex-valid monitor information are discarded, so that the tier relocation is interrupted. After completion of the pool-VOLs deleting, the tier determination calculation performs again and completes. Processed by this way, the valid monitor information are re-created.

Tiering policy

The tiering policy function is used to assign a specific storage tier to a specific DP-VOL. A tiering policy specifies subset of tiers that is available to a given set of DP-VOLs.

Tier relocation changes the location of previously stored data. It is performed in conformance to the tiering policy. If a DP-VOL is initially allocated to a low-speed tier and the tiering policy is changed to a high-speed tier, relocation is performed in the next cycle.

For example, if you set the tiering policy level on a V-VOL (DP-VOL) to a tier with a high I/O speed, the data is always stored on the high-speed tier when relocating tiers. When you use that V-VOL (DP-VOL), regardless of the actual size of the I/O load, you can always get high-speed responses. See Tiering policy levels on page 194.

When you create the DP-VOL, you can designate one of six existing tiering policies and define up to 26 new tiering policies. See Tiering policy levels on page 194 and Setting tiering policy on a DP-VOL on page 193.

Use the **Edit LDEVs** window to change the tiering policy settings. When tier relocation occurs, the related tiering policy set for the DP-VOL is used to relocate data to the desired tier or tiers.

The tiering policy does not own pool capacity. Rather, pool capacity is shared among tiers. Pages are allocated in order of priority from upper to lower tiers in a tiering policy. When you specify a new allocation tier, pages are allocated starting from the tier that you specify.

The tier range, frequency distribution, and used capacity are displayed per tiering policy: existing tier level All(0), Level1(1) through Level5(5), and Level6(6) to Level31(31).

Custom policies

The settings of the tiering policy can be changed and these tiering policies changed by a user are called custom policies. Custom policies can be defined for IDs of tiering policies from 6 to 31 (from Level6(6) to Level31(31)). The following items can be set in the custom policy:

- Rename custom policy
- Change allocation threshold

Custom policy name

A custom policy name can be changed arbitrarily. You can change the names of custom policies from Level6(6) to Level31(31). For example, if you change the name of Level6(6) to Policy06, Policy06(6) will then be displayed.

Allocation threshold

You can define allocation thresholds in new policies from Level6(6) to Level31(31).

For all DP-VOLs that have the tiering policy in a pool, Dynamic Tiering performs the relocation of pages to each tier based on the tiering policy setting.

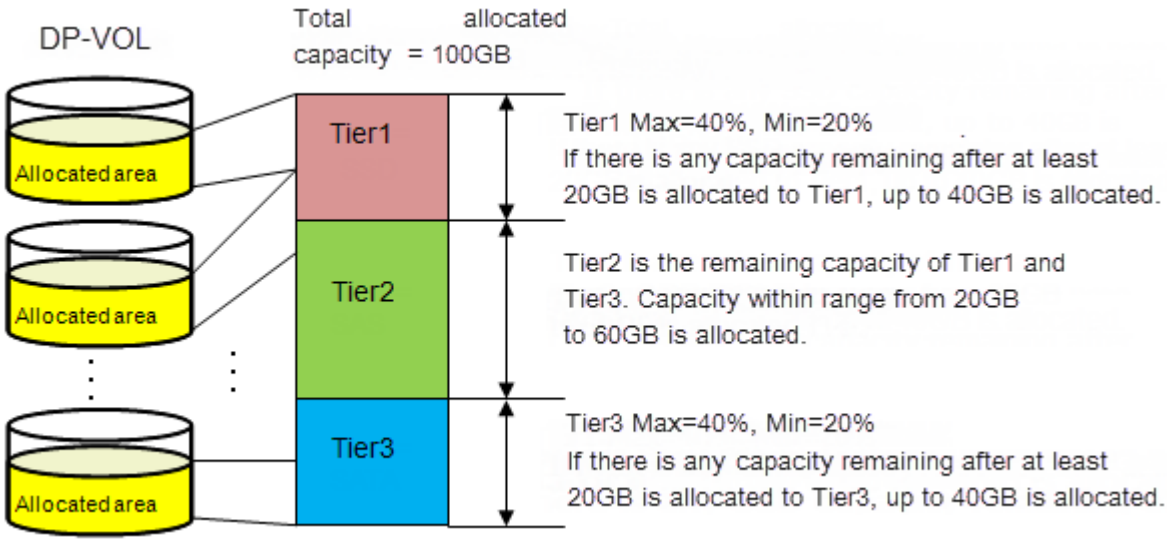
Max(%) and Min(%) parameters: When a tiering policy is created, 4 types of parameters can be set: Tier1 Max and Tier 1 Min, Tier 3 Max and Tier 3 Min. Each parameter setting is a ratio that corresponds to the total capacity of the allocated area of DP-VOLs that have the same tiering policy set for a pool.

Tier1 and Tier3 parameter settings can also limit the capacity for all volumes in a configuration that contain multiple DP-VOLs that have the same intended use. These settings can prevent conditions such as the following from occurring:

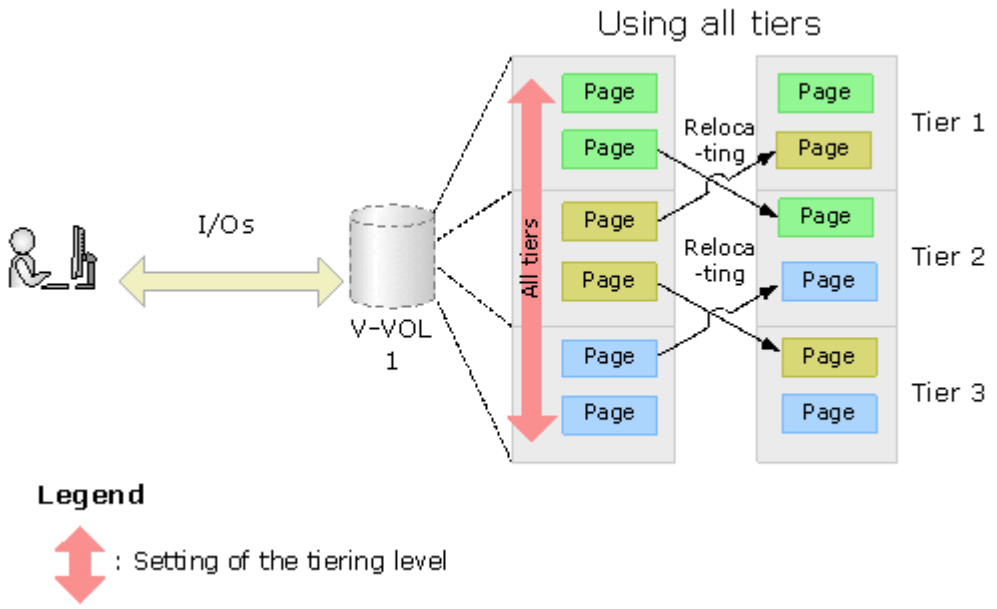
- Excess allocation of SSD capacity for unimportant applications.
- Degradation in average response time for high performance operations.

Tiering policy examples

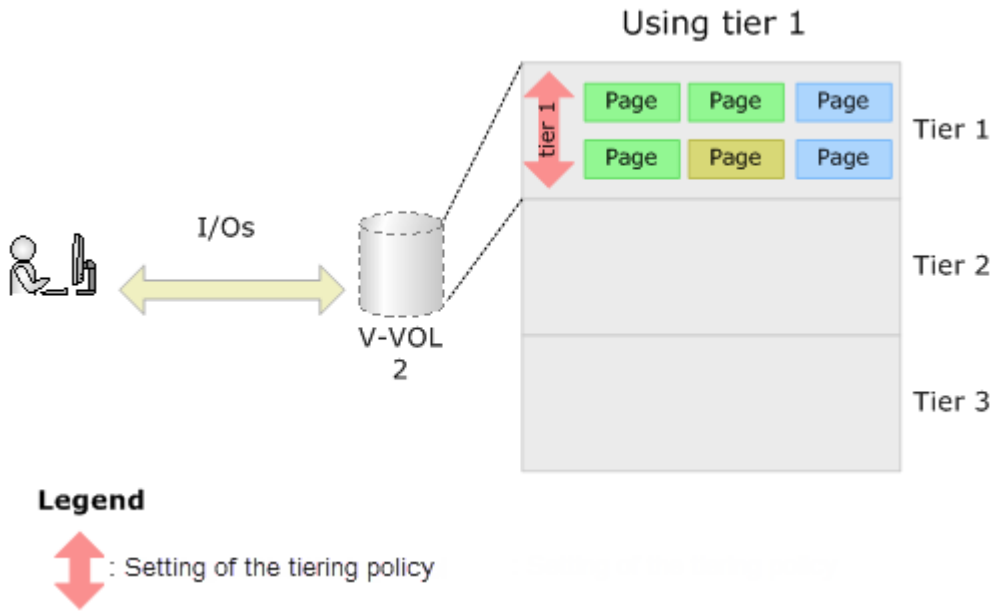
The following figure shows the allocation threshold settings Tier1 Max=40%, Tier1 Min=20%, Tier3 Max=40%, and Tier3 Min=20% for a DP-VOL with a Level6(6) setting when the initial mapped capacity is 100GB.



The following figure shows an example of data allocation when the default tiering policy level All(0) is specified. Pages in the DP-VOL are relocated to any tier.



The following figure shows an example of data allocation when setting the tiering policy to Level1(1) (see Level1(1) in Tiering policy levels on page 194). In this case, pages in the DP-VOL are relocated to tier 1, and are not relocated to other tiers.



Setting tiering policy on a DP-VOL

The setting of a tiering policy for a DP-VOL is optional. If one is not selected, the default is the All(0) tiering policy level. The available levels are listed in Tiering policy levels on page 194. DP-VOLs of different tiering policies can

coexist in one pool. If you specify the level of the tiering policy, DP-VOLs with the policy are grouped together.

- All(0) is the default policy. In this case, data is stored to all of the tiers.
- When a tier is added to the pool after setting the tiering policy on a DP-VOL, the DP-VOL is relocated according to the new tier lineup.
  For example, if you set the tiering policy to level 5, the data is always allocated to the tier of the low I/O speed. If the pool has two tiers, data is stored in tier 2. If a new tier is added, the number of tiers becomes three and if the new tier is the lowest tier, relocation will be performed to move data into tier 3.

For more information about tiering policy and groups, see Tiering policy levels on page 194.

Tiering policy levels

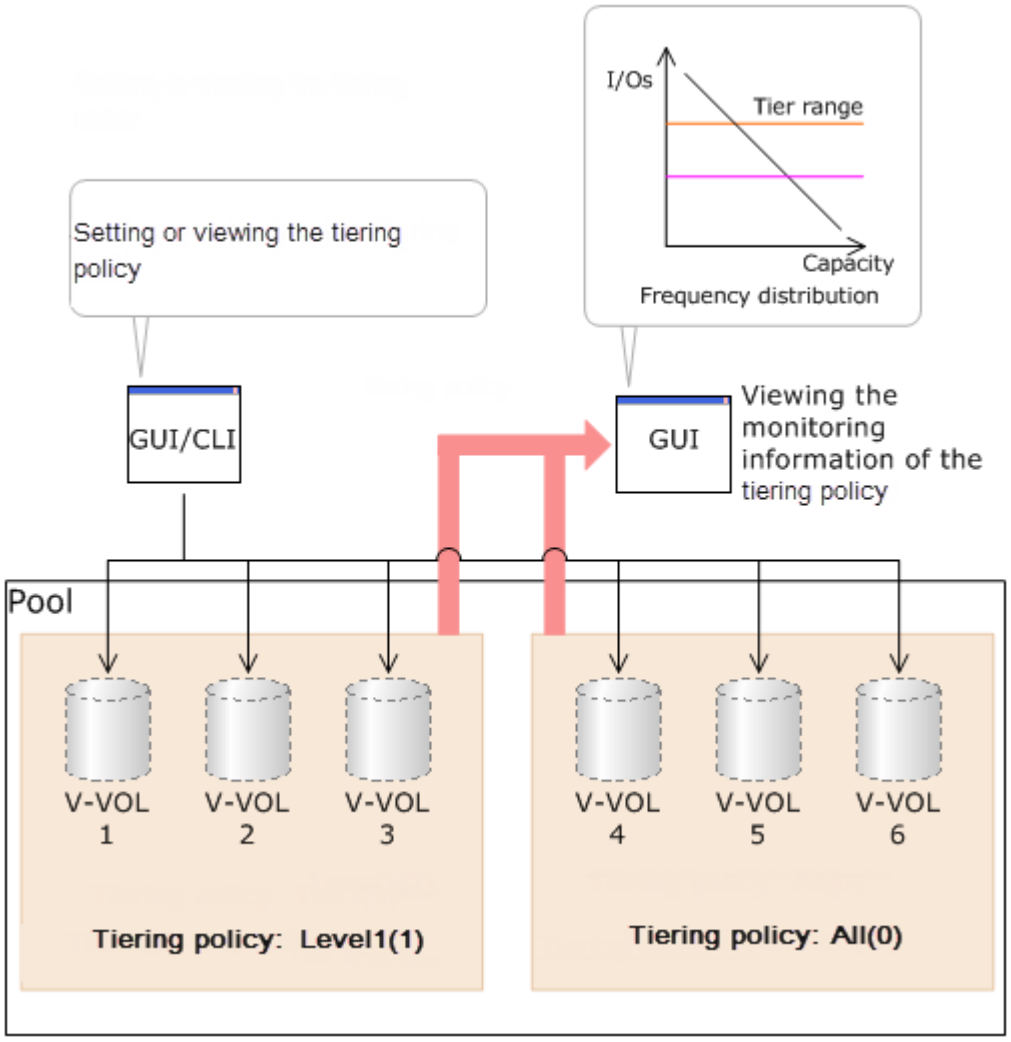
Tiering policy	1 tier pool	2 tier pool	3 tier pool	Note
All(0)	Single Tier	Both tiers	All 3 tiers	Default Tiering Policy
Level1(1)	Same as All(0)	Tier 1	Tier 1	Data is located to the Top Tier. Any overflow moves to the next lower tier.
Level2(2)	Same as All(0)	Same as All(0)	Tier 1 and Tier 2 See note	Data is located to the Top Tier after Level1(1) assignments are processed. Any overflow moves to the next lower tier.
Level3(3)	Same as All(0)	Same as All(0)	Tier 2 See note	Data is located to the Middle Tier. Any overflow moves to the top tier.
Level4(4)	Same as All(0)	Same as All(0)	Tier 2 and Tier 3 See note	Data is located to the Middle Tier after Level3(3) assignments are processed. Any overflow moves to the next lower tier.
Level5(5)	Same as All(0)	Tier 2	Tier 3 See note	Data is located to the bottom tier. Any overflow moves to the next higher tier.
From Level6(6) to Level31(31)	Same as All(0)	Depends on user setting	Depends on user setting	
For example: If additional capacity is added to the pool and the capacity defines a new Tier 1 or new Tier 2, the DP-VOLs with a Level 5(5) assignment will not physically move but Level 5(5) will be associated with Tier 3. If additional capacity is added to the pool and the capacity defines a new Tier 3, the DP-VOLs with a Level 5(5) assignment will physically move to the new Tier 3 and Level 5(5) will be associated with Tier 3.				

Viewing the tiering policy in the performance graph

You can view the frequency distribution graph of the pool by selecting either the level of the tiering policy or the entire pool on the performance graph in the **View Tier Properties** window.

The following table shows how tiering policy is shown in the performance graph. How the graph appears depends on the number of tiers set in a pool and tiering policy level selected when viewing the performance graph.

Tiering policy selected with performance graph	V-VOL displayed in the performance graph
All(0)	In the performance graph, you can display a frequency distribution of a DP-VOL, set to all tiers.
Level 1(1)	In the performance graph, you can display the frequency distribution of a DP-VOL set to level 1.
Level 2(2)	In the performance graph, you can display the frequency distribution of a DP-VOL set to level 2.
Level 3(3)	In the performance graph, you can display the frequency distribution of a DP-VOL set to level 3.
Level 4(4)	In the performance graph, you can display the frequency distribution of a DP-VOL set to level 4.
Level 5(5)	In the performance graph, you can display the frequency distribution of a DP-VOL set to level 5.
From Level6(6) to Level31(31)	In the performance graph, you can display the frequency distribution of a DP-VOL set to custom policy.

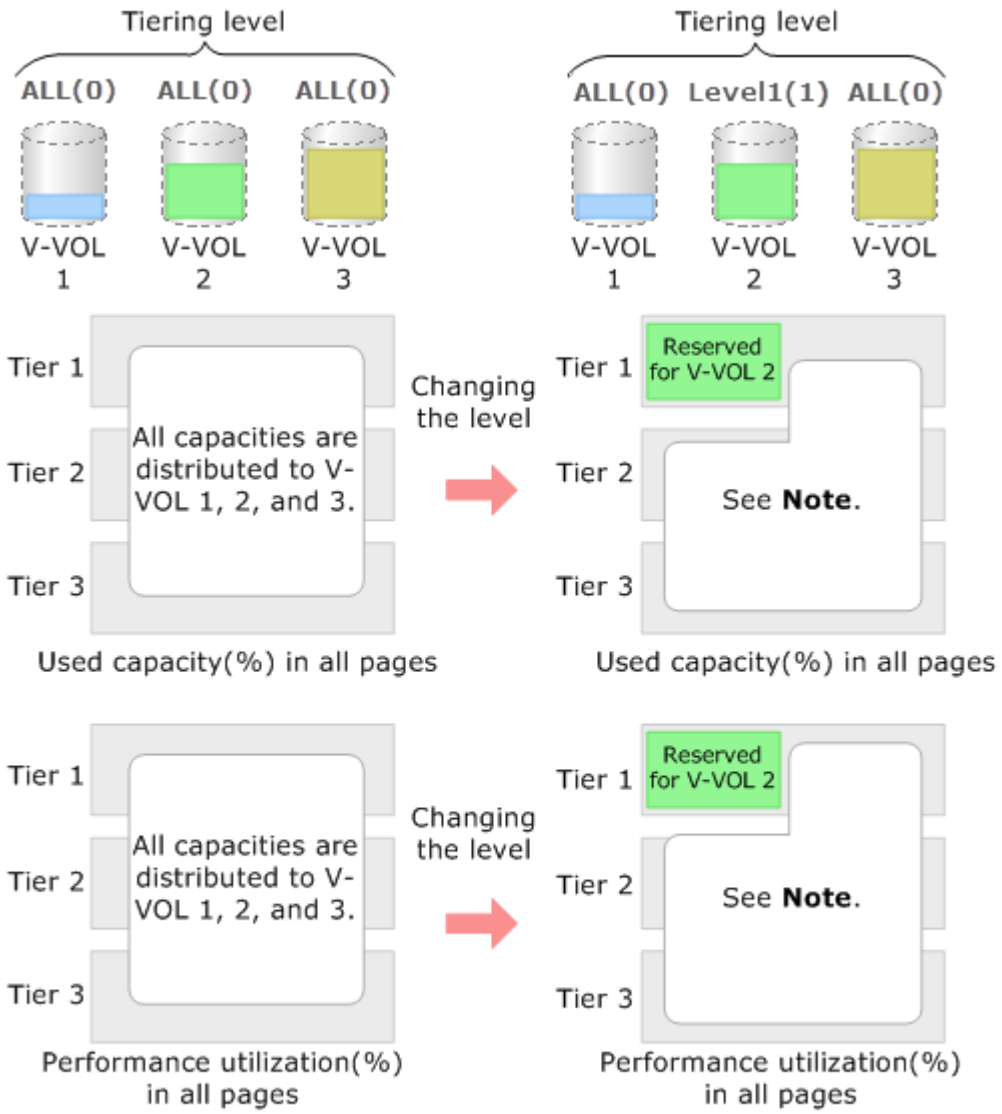


Reserving tier capacity when setting a tiering policy

If you set the tiering policy of a DP-VOL, the DP-VOL used capacity and the I/O performance limitation are reserved from the tier. The reserved limit performance per page is calculated as follows:

The reserved limit performance per page = *(The performance limit of the tier) ÷ (The number of pages in the tier)*.

A DP-VOL without a tiering policy setting uses the unreserved area in the pool.



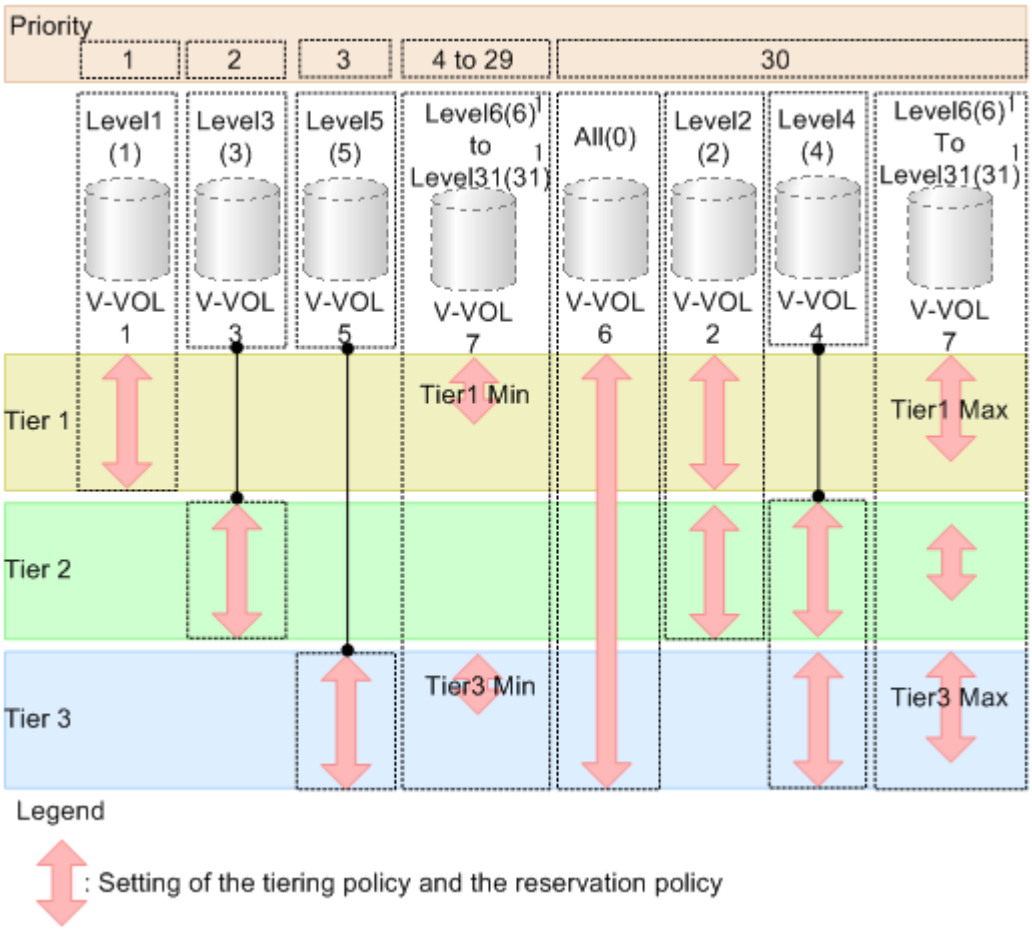
Note: The remaining capacity to which the reserved capacity is deducted is distributed to V-VOL 1 and 3.

Example of reserving tier capacity

The reservation priority depends on the level of tiering policy. The following figure illustrates the reservation priority. Tiers are reserved in order of priority from (1) to (7) in the figure. If the pool-VOL capacity is deficient when you reserve a tier, the nearest tier of your specified tier is allocated. If you specify two tiers like level 2 or level 4 of the tiering policy, first of all the upper tier is reserved. At this time, if the capacity of the pool-VOL assigned to the upper tier is deficient, the lower tier defined by the tiering policy is reserved automatically. For example, in case of level 2 in the diagram below, tier 1 is reserved first. If the capacity of tier 1 is deficient at this point, tier 2

is reserved automatically. For details, see Notes on tiering policy settings on page 199.

Tier reservation priority	Tiering policy	Reserved tier
1	Level1(1)	Tier 1
2	Level3(3)	Tier 2
3	Level5(5)	Tier 3
From 4 to 29	From Level6(6) to Level31(31)	The custom policy whose number is small is prioritized. Tier 1: From Level6(6) to Level31(31), each of the Tier1 Min values are reserved. Tier 2: From Level6(6) to Level31(31), each of values that deducted the total value of Tier1 Max and Tier3 Max from 100(%) are reserved. Tier 3: From Level6(6) to Level31(31), each of the Tier3 Min values are reserved.
30	All(0)	All tiers
	Level2(2)	Tier 1 and Tier 2
	Level4(4)	Tier 2 and Tier 3
	From Level6(6) to Level31(31)	Tier 1: From Level6(6) to Level31(31), each of the Tier1 Max values are reserved. Tier 3: From Level6(6) to Level31(31), each of the Tier3 Max values are reserved.



Notes on tiering policy settings

- If Auto is set as the execution mode, tier relocation is performed based on the monitoring cycle. Therefore, when the tiering policy setting is changed, tier relocation will automatically implement the tiering policy at the end of the current monitoring cycle. See Example 1 in Execution mode settings and tiering policy on page 201.
- If Manual is set as the execution mode, you must manually perform monitoring, issue a monitor stop, and then start relocation (see Example 2, Case 1, in Execution mode settings and tiering policy on page 201). If you change the tiering policy settings while obtaining monitoring data, the monitoring data is used for the next tier relocation (see Example 2, Case 2, in Execution mode settings and tiering policy on page 201). Therefore, you do not need to perform new monitoring.
- If a capacity shortage exists in the tier being set, a message may appear in the **View Tier Property** window that the page allocation cannot be completed according to the tiering policy specified for the V-VOL. Should that occur, the page allocation in the entire pool, including the tier that defines the tiering policy might not be optimized.

Note: The message that page allocation cannot be completed according to the tiering policy does not appear when these tiering policies are set:

- All(0)
- In a 2-tier configuration, Level2(2), Level3(3), or Level4(4) which is equivalent to All(0)

When a capacity shortage exists in a tier, you can revise the setting of the tiering policy or the configuration of tiers. If the capacity of one tier is fully exhausted, the migrating pages are assigned to the next tier according to the tiering policy.

- Level1(1): When tier 1 is full, the remaining pages are allocated to tier 2. If tier 2 is full, the remaining pages are allocated to tier 3.
- Level3(3): When tier 2 is full, the remaining pages are allocated to tier 1. If tier 1 is full, the remaining pages are allocated to tier 3.
- Level5(5): When tier 3 is full, the remaining pages are allocated to tier 2. If tier 2 is full, the remaining pages are allocated to tier 1.
- Level2(2), Level4(4), and from Level6(6) to Level31(31): When the specified tier is full, the unallocated pages are kept in the prior tier or they are allocated to the tier that has free space. From Level 6 (6) to Level 31 (31), the names of tiering policies can be changed. If these names have changed, the new names appear.

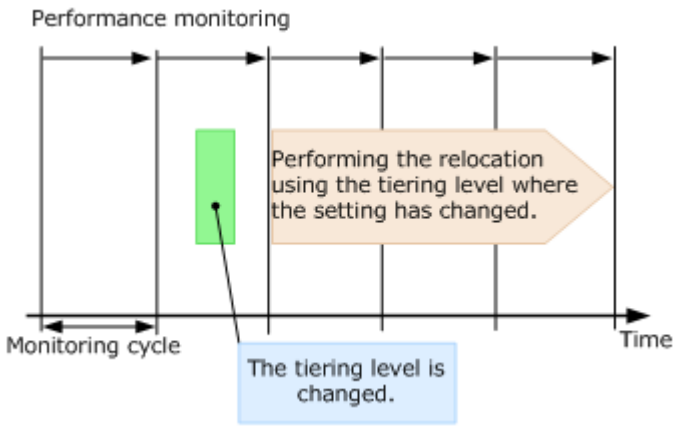
- If a performance shortage exists in the tier being set, pages may not be allocated in conformance to the tiering policy specified for the V-VOL. In that case, pages are allocated according to the performance ratio of each tier.

  As shown in the following table, allocation capacity considerations are based on the tiering policy.

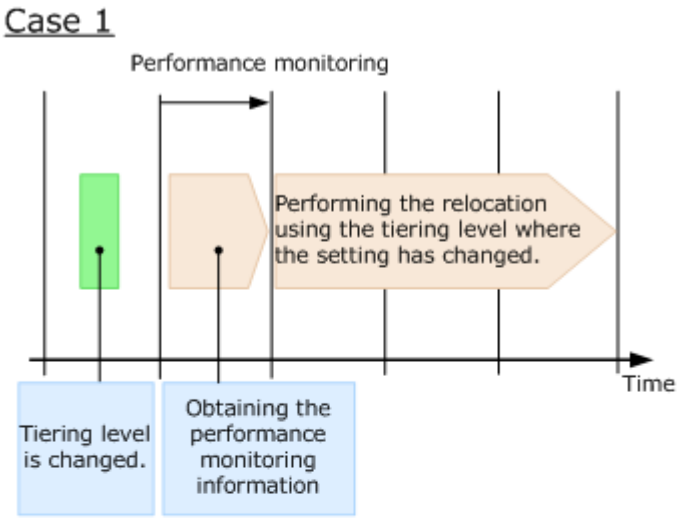
Tiering Policy	Allocation capacity considerations
All(0), Level2(2), or Level4(4)	Tier range and I/O performance
Level1(1), Level3(3), or Level5(5)	Tier range
From Level6(6) to Level31(31)	First phase: Tier range. Allocation capacities in each tier. • Tier1: The setting value(%) in Tier1 Min. • Tier2: The value deducted Tier1 Max(%) and Tier3 Max(%) from 100(%). • Tier3: The setting value(%) in Tier3 Min.
	Second phase: Tier range and I/O performance. Capacities deducted from the mapped capacities of the first phase from the total used capacity, are mapped to each tier.

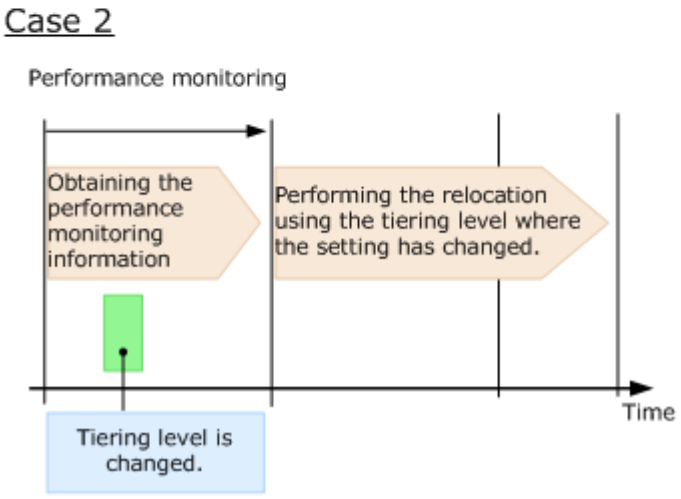
Execution mode settings and tiering policy

The following figure depicts how tier relocation is performed after changing the tiering policy setting while Auto execution mode is used.



The following figure depicts two cases of how tier relocation is performed after changing the tiering policy setting while Manual execution mode is used.





New page assignment tier

If you set the new page assignment tier value, when a new page is needed by a DP-VOL the page is taken from the specified tier aligned with the new page assignment tier value. You can set this function by using Hitachi Device Manager - Storage Navigator. In addition, this function becomes effective just after setting. The following table lists setting values:

Setting value	Description
High	The new page is assigned from the higher tier of tiers set in the tiering policy.
Middle	The new page is assigned from the middle tier of tiers set in the tiering policy.
Low	The new page is assigned from the lower tier of tiers set in the tiering policy.

The following tables show the tiers to which new pages are preferentially assigned.

Tiering Policy	When specifying High	When specifying Middle	When specifying Low	Note
All	From tier 1 to 2	From tier 1 to 2	From tier 2 to 1	If you set Low, tier 2 is given a priority over tier 1.
Level 1	From tier 1 to 2	From tier 1 to 2	From tier 1 to 2	Assignment sequences when High, Middle, and Low are same.
Level 2	From tier 1 to 2	From tier 1 to 2	From tier 2 to 1	Every assignment sequence is the same as when All is specified as the tiering policy.
Level 3	From tier 1 to 2	From tier 1 to 2	From tier 2 to 1	Every assignment sequence is the same as when All is specified as the tiering policy.
Level 4	From tier 1 to 2	From tier 1 to 2	From tier 2 to 1	Every assignment sequence is the same as when All is specified as the tiering policy.
Level 5	From tier 2 to 1	From tier 2 to 1	From tier 2 to 1	Assignment sequences when High, Middle, and Low are same.

Number	Condition	Order of new page allocation
1	T1 MIN = 100%	Same as Level1(1)
2	T1 MAX = 0%	Same as Level5(5)
3	T1 MAX > 0%	Same as All(0)

Tiering policy	When specifying High	When specifying Middle	When specifying Low	Note
All	From tier 1, 2, to 3.	From tier 2, 3, to 1.	From tier 3, 2, to 1.	Specifying High, Middle or Low to the assignment sequence is effective.
Level 1	From tier 1, 2, to 3.	From tier 1, 2, to 3.	From tier 1, 2, to 3.	Assignment sequences when High, Middle, and Low are same.
Level 2	From tier 1, 2, to 3.	From tier 1, 2, to 3.	From tier 2, 1, to 3.	If you set Low, tier 2 is given a priority over tier 1.
Level 3	From tier 2, 3, to 1	From tier 2, 3, to 1	From the 2, 3, to 1	Assignment sequences when High, Middle, and Low are same.

Tiering policy	When specifying High	When specifying Middle	When specifying Low	Note
Level 4	From tier 2, 3, to 1	From tier 2, 3, to 1	From tier 3, 2, to 1	If you set Low, tier 3 is given priority over tier 2.
Level 5	From tier 3, 2, to 1	From tier 3, 2, to 1	From tier 3, 2, to 1	Assignment sequences when High, Middle, and Low are same.

Number	Condition	Order of new page allocation
1	T1 MIN = 100%	Same as Level1(1)
2	T3 MIN = 100%	Same as Level5(5)
3	T1 MAX > 0% and T3 MAX = 0%	Same as Level2(2)
4	T1 MAX = 0% and T3 MAX = 0%	Same as Level3(3)
5	T1 MAX = 0% and T3 MAX > 0%	Same as Level4(4)
6	T1 MAX > 0% and T3 MAX > 0%	Same as All(0)

Relocation priority

If you use the relocation priority function, you can set the selection priority of a DP-VOL when performing relocation. With this setting, a prioritized DP-VOL can be relocated earlier during a relocation cycle. You can set this function by using Hitachi Device Manager - Storage Navigator. The function is activated after the monitoring data is collected.

- If no relocation priority is set for all DP-VOLs, the general order of DP-VOL selection is to select the next DP-VOL in LDEV number order after the last DP-VOL that fully performed relocation. This selection order persists across relocation cycles.
- If one or more DP-VOLs is assigned a relocation priority, the prioritized DP-VOLs are operated upon in the early portion of the relocation cycle, before others in the general order of DP-VOL selection.
- If V-VOL is not given priority for relocation:

  For example, if LDEVs of LDEV IDs with LDEV#1, LDEV#2, LDEV#3, LDEV#4, and LDEV#5 are not given priority for relocation, LDEVs are relocated with the following sequences. In this example, three LDEVs are relocated in each period, but the number of LDEVs to relocate may change by the relocation cycle or the data size.

Relocating cycle	Relocating sequence of LDEV#1 in each cycle	Relocating sequence of LDEV#2 in each cycle	Relocating sequence of LDEV#3 in each cycle	Relocating sequence of LDEV#4 in each cycle	Relocating sequence of LDEV#5 in each cycle
T1	1st	2nd	3rd	Unperformed	Unperformed

Relocating cycle	Relocating sequence of LDEV#1 in each cycle	Relocating sequence of LDEV#2 in each cycle	Relocating sequence of LDEV#3 in each cycle	Relocating sequence of LDEV#4 in each cycle	Relocating sequence of LDEV#5 in each cycle
T2	3rd	Unperformed	Unperformed	1st	2nd
T3	Unperformed	1st	2nd	3rd	Unperformed
T4	2nd	3rd	Unperformed	Unperformed	1st

- If V-VOL is given priority for relocation:
  For example, if LDEVs of LDEV IDs with LDEV#3 and LDEV#4 are set priority for relocation from LDEV#1 to LDEV#5, LDEVs are relocated with the following sequences. In this example, three LDEVs are relocated in each period, but the number of LDEVs to relocate may change by the relocation cycle or data size.

Relocating cycle	Relocating sequence of LDEV#1 in each cycle	Relocating sequence of LDEV#2 in each cycle	Relocating sequence of LDEV#3 in each cycle	Relocating sequence of LDEV#4 in each cycle	Relocating sequence of LDEV#5 in each cycle
T1	3rd	Unperformed	1st	2nd	Unperformed
T2	Unperformed	3rd	1st	2nd	Unperformed
T3	Unperformed	Unperformed	1st	2nd	3rd
T4	3rd	Unperformed	1st	2nd	Unperformed

Assignment tier when pool-VOLs are deleted

When you delete pool-VOLs, the pages allocated to the pool-VOLs are moved to other pool-VOLs. The following table shows the tier numbers to which pages are allocated before and after pool-VOLs are deleted. This operation does not depend on the tiering policy or the settings of newly assigned tiers. Relocate tiers after deleting pool-VOLs.

The following table describes page allocation in a 3-tier configuration.

Tier of deleted pool-VOLs	Order in which pages are allocated to tiers	Description
Tier 1	Tier 1, Tier 2, and Tier 3	If there is free space in Tier 1, pages are allocated to Tier 1. If there is no free space in Tier 1, pages are allocated to Tier 2. If there is no free space in Tier 1 and Tier 2, pages are allocated to Tier 3.
Tier 2	Tier 2, Tier 1, and Tier 3	If there is free space in Tier 2, the pages are allocated to Tier 2. If there is no free space in Tier 2, pages are allocated to Tier 1.

Tier of deleted pool-VOLs	Order in which pages are allocated to tiers	Description
		If there is no free space in Tier 1 and Tier 2, pages are allocated to Tier 3.
Tier 3	Tier 3, Tier 2, and Tier 1	If there is free space in Tier 3, pages are allocated to Tier 3. If there is no free space in Tier 3, pages are allocated to Tier 2. If there is no free space in Tier 2 and Tier 3, pages are allocated to Tier 1.

The following table describes page allocation in a 2-tier configuration.

Tier of deleted pool-VOLs	Order in which pages are allocated to tiers	Description
Tier 1	Tier 1 and Tier 2	If there is free space in Tier 1, pages are allocated to Tier 1. If there is no free space in Tier 1, pages are allocated to Tier 2.
Tier 2	Tier 2 and Tier 1	If there is free space in Tier 2, pages are allocated to Tier 2. If there is no free space in Tier 2, pages are allocated to Tier 1.

Formatted pool capacity

The formatted pool capacity equals the capacity of the initialized free space and the reserved capacity of a pool, but not the capacity of all free space and reserved capacity of the pool. The free space of the pool is monitored by a storage system. Space is formatted automatically if needed. You can confirm the formatted pool capacity in the **View Pool Management Status** window. Dependent on the load of the storage system, the format speed of free space and reserved capacity of the pool is adjusted.

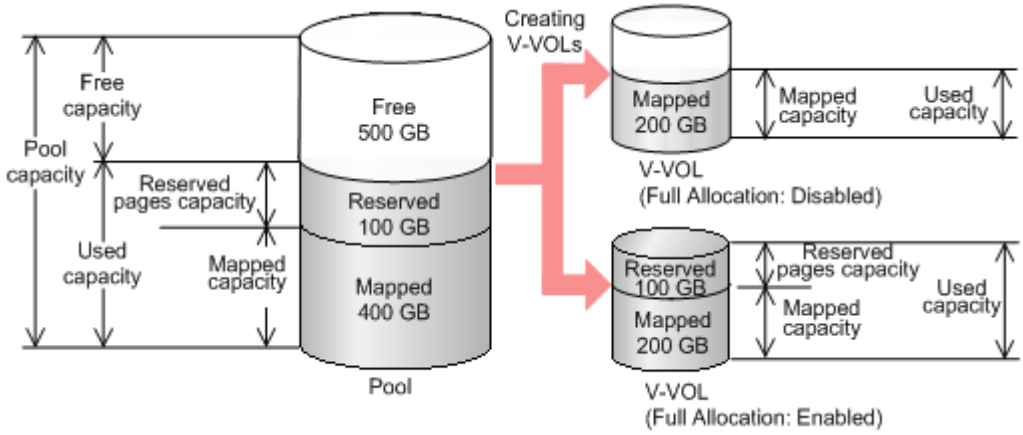
For a pool with pool-VOLs that have accelerated compression enabled, the formatted pool capacity is not the parity group capacity. Instead, it is the pool capacity.

New pages are allocated, then initialized, during data write operations to the V-VOL. If a significant number of new pages are allocated, initialization might be delayed as a result of conflicts between data write and new page initialization processes. Such conflicts could occur, for example, when you create a file system of new DP-VOLs from the host. You can initialize the free space of a pool in advance to prevent delays in data write operations.

If you want to change the method of performing the function to format the free space of a pool, contact customer support.

Used capacity, mapped capacity, and reserved capacity

The used capacity is the total capacity of pages that are assigned and reserved for each V-VOL. The mapped capacity is the total of pages which contain user data and control information of each V-VOL. The reserved capacity is the total of pages reserved in each V-VOL for which the full allocation function is enabled.



Rebalancing the usage level among parity groups

If multiple parity groups that contain LDEVs used as pool volumes exist, rebalancing can improve biased usage rates in parity groups. Rebalancing is performed as if each parity group were a single pool volume. After rebalancing, the usage rates of LDEVs in a parity group may not be balanced, but the usage rate in the entire pool is balanced.

The usage level among parity groups is automatically rebalanced when these operations are in progress:

Note: In pools comprised of pool volumes assigned by parity groups with accelerated compression enabled, the rebalancing operation is performed with consideration of the parity group's used capacity. Therefore, after performing the rebalancing operation, the capacity of the pool volume may not be reduced.

- Expanding pool capacity
- Shrinking pool capacity
- Reclaiming zero pages
- Reclaiming zero pages in a page release request issued by the host with the Write Same command, for example.
- Performing tier relocations

If you expand the pool capacity, Dynamic Provisioning moves data to the added space on a per-page basis. When the data is moved, the usage rate among parity groups of the pool volumes is rebalanced.

Host I/O performance may decrease when data is moved. If you do not want to have the usage level of parity groups automatically balanced, call the customer support.

You can see the rebalancing progress of the usage level among parity groups in the **View Pool Management Status** window. Dynamic Provisioning automatically stops balancing the usage levels among parity groups if the cache memory is not redundant or the pool usage rate reaches up to the threshold.

Related references

- View Pool Management Status window on page 625

Changing the tiering policy level of a DP-VOL

Use this procedure to change the tiering policy level of a DP-VOL.

Note: This operation cannot be performed on the following types of DP-VOLs:
- Deduplication system data volume
- DP-VOLs with capacity saving enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane of the **Logical Devices** window, select the **LDEV ID** of the LDEV with the tiering policy you want to change.
4. Click **Edit LDEVs**.
5. In the **Edit LDEVs** window, click **Tiering Policy**, and then select a tiering policy.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing new page assignment tier of a V-VOL

Use this procedure to change the new page assignment tier of a V-VOL.

Caution: This operation cannot be performed on the following types of DP-VOLs:

- Deduplication system data volume
- DP-VOL with Compression or Deduplication and Compression enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane of the **Logical Devices** window, select an **LDEV ID**.
4. Click **More Actions**, and then select **Edit LDEVs**.
5. In the **Edit LDEVs** window, select **New Page Assignment Tier**, and select the new page assignment tier you want to use.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Opening the Edit Tiering Policies window

Follow these steps to open the **Edit Tiering Policies** window.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** window, click **Edit Tiering Policies**.

Changing a tiering policy name

Use this procedure to change a tiering policy name.

From Level6(6) to Level31(31), the names of tiering policies can be changed. However, for tiering policies from All(0) to Level5(5), names cannot be changed.

Before you begin

The Storage Administrator (System Resource Management) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** window, click **Edit Tiering Policies**.
4. In the **Edit Tiering Policies** window, select the tiering policy that you want to change, and then click **Change**.

   The **Change Tiering Policy** window appears. Policies with ID 0 to 5 cannot be changed.
5. Select the **Change Tiering Policy** check box.
6. Enter the name of the tiering policy.

   You can enter up to 32 alphanumeric characters.
7. Click **OK**.
8. Return to the **Edit Tiering Policies** window. Each tiering policy value needs to meet the conditions described in the following table.
9. Click **Finish**.

   The **Confirm** window appears.
10. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
11. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing an allocation threshold

Use this procedure to change an allocation threshold.

From Level6(6) to Level31(31), allocation thresholds can be changed. However, for tiering policies from All(0) to Level5(5), allocation thresholds cannot be changed.

Before you begin

The Storage Administrator (System Resource Management) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** window, click **Edit Tiering Policies**.

4. In the **Edit Tiering Policies** window, select the tiering policy that you want to change and click **Change**. The **Change Tiering Policy** window appears.
5. Select the **Allocation Threshold** checkbox.
6. Change thresholds, and click **OK**.
7. Return to the **Edit Tiering Policies** window.

   Each allocation threshold value is needed in order to meet the conditions described in the following table.
8. Click **Finish**.

   The **Confirm** window appears.
9. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
10. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Item	Explanation
Tier1 Max	Satisfy either one of following: Equal to Tier1 Min Bigger than Tier1 Min
Tier1 Min*	Satisfy either one of following: Equal to Tier1 Max Smaller than Tier1 Max
Tier3 Max	Satisfy either one of following: Equal to Tier3 Min Bigger than Tier3 Min
Tier3 Min*	SSD Satisfy either one of following: Equal to Tier3 Max Smaller than Tier3 Max
* The sum of Tier1 Min and Tier3 Min must be 100 (%) or less.	

Changing relocation priority setting of a V-VOL

Use this procedure to change the relocation priority setting of a V-VOL.

Caution: This operation cannot be performed on the following types of DP-VOLs:

- Deduplication system data volume

- DP-VOL with Compression or Deduplication and Compression enabled

Before you begin

The Storage Administrator (System Resource Management) role is required to perform this task.

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **Logical Devices** window, select the **LDEV ID** of the volume with the relocation priority you want to change.
4. Click **Edit LDEVs**.
5. In the **Edit LDEVs** window, select the **Relocation Priority** and click **Default** or **Prioritize**.

   If you choose **Prioritize**, the LDEV is relocated preferentially.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Functions overview for active flash and Dynamic Tiering

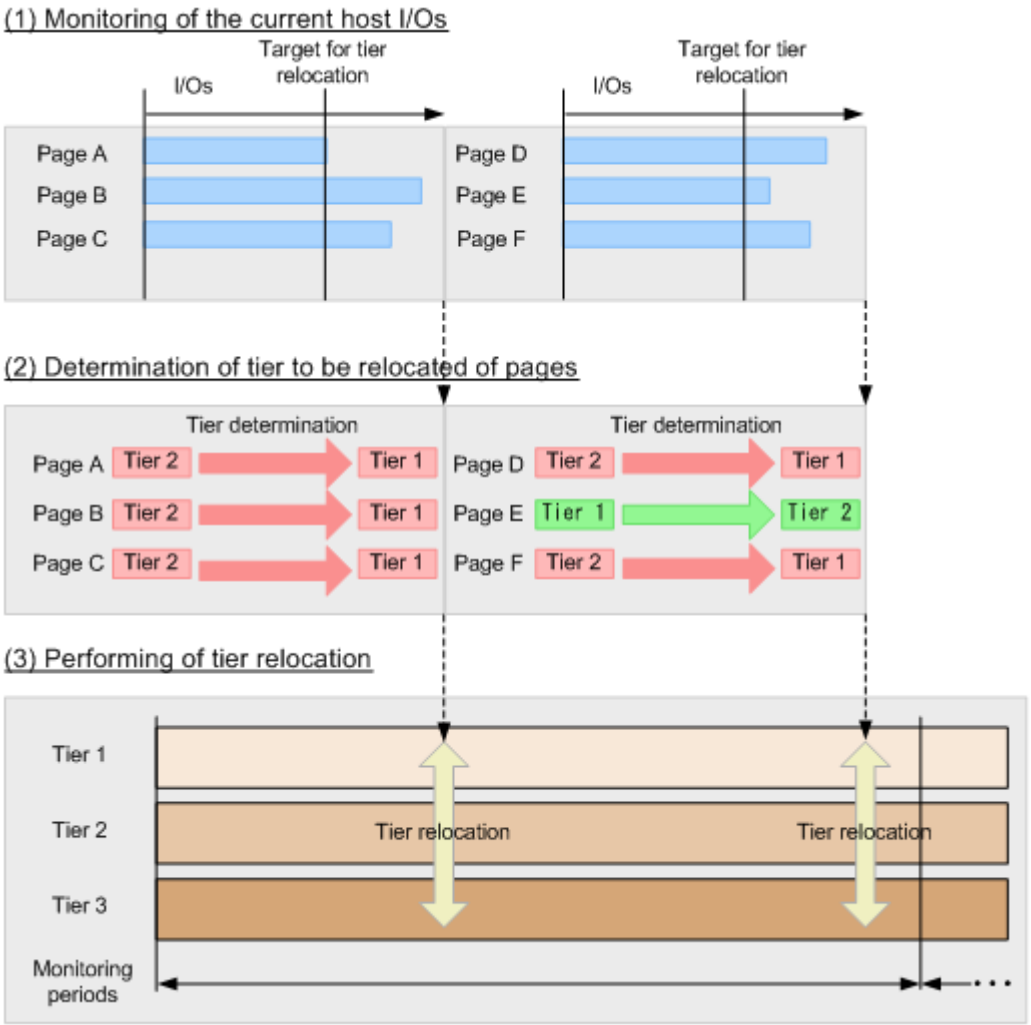
Tier management is performed by both active flash and Dynamic Tiering. The differences in supported functionality are included in the table below.

Category	Functions	active flash	Dynamic Tiering
Initial page allocation	Assigning new pages to the write data of the host	Supported	Supported
Monitoring of performance	Monitoring tiers based on the specified cycle time	Supported	N/A
Tier relocation	Promoting pages to the tier which is determined by the scheduled performance monitoring	Supported	Supported
	Promoting pages from the tier 2 or 3 to tier 1, the pages where the latest access frequency is suddenly high	Supported	N/A

Category	Functions	active flash	Dynamic Tiering
	To maintain capacity in the tier 1, demoting pages from the tier 1 to tier 2 or 3, the pages where the latest access frequency is low	Supported	N/A

Relocating pages whose latest I/Os frequency is suddenly high by active flash

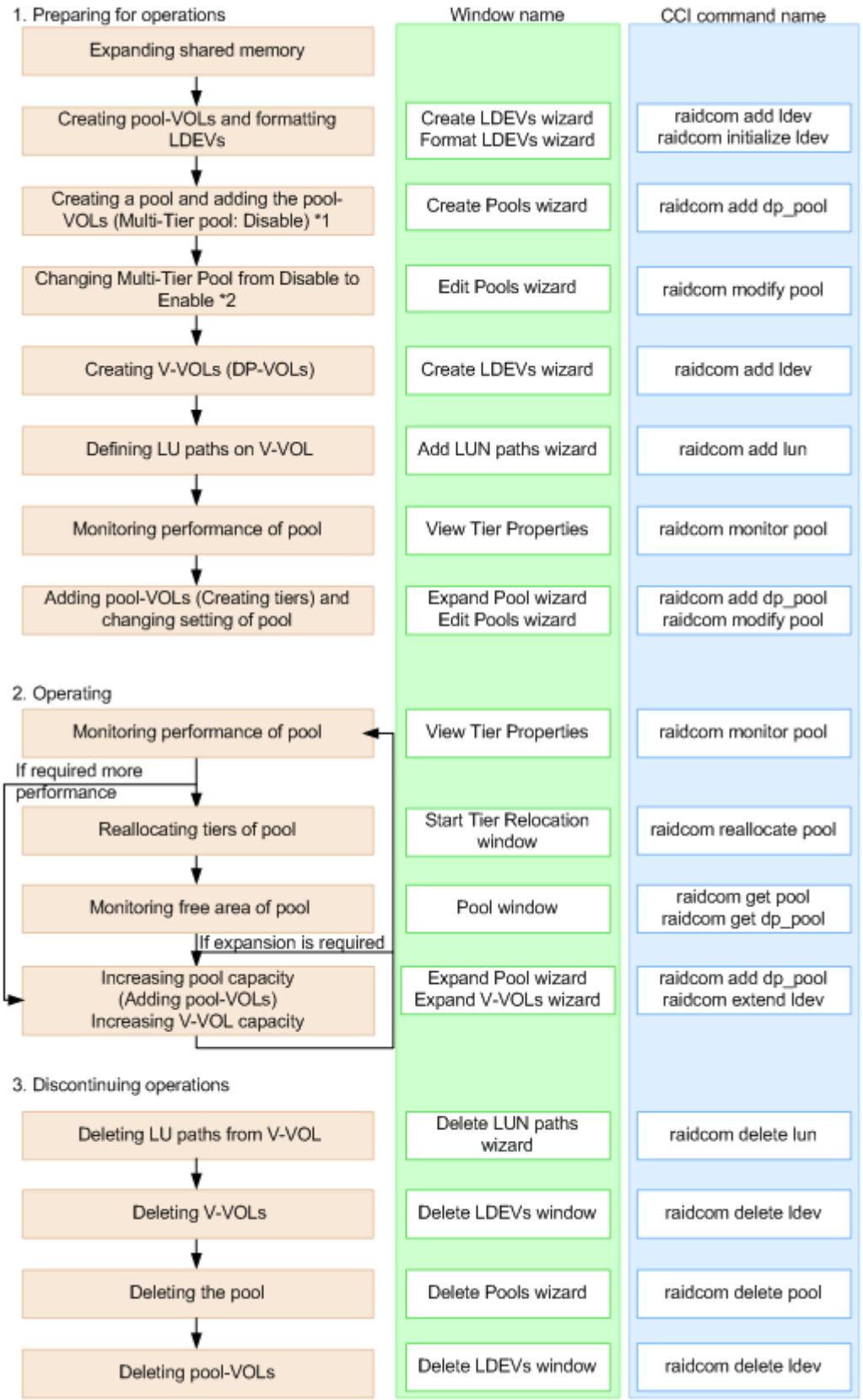
The active flash feature identifies the frequently accessed pages by counting the number of I/Os to specific pages. Pages that are accessed many times are promoted to tier 1. Pages where the latest access frequency is low are allocated to lower tiers.



Dynamic Tiering workflow

The following illustration shows the workflow for setting up Dynamic Tiering on the storage system.

As shown in the illustration, Hitachi Device Manager - Storage Navigator and Command Control Interface (CCI) have different workflows. This document describes how to set up Dynamic Tiering using Hitachi Device Manager - Storage Navigator . For details about how to set up Dynamic Tiering using CCI, see the *Command Control Interface Command Reference* and *Command Control Interface User and Reference Guide*. Use Hitachi Device Manager - Storage Navigator to create pools and DP-VOLs.


1. Preparing for operations
Window name
CCI command name
Expanding shared memory
Creating pool-VOLs and formatting LDEVs
Create LDEVs wizard
Format LDEVs wizard
raidcom add ldev
raidcom initialize ldev
Creating a pool and adding the pool-VOLs (Multi-Tier pool: Disable) *1
Create Pools wizard
raidcom add dp_pool
Changing Multi-Tier Pool from Disable to Enable *2
Edit Pools wizard
raidcom modify pool
Creating V-VOLs (DP-VOLs)
Create LDEVs wizard
raidcom add ldev
Defining LU paths on V-VOL
Add LUN paths wizard
raidcom add lun
Monitoring performance of pool
View Tier Properties
raidcom monitor pool
Adding pool-VOLs (Creating tiers) and changing setting of pool
Expand Pool wizard
Edit Pools wizard
raidcom add dp_pool
raidcom modify pool
2. Operating
Monitoring performance of pool
View Tier Properties
raidcom monitor pool
If required more performance
Reallocating tiers of pool
Start Tier Relocation window
raidcom reallocate pool
Monitoring free area of pool
Pool window
raidcom get pool
raidcom get dp_pool
If expansion is required
Increasing pool capacity
(Adding pool-VOLs)
Increasing V-VOL capacity
Expand Pool wizard
Expand V-VOLs wizard
raidcom add dp_pool
raidcom extend ldev
3. Discontinuing operations
Deleting LU paths from V-VOL
Delete LUN paths wizard
raidcom delete lun
Deleting V-VOLs
Delete LDEVs window
raidcom delete ldev
Deleting the pool
Delete Pools wizard
raidcom delete pool
Deleting pool-VOLs
Delete LDEVs window
raidcom delete ldev

*Notes:

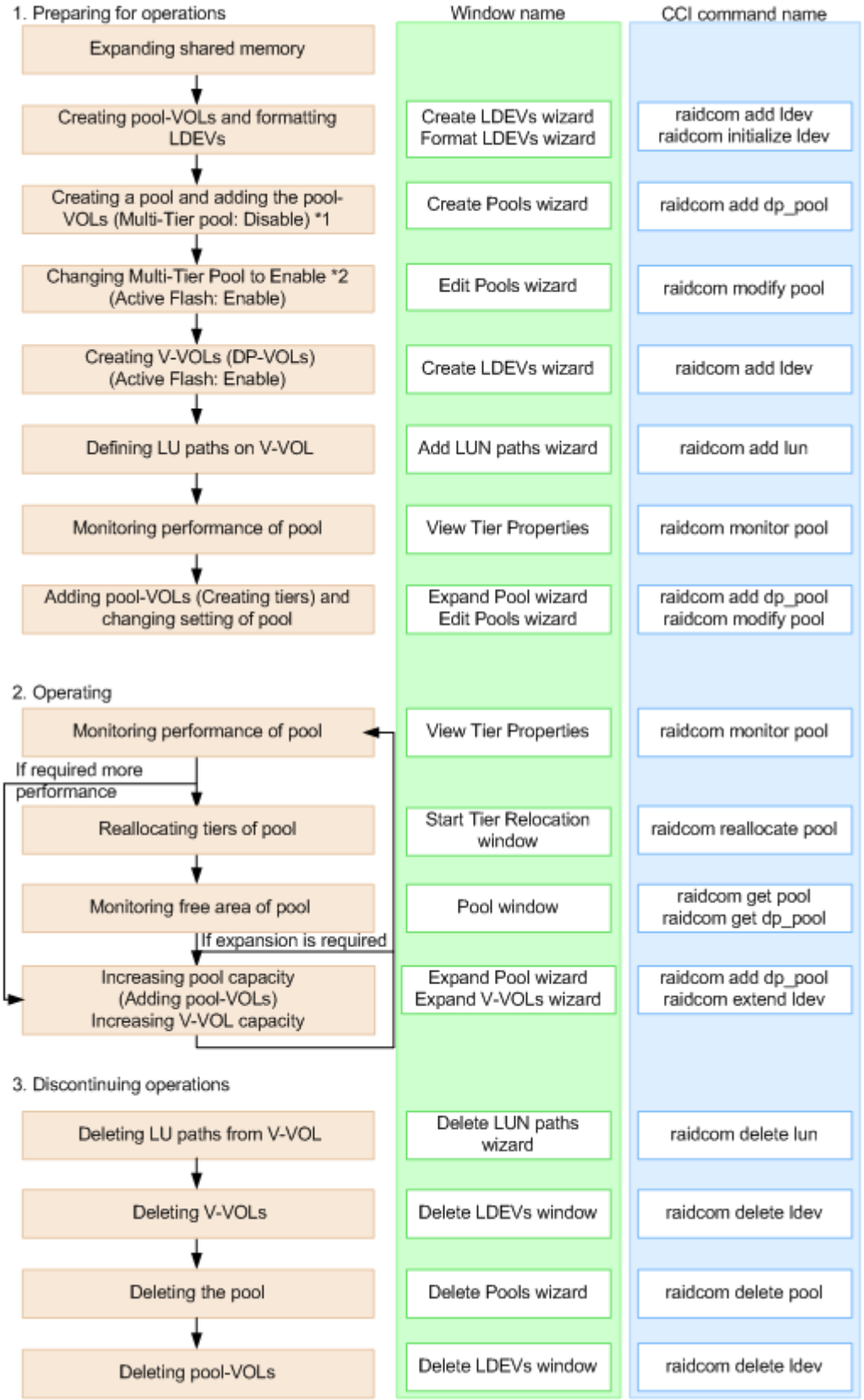
1. When you create a pool using CCI, you cannot enable the multi-tier pool option or register multiple media as pool-VOLs. Before making tiers, enable the multi-tier pool option.
2. Enabling the multi-tier pool option from CCI automatically sets Tier Management to Manual. You must use Hitachi Device Manager - Storage Navigator to change Tier Management to Auto.

Caution: When you delete a pool, its pool-VOLs (LDEVs) are blocked, and you must format the blocked LDEVs before using them.

Active flash workflow

The active flash feature of Dynamic Tiering can be set up using either Hitachi Device Manager - Storage Navigator or Command Control Interface.

The following illustration shows the workflow for a Storage Administrator to set up active flash on the storage system. As shown in the illustration, Hitachi Device Manager - Storage Navigator and Command Control Interface have different workflows. The details about how to set up active flash using Hitachi Device Manager - Storage Navigator are covered in subsequent topics. For details about how to set up active flash using Command Control Interface, see the *Command Control Interface Command Reference* and *Command Control Interface User and Reference Guide*. Use Hitachi Device Manager - Storage Navigator to create pools and DP-VOLs.


1. Preparing for operations
Window name
CCI command name
Expanding shared memory
Creating pool-VOLs and formatting LDEVs
Create LDEVs wizard
Format LDEVs wizard
raidcom add ldev
raidcom initialize ldev
Creating a pool and adding the pool-VOLs (Multi-Tier pool: Disable) *1
Create Pools wizard
raidcom add dp_pool
Changing Multi-Tier Pool to Enable *2 (Active Flash: Enable)
Edit Pools wizard
raidcom modify pool
Creating V-VOLs (DP-VOLs) (Active Flash: Enable)
Create LDEVs wizard
raidcom add ldev
Defining LU paths on V-VOL
Add LUN paths wizard
raidcom add lun
Monitoring performance of pool
View Tier Properties
raidcom monitor pool
Adding pool-VOLs (Creating tiers) and changing setting of pool
Expand Pool wizard
Edit Pools wizard
raidcom add dp_pool
raidcom modify pool
2. Operating
Monitoring performance of pool
View Tier Properties
raidcom monitor pool
If required more performance
Reallocating tiers of pool
Start Tier Relocation window
raidcom reallocate pool
Monitoring free area of pool
Pool window
raidcom get pool
raidcom get dp_pool
If expansion is required
Increasing pool capacity (Adding pool-VOLs) Increasing V-VOL capacity
Expand Pool wizard
Expand V-VOLs wizard
raidcom add dp_pool
raidcom extend ldev
3. Discontinuing operations
Deleting LU paths from V-VOL
Delete LUN paths wizard
raidcom delete lun
Deleting V-VOLs
Delete LDEVs window
raidcom delete ldev
Deleting the pool
Delete Pools wizard
raidcom delete pool
Deleting pool-VOLs
Delete LDEVs window
raidcom delete ldev

- In Command Control Interface, when creating a pool, you cannot enable Multi-Tier Pool and cannot register multiple media as pool-VOLs. Before making tiers, enable Multi-Tier Pool.
- Enabling Multi-Tier Pool from Command Control Interface automatically sets Tier Management to Manual. To change Tier Management to Auto, you must do this in Hitachi Device Manager - Storage Navigator.

Note: If you delete a pool, its pool-VOLs (LDEVs) will be blocked. If they are blocked, format them before using them.

Dynamic Tiering, active flash tasks and parameters

The following topics list the tasks and parameter settings for Dynamic Tiering and active flash and indicate whether the tasks can be performed or the parameters can be set in Hitachi Device Manager - Storage Navigator (GUI), Command Control Interface (CCI), or both.

Task and parameter settings

Item			GUI	CCI
DP pool	Create (Setting item)	Create	Y	Y
		Pool Name	Y	Y
		Threshold	Y	Y
		Multi-Tier Pool: Enable/Disable	Y	N[1]
		active flash: Enable/Disable	Y	N[1]
		Tier Management: Auto mode	Y	N
		Tier Management: Manual mode	Y	N
		Rate of space for new page assignment	Y[3]	N
		Buffer Space for Tier relocation	Y	N
		Cycle Time	Y	N
		Monitoring Period	Y	N
		Monitoring Mode	Y	N
		External LDEV Tier Rank	Y	N
		Relocation speed	Y	N
	Delete		Y	Y
	Change Settings (Setting item)	Change Settings	Y	Y
		Pool Name	Y	Y[2]
		Threshold	Y	Y
		Multi-Tier Pool: Enable/Disable	Y	Y
		active flash: Enable/Disable	Y	Y
		Tier Management: Auto to Manual	Y	Y

Item			GUI	CCI
		Tier Management: Manual to Auto	Y	N
		Buffer Space for New page assignment	Y[3]	Y[3]
		Buffer Space for Tier relocation	Y	Y
		Cycle Time	Y	N
		Monitoring Period	Y	N
		Monitoring Mode	Y	Y
		External LDEV Tier Rank	Y	N
		Relocation speed	Y	N
DP pool	Add pool-VOLs		Y	Y
	Delete pool-VOLs		Y	Y
	Restore Pools		Y	Y
	Monitoring start/end		Y	Y
	Tier relocation start/stop		Y	Y
DP-VOL	Create (Setting item)	Create	Y	Y
		DP-VOL Name	Y	Y
		Multi-Tier Pool relocation: Disable	N	N
		Tiering Policy	Y	N
		New page assignment tier	Y	N
		Relocation priority	Y	N
	Expand		Y	Y
	Reclaim zero pages		Y	Y
	Delete		Y	Y
	Change Settings (Setting item)	Change Settings	Y	Y
		Tier relocation: Enable/Disable	Y	Y
		Tiering Policy	Y	Y
		New page assignment tier	Y	N
		Relocation priority	Y	N
Relocation log	Download relocation log		Y	N

Notes:

1. Set to `Disable` if the pool is created by Command Control Interface.
   The Command Control Interface cannot be used to create Dynamic Tiering pools initially. You can use the Command Control Interface **`raidcom modify pool`** command to modify Dynamic Provisioning pools for use as Dynamic Tiering or active flash pools.
2. You can rename a pool when adding pool-VOLs to it.
3. Recommendation is to specify 0% for SSD and 8% for other drives.

Display items: Setting parameters

No.	Category	Output information	GUI	Command Control Interface
1	DP pool	Multi-Tier Pool: Disable	Y	Y
2		active flash: Enable/Disable	Y	Y
3		Tier Management mode: Auto/Manual	Y	Y
4		Rate of space for new page assignment	Y	Y
5		Cycle Time	Y*	N
6		Monitoring Period	Y*	N
7		Monitoring Mode	Y	Y
8		External LDEV Tier Rank	Y	N
9		Relocation speed	Y	N
10	DP-VOL	Tier relocation: Enable/Disable	Y	Y
11		Tiering Policy	Y	Y
12		New page assignment tier	Y	N
13		Relocation priority	Y	N
*You can view this item only in the Auto execution mode.				

Display items: Capacity usage for each tier

No.	Category	Output information	GUI	Command Control Interface
1	DP pool	Capacity for each tier (Total)	Y	Y
2		Capacity for each tier (Usage)	Y	Y
3	DP-VOL	Capacity for each tier (Usage)	Y	Y

Display items: Performance monitor statistics

No.	Category	Output information	GUI	Command Control Interface
1	DP pool	Frequency distribution	Y[1]	N
2		Tier range	Y[1]	Y[2]
3		Performance utilization	Y	Y
4		Monitoring Period starting time	Y	N
5		Monitoring Period ending time	Y	N
6	DP-VOL	Frequency distribution	Y	N
7		Tier range	Y	N
8		Monitoring Period starting time	Y	N
9		Monitoring Period ending time	Y	N
Notes:				

No.	Category	Output information	GUI	Command Control Interface
1. You can select either each level of the tiering policy or the entire pool. If you set other than All(0), the tier range is not displayed when you select the entire pool. 2. The tier range when the tiering policy All(0) is selected is displayed.				

Display items: Operation status of performance monitor/relocation

No.	Category	Output information	GUI	Command Control Interface
1	DP pool	Monitor operation status: Stopped/ Operating	Y	Y
2		Performance monitor information: Valid/ Invalid/Calculating	Y	Y
3		Relocation status: Relocating/Stopped	Y	Y
4		Relocation progress: 0 to 100%	Y	Y

Managing Dynamic Tiering and active flash

Changing a Dynamic Provisioning pool to a Dynamic Tiering pool

Use this procedure to change a Dynamic Provisioning pool to a pool for Dynamic Tiering or active flash.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool you want to edit.
4. Perform one of the following to display the **Edit Pools** window.
   - Click **More Actions** and select **Edit Pools**.
   - Click **Actions > Pool > Edit Pools** to open the window.
5. Check **Multi-Tier Pool**.
6. Select **Enable** from the Multi-Tier Pool field.
7. If active flash is used, select the **Active Flash** check box. If there is no pool volume whose drive type is SSD, the check box cannot be selected.
8. Select the **Tier Management** check box.
9. In the **Tier Management** field, select **Auto** or **Manual**.

   Normally **Auto** should be set.

   When you select **Auto**, monitoring and tier relocation can be automatically executed.

When you select **Manual**, monitoring and tier relocation can be executed with the Command Control Interface commands or the **Pools** window.

When you change the setting of **Auto** to **Manual** while monitoring and tier relocation is executing, it is cancelled.

10. From the **Cycle Time** list, select the cycle of performance monitoring and tier relocation.

Note:

- When you change the **Cycle Time** while performance monitoring and tier relocation are being executed, the setting becomes effective for the next cycle after the current cycle is complete.
  When you select **24 Hours** (default):
  Monitoring and tier relocation is performed once a day. In the **Monitoring Period** field, specify the time of starting and ending of monitoring in 00:00 to 23:59 (default value).
- If you specify the starting time later than the ending time, the monitoring continues until the time you specified as the ending time on the next day. Any time that is not in the specified range of the monitor period is not monitored.
- You can view the information gathered by monitoring with Hitachi Device Manager - Storage Navigator and Command Control Interface.
- When you change the time range of performance monitoring, the setting becomes effective from the next cycle after the cycle that is executing is complete.
  When you select any of **0.5 Hours**, **1 Hour**, **2 Hours**, **4 Hours** or **8 Hours**:
  Performance monitoring is performed every duration you selected starting at 00:00.
  You cannot specify the monitoring period.

---

11. Select the **Monitoring Mode** check box.
12. From the **Monitoring Mode** options, select **Period Mode** or **Continuous Mode**.
    If you want to perform tier relocation using the monitor results from the prior cycle, select **Period Mode**. If you want to perform tier relocation weighted to the past period monitoring result, select **Continuous Mode**.
13. Select the speed to use for page relocation in **Relocation speed**. You can set the speed to: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). The default is 3(Standard). If the speed specified is slower than 3(Standard), the data drive load is low when tier relocation is performed.

14. Select the **Buffer Space for New page assignment** check box.
15. In the **Buffer Space for New page assignment** text box, enter an integer value from 0 to 50 as the percentage (%) to set for each tier.
16. Select the **Buffer Space for Tier relocation** check box.
17. In the **Buffer Space for Tier relocation** text box, enter an integer value from 2 to 40 as the percentage (%) to set for each tier.
18. Click **Finish**.

    The **Confirm** window appears.
19. In the **Task Name** text box, enter the task name.

    You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
20. In the **Confirm** window, click **Apply** to register the setting in the task.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing monitoring and tier relocation settings

You can change the following monitoring and tier relocation settings of Dynamic Tiering pools:

- Automatic or manual execution of monitoring and tier relocation
- Cycle time of monitoring and tier relocation
- Time period of monitoring

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, click the row of a pool you want to change.
4. Perform one of the following to display the **Edit Pools** window.

   - Click **More Actions** and select **Edit Pools**.

   - Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. Select the **Tier Management** check box.
6. In **Tier Management**, select **Auto** or **Manual**.

   Normally **Auto** should be set to allow relocation to be automatically executed.

   When you select **Manual**, monitoring and tier relocation can be executed with the Command Control Interface commands or from the **Pools** window.

   When you change the setting from **Auto** to **Manual** during performance monitoring and tier relocation is executing, the operation is cancelled and is no longer performed.

7. If **Auto** is selected from the **Cycle Time** list, select the cycle of performance monitoring and tier relocation.
8. Click **Finish**.

   The **Confirm** window appears.
9. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
10. In the **Confirm** window, click **Apply** to register the setting in the task.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing monitoring mode settings

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, click the row of a pool for which you want to change.
4. Perform one of the following to display the **Edit Pools** window.

   - Click **More Actions** and select **Edit Pools**.

   - Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. Click the **Monitoring Mode** check box.
6. Select **Period Mode** or **Continuous Mode.**

   If you want to perform tier relocation using the monitor results from the prior cycle, select **Period Mode**. If you want to perform tier relocation weighted to the past period monitoring result, select **Continuous Mode**.
7. Click **Finish**.

   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing relocation speed

Use this procedure to change the relocation speed.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** table, click the row of a pool you want to change.
4. Perform one of the following to display the **Edit Pools** window.
   - Click **More Actions** and select **Edit Pools**.
   - Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. Set the **Relocation Speed** check box to **ON**.
6. Use the **Relocation Speed** option to set the speed for page relocation to **1(Slowest)**, **2(Slower)**, **3(Standard)**, **4(Faster)**, and **5(Fastest)**.
   The default is **3(Standard)**. If you want to perform tier relocation at high speed, set **5(Fastest)**. If the speed specified is slower than 3(Standard), the data drive load is low when tier relocation is performed.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing buffer space for new page assignment setting

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** table, click the row of a pool you want to change.
4. Perform one of the following to display the **Edit Pools** window.
   - Click **More Actions** and select **Edit Pools**.
   - Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. Select the **Buffer Space for New page assignment** check box.
6. In the **Buffer Space for New page assignment** text box, enter an integer value from 0 to 50 as the percentage (%) to set for each tier.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.

If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing buffer space for tier relocation setting

Use this procedure to change the buffer space for tier relocation.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **DP Pools** table, click the row of a pool you want to change.
4. Perform one of the following to display the **Edit Pools** window.
   - Click **More Actions** and select **Edit Pools**.
   - Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. Select the **Buffer Space for Tier relocation** check box.
6. In the **Buffer Space for Tier relocation** text box, enter an integer value from 2 to 40 as the percentage (%) to set for each tier.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Viewing pool tier information

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** window, select a pool with the properties you want to view.
4. Perform one of the following to display the **View Tier Properties** window.
   - Click **More Actions** and select **View Tier Properties**.
   - Click **Actions > Pool > View Tier Properties** to open the window.
5. Select the target pool to display the graph.

Viewing DP-VOL tier information

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** tab, select a pool associated with the DP-VOL for which you want to view the information.
4. Click the **Virtual Volumes** tab.
5. From the **Virtual Volumes** table, select the DP-VOL for which you want to view the information.
6. Perform one of the following to display the **View Tier Properties** window.
   - Click **More Actions** and select **View Tier Properties**.
   - Click **Actions > Pool > View Tier Properties** to open the window.

Changing a Dynamic Tiering or active flash pool to a pool for Dynamic Provisioning

You can use this procedure to change a Dynamic Tiering or active flash pool to a Dynamic Provisioning pool.

Note: You cannot change a Dynamic Tiering pool to a Dynamic Provisioning pool in the following cases:

- Tier relocation is being executed manually.
- Pool-VOLs are being deleted.
- Zero pages are being reclaimed.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** tab, select a pool to be changed.
4. Perform one of following to display the **Edit Pools** window.
   a. Click **More Actions** and select **Edit Pools**.
   b. Click **Actions** > **Pool** > **Edit Pools** to open the window.
5. In the **Edit Pools** window, check **Multi-Tier Pool**.
6. Select **Disable** and click **OK** in the warning message.

7. Click **Finish**.

   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling active flash on an existing Dynamic Tiering pool

Use this procedure to enable the active flash feature on a Dynamic Tiering pool.

Note: Active flash cannot be enabled in the following cases:
- The pool contains DP-VOLs for which capacity saving is enabled.
- The pool contains a deduplication system data volume.

Before you begin
- The Storage Administrator (Provisioning) role is required to perform this task.
- Pool volumes whose drive type is SSD must be installed.
- If tier relocation is set to Manual mode, you must change tier relocation to Auto before beginning this procedure.
- If pool-VOLs are being deleted, you must wait until the delete pool-VOL operations are complete before beginning this procedure.
- If zero pages are being reclaimed, you must wait until the reclaim zero page operations are complete before beginning this procedure.

Procedure

1. In the **Storage Systems** tree on the left pane of the main window, select **Pools**.
2. From the **Pools** table, select the pool you want to change, and click **More Actions > Edit Pools**.
3. Check **Active Flash** to ON.

   If there is no pool volume whose drive type is SSD, the check box cannot be selected.
4. Click **Finish**.

   The Confirm window appears.
5. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

6. In the **Confirm** window, click **Apply** to register the setting in the task. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Working with pools

About pools

Dynamic Provisioning requires the use of pools. A pool consists of more than one pool-VOL. Pages in the pool are assigned to store user data and control information. Four pages on a DP-VOL are required for the control information.

A storage system supports up to 128 pools, each of which can contain up to 1024 pool-VOLs and 63,232 DP-VOLs per pool. The pool for Dynamic Provisioning cannot be used in conjunction with other pools.

The 128-pool maximum per storage system applies to the total number of Dynamic Provisioning pools and Dynamic Tiering pools. The pool for Dynamic Provisioning or Dynamic Tiering cannot be used in conjunction with other pools.

A pool number must be assigned to a pool. Multiple DP-VOLs can be related to one pool.

The total pool capacity combines the capacity of all the registered Dynamic Provisioning pool-VOLs assigned to the pool. Pool capacity is calculated using the following formulas:

- *capacity of the pool* (MB) = *total number of pages* * 42 - 4200
  4200 in the formula is the management area size of the pool-VOL with System Area.
- *total number of pages* = Σ(floor(floor(*pool-VOL number of blocks* ÷ 512) ÷ 168)) for each pool-VOL

where

- floor( ) means to truncate the part of the formula within the parentheses after the decimal point.

About pool-VOLs

Pool-VOLs are grouped together to create a pool. When a new pool is created, the available pool-VOLs are selected in the **Select Pool VOLs** window and added to the Selected Pool Volumes table. Every pool must have a pool-VOL with System Area.

When adding a volume to the pool for which Multi-Tier Pool is enabled, note the following:

- Up to three different drives types/RPM are allowed between all the pool-VOLs to be added.

- Volumes to be added to the same pool must have the same RAID level across all the same drive type/RPM pool-VOLs.
  For example, you cannot add a volume whose drive type/RPM is SAS/15k and whose RAID level is 5 (3D+1P) when a volume whose drive type/RPM is also SAS/15k but whose RAID level is 5 (7D+1P) is already in the pool.
- Up to three values are allowed for Drive Type/RPM for the volume.

If you increase the pool capacity by adding a pool-VOL, a portion of the existing data in the pool automatically migrates from an older pool-VOL to the newly added pool-VOL, balancing the usage levels of all the pool-VOLs. If you do not want to automate balancing of the usage levels of pool-VOLs, call customer support for assistance.

Dynamic Provisioning does not automatically balance the usage levels among pool-VOLs if the cache memory is not redundant or if the pool usage reaches up to the threshold.

The pool-VOLs contained in a pool can be added or deleted. Removing a pool-VOL does not delete the pool or any related DP-VOLs. You must delete all DP-VOLs related to the pool before the pool can be deleted. When the pool is deleted, all data in the pool is also deleted.

Creating pools

When you create a pool, you select the pool volumes (pool-VOLs) for the pool (manually or automatically) and set options such as the subscription limit and the warning and depletion thresholds for the pool. You can also enable options such as V-VOL protection and data deduplication.

The following procedures describe how to create pools for Dynamic Provisioning and Dynamic Tiering.

- Creating Dynamic Provisioning pools by selecting pool-VOLs manually on page 231
- Creating Dynamic Provisioning pools by selecting pool-VOLs automatically on page 234
- Creating Dynamic Tiering or active flash pools by selecting pool-VOLs manually on page 237
- Creating a Dynamic Tiering or active flash pool by automatically selecting pool-VOLs on page 240

Prerequisites for creating pools

- Before you can create pools, the proper amount of shared memory must be installed, and you must have a V-VOL management area in shared memory. When shared memory is added, the V-VOL management area is automatically created. To add shared memory, contact your service representative.
- One pool-VOL with system area is defined for a pool. The priority of the pool-VOL with system area is assigned according to the drive type. The available capacity of the pool-VOL with system area is deducted from the

management area capacity. The management area capacity stores the management information of software that uses the pool. If Dynamic Provisioning, Dynamic Tiering, or Thin Image is used on an open system, 4.2 GB is used as the management area in the pool-VOL with system area.

- When a pool is created, a pool-VOL with system area is assigned the priority shown in the following table. If multiple pool-VOLs of the same drive type exist, the priority of each is determined by the internal index of the storage system.

Priority	Drive type
1	SAS 7.2K
2	SAS 10K
3	SAS 15K
4	SSD
5	External volume

Creating Dynamic Provisioning pools by selecting pool-VOLs manually

You can use Storage Navigator to create a Dynamic Provisioning pool with manually selected pool-VOLs.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Click **Create Pools**.
4. From the **Pool Type** list, select **Dynamic Provisioning**.
5. From the **Multi-Tier Pool** field, select **Disable**.

   You cannot select **Enable** if the storage system has only external volumes with the **Cache Mode** set to **Disable**.
6. From the **Pool Volume Selection** field, select **Manual**.
7. Follow the steps below to select pool-VOLs.
   a. From the **Drive Type/RPM** list, select a data drive type and RPM.
   b. From the **RAID Level** list, select RAID level.

      If you select **External Storage** from the **Drive Type/RPM** list, a hyphen (-) appears and you cannot select the RAID level.
   c. Click **Select Pool VOLs**.

      The **Select Pool VOLs** window appears.
   d. In the **Available Pool Volumes** table, select the pool-VOL row to be associated with a pool, and then click **Add**.

      You can select a value other than **Middle** from **External LDEV Tier Rank** and click **Add** to set another tier rank for an external volume.

The selected pool-VOL is registered in the **Selected Pool Volumes** table. Up to 1,024 volumes can be added to a pool.

If LDEVs in the parity group with accelerated compression enabled are used as pool volumes, these LDEVs can be assigned to only one pool. LDEVs in one parity group with accelerated compression enabled cannot be assigned to multiple pools as pool volumes. We recommend that LDEVs of the two types do not coexist in a single pool. One type of LDEV belongs to the accelerated compression-enabled parity group and another type of LDEV belongs to the accelerated compression-disabled parity group.

Caution: For details about adding LDEVs to parity groups with accelerated compression enabled, see Guidelines for pools when accelerated compression is enabled on page 417.

Tip: Perform the following steps if necessary:
- Click **Filter** to open the menu, specify the filtering conditions, and click **Apply**.
- Click **Select All Pages** to select all pool-VOLs in the table. To cancel the selection, click **Select All Pages** again.
- Click **Options** to specify the volumes or the number of rows to be displayed.

e. Click **OK**.

The information in the **Selected Pool Volumes** table is applied to **Total Selected Pool Volumes** and **Total Selected Capacity**.

8. In **Assign Deduplication System Data Volume**, select **Yes** or **No**.

Note: You cannot select **Yes** in the following cases:
- **Enable** is selected for **Data Direct Mapping**.
- The dedupe and compression license is not installed.
- **Enable** is selected for Multi-Tier Pool.
- Pool volumes are not selected.
- The number of available LDEV IDs is not enough.
- The number of available cache management devices is not enough.
- **Mainframe** is selected for **System Type**.

9. If you want to change the deduplication system data volume options, click **Change Deduplication System Data Volume Options**:

a. To change **LDEV Name**, specify the prefix characters and the initial number for this LDEV.

b. To change **Initial LDEV ID**, specify the number of LDKC, CU, LDEV, and Interval. To confirm used LDEV IDs, click **View LDEV IDs** to confirm the used LDEV IDs in the **View LDEV IDs** window.
c. To change **Initial SSID**, specify the 4-digit SSID as a hexadecimal number (0004 to FFFE). To confirm used SSIDs, click **View SSIDs** to confirm the used SSIDs in the **View SSIDs** window.
d. Click **OK** to save your changes and return to the **Create Pools** window.

10. Enter the name in the **Pool Name** text box.
11. Click **Options**.
12. In the **Initial Pool ID** text box, type the number of the initial pool ID, from 0 to 127.

    When you specify a pool ID that was previously registered, the smallest available ID is displayed by default instead of the ID you specified. If a pool ID is unavailable, no number is displayed.
13. In the **Subscription Limit** text box, enter an integer value from 0 to 65534 as the subscription rate (%) for the pool.

    If no number is entered, the subscription rate is set to unlimited.

Caution: If you are using a pool comprised of pool volumes assigned by accelerated compression-enabled parity groups, you can create a DP-VOL with a capacity larger than the pool capacity and writing is assured even if the subscription limit is defined to 100% or less. In this case, the free area of the pool must be monitored.

This is not a requirement for monitoring the free area of the pool but if you want to specify the pool subscription limit, specify a value lower than the value calculated by the following formula:

```
100 % * ( Pool physical capacity / Pool capacity )
```

---

14. In the **Warning Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 70%.
15. In the **Depletion Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 80%.

    Enter a value that is equal to or greater than the value of the **Warning Threshold**.
16. In **Protect V-VOLs when I/O fails to Blocked Pool VOL**, select **Yes** or **No**. If **Yes** is selected, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.
17. In **Protect V-VOLs when I/O fails to Full Pool**, select **Yes** or **No**. If **Yes** is selected, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.
18. Click **Add**.

The created pool is added to the **Selected Pools** table. If invalid values are set, an error message appears.

The **Pool Type**, **Pool Volume Selection**, and **Pool Name** must be set. If the required items are not entered or selected, you cannot click **Add**.

If you select a row and click **Detail**, the **Pool Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.

19. Click **Next**.
    The **Create LDEVs** window appears.

    If **Subscription Limit** of the created pool is set to 0%, the **Create LDEVs** window does not appear.
20. Click **Finish**.
21. Check the settings in the **Confirmation** window, and then enter the task name in **Task Name**.
    Select the pool radio button and then click **Details**. The **Pool Properties** window appears.
22. Click **Apply**
    The tasks are registered. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Creating Dynamic Provisioning pools by selecting pool-VOLs automatically

Use this procedure to create a Dynamic Provisioning pool by selected pool-VOLs automatically.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Click **Create Pools**.
4. In the **Create Pools** window, select **Dynamic Provisioning** from the **Pool Type** list.
5. From the **Multi-Tier Pool** field, select **Disable**.
6. From the **Pool Volume Selection** field, select **Auto**.

Note: Select **Manual** if creating a pool that contains LDEVs in a parity group with accelerated compression enabled.

7. Select pool-VOLs as follows:
   a. From the **Resource Group** list, select the resource group name of the pool-VOL.

b. From the **Performance** list, select the performance of the pool.
c. In the **Total Capacity** list, specify the capacity of the pool.

   Values are displayed in **Total Pool Volumes** and **Total Capacity**. These values are greater than the specified value of the pool capacity. If you change the pool configuration, perform steps d, e, and f.
d. Click **Change Pool Configuration**.

   The **Change Pool Configuration Pattern** window appears. You can change the pool configuration that is automatically selected.
e. From the **Pool Configuration Patterns** table, select the pool configuration row. Then click **Select**.

Note:

- You can select the pool configuration on a parity group basis.
- The priority of the pool configuration is determined by these conditions:

  Priority 1: There is no free space in the parity group and one LDEV exists in the group.

  Priority 2: There is no free space in the parity group and multiple LDEVs exist in the group.

  Priority 3: There is free space in the parity group and multiple LDEVs exist in the group.
- The following items are not displayed in the **Pool Configuration Patterns** table:

  Parity groups with LDEVs that cannot be used as pool-VOLs.

  Pool configuration patterns that contain more than 1,024 LDEVs.

f. Click **OK**.

   The information in the **Pool Configuration Patterns** table is applied to **Total Pool Volumes** and **Total Capacity**.

8. In **Assign Deduplication System Data Volume**, select **Yes** or **No**.

Note: You cannot select **Yes** in the following cases:

- **Enable** is selected for **Data Direct Mapping**.
- The dedupe and compression license is not installed.
- **Enable** is selected for Multi-Tier Pool.
- Pool volumes are not selected.
- The number of available LDEV IDs is not enough.
- The number of available cache management devices is not enough.
- **Mainframe** is selected for **System Type**.

9. If you want to change the deduplication system data volume options, click **Change Deduplication System Data Volume Options**:

a. To change **LDEV Name**, specify the prefix characters and the initial number for this LDEV.
b. To change **Initial LDEV ID**, specify the number of LDKC, CU, LDEV, and Interval. To confirm used LDEV IDs, click **View LDEV IDs** to confirm the used LDEV IDs in the **View LDEV IDs** window.
c. To change **Initial SSID**, specify the 4-digit SSID as a hexadecimal number (0004 to FFFE). To confirm used SSIDs, click **View SSIDs** to confirm the used SSIDs in the **View SSIDs** window.
d. Click **OK** to save your changes and return to the **Create Pools** window.

10. Enter the name in the **Pool Name** text box.

11. Click **Options**.

12. In the **Initial Pool ID** text box, type the number of the initial pool ID, from 0 to 127.

When you specify a pool ID that was previously registered, the smallest available ID is displayed by default instead of the ID you specified. If a pool ID is unavailable, no number is displayed.

13. In the **Subscription Limit** text box, enter an integer value from 0 to 65534 as the subscription rate (%) for the pool.

If no number is entered, the subscription rate is set to unlimited.

14. In the **Warning Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 70%.

15. In the **Depletion Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 80%.

Enter a value that is equal to or greater than the value of the **Warning Threshold**.

16. In **Protect V-VOLs when I/O fails to Blocked Pool VOL**, select **Yes** or **No**. If **Yes** is selected, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. At the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.

17. In **Protect V-VOLs when I/O fails to Full Pool**, select **Yes** or **No**. If **Yes** is selected, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. At the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.

18. Click **Add**.

The created pool is added to the **Selected Pools** table. If invalid values are set, an error message appears.

If an item that must be set is not entered or selected, you cannot click **Add**.

The **Pool Type**, **Pool Volume Selection**, and **Pool Name** must be set. If the required items are not entered or selected, you cannot click **Add**.

If you select a row and click **Detail**, the **Pool Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.

19. Click **Next**.
    The **Create LDEVs** window appears.

    If **Subscription Limit** of the created pool is set to 0%, the **Create LDEVs** window does not appear.

    Click **Finish**, and the **Confirmation** window appears.
20. Check the settings in the **Confirmation** window, and then enter the task name in **Task Name**.
    Select the pool radio button and then click **Details**. The **Pool Properties** window appears.
21. Click **Apply**
    The tasks are registered. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Creating Dynamic Tiering or active flash pools by selecting pool-VOLs manually

Use this procedure to create pool-VOLs manually. These pools can be used by Dynamic Tiering and by active flash.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- If you are creating a pool for active flash, LDEVs whose drive type is SSD must be created in advance.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Click **Create Pools**.
4. In the **Create Pools** window, select **Dynamic Provisioning** from the **Pool Type** list.
5. From the **Multi-Tier Pool** field, select **Enable**.
6. If the pool is to be used by active flash, select the check box for **Active Flash**.

   Note: To use active flash, pool volumes whose drive type is SSD must be installed in advance. If there are no pool volumes whose drive type is SSD, this check box cannot be selected.

7. From the **Pool Volume Selection** field, select **Manual**.
8. Follow the steps below to select pool-VOLs:
   a. In the **Drive Type/RPM** list, make sure **Mixable** is selected.
   b. In the **RAID Level** list, make sure **Mixable** is selected.
   c. Click **Select Pool VOLs**.
      The **Select Pool VOLs** window appears.

d. In the **Available Pool Volumes** table, select the pool-VOL row to be associated with a pool, and then click **Add**.

The selected pool-VOL is registered in the **Selected Pool Volumes** table. Up to 1,024 volumes can be added to a pool.

You can add volumes with the same Drive Type/RPM and different RAID Levels. For example, you can add a volume that has an SAS/15K Drive Type/RPM and a 5(3D+1P) RAID Level to the same pool with a volume that has an SAS/15K Drive Type/RPM and a 5(7D+1P) RAID Level.

If LDEVs in the parity group with accelerated compression enabled are used as pool-VOLs, these LDEVs can be assigned to only one pool. LDEVs in one parity group with accelerated compression enabled cannot be assigned to multiple pools as pool-VOLs. We recommend that LDEVs of the two types do not coexist in one pool. One type of LDEV belongs to the accelerated compression-enabled parity group and another type of LDEV belongs to the accelerated compression-disabled parity group.

Note: You can select a value other than **Middle** from **External LDEV Tier Rank** and click **Add** to set another tier rank for an external volume.

Tip: Perform the following steps if necessary:

- Click **Filter** to open the menu, specify the filtering conditions, then click **Apply**.
- Click **Select All Pages** to select all pool-VOLs in the table. To cancel the selection, click **Select All Pages** again.
- Click **Options** to specify the volumes or the number of rows to be displayed.

e. Click **OK**.

The information in the **Selected Pool Volumes** table is applied to **Total Selected Pool Volumes** and **Total Selected Capacity**.

9. Enter the name in the **Pool Name** text box.
10. Click **Options**.
11. In the **Initial Pool ID** text box, type the number of the initial pool ID, from 0 to 127.

    When you specify a pool ID that was previously registered, the smallest available ID is displayed by default instead of the ID you specified. If a pool ID is unavailable, no number is displayed.
12. In the **Subscription Limit** text box, enter an integer value from 0 to 65534 as the subscription rate (%) for the pool.

    If no number is entered, the subscription rate is set to unlimited.

13. In the **Warning Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 70%.
14. In the **Depletion Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 80%.

    Enter a value that is equal to or greater than the value of the **Warning Threshold**.
15. Configure Dynamic Tiering with the following steps.

    From the **Tier Management** option, select **Auto** or **Manual**.

    a. The selection is usually **Auto** which allows performance monitoring and tier relocation to be performed automatically.

       If you select **Manual**, use the Command Control Interface or Hitachi Device Manager - Storage Navigator to manually perform performance monitoring and tier relocation.

    b. From the **Cycle Time** option, select the cycle for performance monitoring and tier relocation.

       When you select **24 Hours** (default value):

       Performance monitoring and tier relocation is performed once a day.

       In the **Monitoring Period** field, set the time to start and end performance monitoring. The default value is 00:00 to 23:59.

       Set one or more hours between the starting and ending times. If you specify a starting time that is later than the ending time, the performance monitoring continues until the ending time on the next day.

       You can view the information gathered by performance monitoring with Hitachi Device Manager - Storage Navigator or the Command Control Interface.

       When you select **0.5 Hours**, **1 Hour**, **2 Hours**, **4 Hours**, **8 Hours**:

       Performance monitoring is performed every hour that is selected, starting at 00:00.

       You cannot set a specific time to start performance monitoring.

Caution: When **Auto** is set, all the V-VOL pages may not be completely migrated in one cycle. In the next cycle, migration starts by updating information for the last processed V-VOL. At that point, the collection of performance monitoring information is switched to the current cycle.

16. From the **Monitoring Mode** option, select **Period Mode** or **Continuous Mode**.

    If you perform tier relocation in a specified cycle, **Period Mode** is selected by default. If you perform tier relocation weighted to the monitoring result of the past period, select **Continuous Mode**.

17. From the **Relocation Speed** option, select the page relocation speed to use when performing relocation.

    You can set the speed to: **1(Slowest)**, **2(Slower)**, **3(Standard)**, **4(Faster)**, and **5(Fastest)**. The default is **3(Standard)**. If you want to perform tier relocation at high speed, use the **5(Fastest)** setting. If the speed specified is slower than 3(Standard), the data drive load is low when tier relocation is performed.

18. In the **Buffer Space for New page assignment** text box, enter an integer value from 0 to 50 as the percentage (%) for each tier.

    A default value depends on the data drive type of the pool-VOL in each tier. The default value of SSD is 0%. The default value of a type other than SSD is 8%.

19. In the **Buffer Space for Tier relocation** text box, enter an integer value from 2 to 40 as the percentage (%) to set for each tier.

    The default value is 2%.

20. Click **Add**.

    The created pool is added to the **Selected Pools** table. If invalid values are set, an error message appears. If **Detail** is clicked when you select a row, the **Pool Property** window appears

    The **Pool Type**, **Multi-Tier Pool**, **Pool Volume Selection**, and **Pool Name** must be set. If the required items are not registered, you cannot click **Add**.

    If you select a row and click **Detail**, the **Pool Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.

21. Click **Next**.

    The **Create LDEVs** window appears. For instructions, see Creating an LDEV on page 122.

    If the **Subscription Limit** of the created pool is set to 0%, the **Create LDEVs** window does not appear.

    Click **Finish**. The **Confirmation** window appears.

22. Check the settings in the **Confirmation** window, and then enter the task name in **Task Name**.

    Select the pool radio button and then click **Details**. The **Pool Properties** window appears.

23. Click **Apply**

    The tasks are registered. If **Go to tasks window for status** is selected, the **Tasks** window opens automatically.

Creating a Dynamic Tiering or active flash pool by automatically selecting pool-VOLs

Use this procedure to create pool-VOLs automatically. These pools can be used by Dynamic Tiering and by active flash.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- If you are creating a pool for active flash, LDEVs whose drive type is SSD must be created in advance.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Click **Create Pools**.
4. From the **Pool Type** list, select **Dynamic Provisioning**.
5. From the **Multi-Tier Pool** field, select **Enable**.
6. If the pool is to be used by active flash, select the check box for **Active Flash**.

   Note: To use active flash, pool volumes whose drive type is SSD must be installed in advance. If there are no pool volumes whose drive type is SSD, this check box cannot be selected.

7. From the **Pool Volume Selection** field, select **Auto**.

   Note: Select **Manual** if creating a pool that contains LDEVs in the parity group with accelerated compression enabled.

8. Follow the steps below to select pool-VOLs:
   a. From the **Resource Group list**, select the resource group name of the pool.
   b. From the **Performance** list, select the performance of the pool.
   c. In the **Total Capacity** list, specify the capacity of the pool.
      Values are displayed in **Total Pool Volumes** and **Total Capacity**. These values are greater than the specified value of the pool capacity. If you change the pool configuration, perform steps d, e, and f.
   d. Click **Change Pool Configuration**.
      The **Change Pool Configuration Pattern** window appears. You can change the pool configuration that is automatically selected.
   e. From the **Pool Configuration Patterns** table, select the pool configuration row. Then click **Select**.

      Note:
      - You can select the pool configuration on a parity group basis.
      - The priority of the pool configuration is determined by these conditions:
        Priority 1: There is no free space in the parity group and one LDEV exists in the group.

Priority 2: There is no free space in the parity group and multiple LDEVs exist in the group.

Priority 3: There is free space in the parity group and multiple LDEVs exist in the group.

- If the check box for **Active Flash** is selected, only the pool configurations that contain LDEVs created by SSD are displayed.
- The following items are not displayed in the **Pool Configuration Patterns** table:

  Parity groups with LDEVs that cannot be used as pool-VOLs.

  Pool configuration patterns that contain more than 1,024 LDEVs.

f. Click **OK**.

The information in the **Pool Configuration Patterns** table is applied to **Total Pool Volumes** and **Total Capacity**.

9. Enter the name in the **Pool Name** text box.
10. Click **Options**.
11. In the **Initial Pool ID** text box, type the number of the initial pool ID, from 0 to 127.

    When you specify a pool ID that was previously registered, the smallest available ID is displayed by default instead of the ID you specified. If a pool ID is unavailable, no number is displayed.
12. In the **Subscription Limit** text box, enter an integer value from 0 to 65534 as the subscription rate (%) for the pool.

    If no number is entered, the subscription rate is set to unlimited.
13. In the **Warning Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 70%.
14. In the **Depletion Threshold** text box, enter an integer value from 1 to 100 as the rate (%) for the pool. The default value is 80%.

    Enter a value that is equal to or greater than the value of the **Warning Threshold**.
15. In **Protect V-VOLs when I/O fails to Blocked Pool VOL**, select **Yes** or **No**. If **Yes** is selected, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOLis changed to the Protect attribute.
16. In **Protect V-VOLs when I/O fails to Full Pool**, select **Yes** or **No**. If **Yes** is selected, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.
17. Configure Dynamic Tiering with the following steps.

    From the **Tier Management** option, select **Auto** or **Manual**.

    a. The selection is usually **Auto** which allows performance monitoring and tier relocation to be performed automatically.

If you select **Manual**, use the Command Control Interface or Hitachi Device Manager - Storage Navigator to manually perform performance monitoring and tier relocation.

b. From the **Cycle Time** option, select the cycle for performance monitoring and tier relocation.

When you select **24 Hours** (default value):

Performance monitoring and tier relocation is performed once a day.

In the **Monitoring Period** field, set the time to start and end performance monitoring. The default value is 00:00 to 23:59.

Set one or more hours between the starting and ending times. If you specify a starting time that is later than the ending time, the performance monitoring continues until the ending time on the next day.

You can view the information gathered by performance monitoring with Hitachi Device Manager - Storage Navigator or the Command Control Interface.

When you select **0.5 Hours**, **1 Hour**, **2 Hours**, **4 Hours**, **8 Hours**:

Performance monitoring is performed every hour that is selected, starting at 00:00.

You cannot set a specific time to start performance monitoring.

Caution: When **Auto** is set, all the V-VOL pages may not be completely migrated in one cycle. In the next cycle, migration starts by updating information for the last processed V-VOL. At that point, the collection of performance monitoring information is switched to the current cycle.

18. From the **Monitoring Mode** option, select **Period Mode** or **Continuous Mode**.

If you perform tier relocation in a specified cycle or you do not need to specify the **Monitoring Mode** option, select **Period Mode**. If you perform tier relocation weighted to the monitoring result of the past period, select **Continuous Mode**.

19. From the **Relocation Speed** option, select the page relocation speed to use when performing relocation.

You can set the speed to: **1(Slowest)**, **2(Slower)**, **3(Standard)**, **4(Faster)**, and **5(Fastest)**. The default is **3(Standard)**. If you want to perform tier relocation at high speed, use the **5(Fastest)** setting. If the speed specified is slower than 3(Standard), the data drive load is low when tier relocation is performed.

20. In the **Buffer Space for New page assignment** text box, enter an integer value from 0 to 50 as the percentage (%) for each tier.

A default value depends on the data drive type of the pool-VOL in each tier. The default value of SSD is 0%. The default value of a type other than SSD is 8%.

21. In the **Buffer Space for Tier relocation** text box, enter an integer value from 2 to 40 as the percentage (%) to set for each tier.

    The default value is 2%.

22. Click **Add**.

    The created pool is added to the **Selected Pools** table. If invalid values are set, an error message appears. If **Detail** is clicked when you select a row, the **Pool Property** window appears.

    The **Pool Type**, **Multi-Tier Pool**, **Pool Volume Selection**, and **Pool Name** must be set. If the required items are not registered, you cannot click **Add**.

    If you select a row and click **Detail**, the **Pool Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.

23. Click **Next**.

    The **Create LDEVs** window appears. For instructions on creating LDEVs, see Creating DP-VOLs on page 247.

    If **Subscription Limit** of the created pool is set to 0%, the **Create LDEVs** window does not appear.

    Click **Finish**.

24. Check the settings in the **Confirmation** window, and then enter the task name in **Task Name**.

    Select the pool radio button and then click **Details**. The **Pool Properties** window appears.

25. Click **Apply**

    The tasks are registered. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Working with DP-VOLs

About DP-VOLs

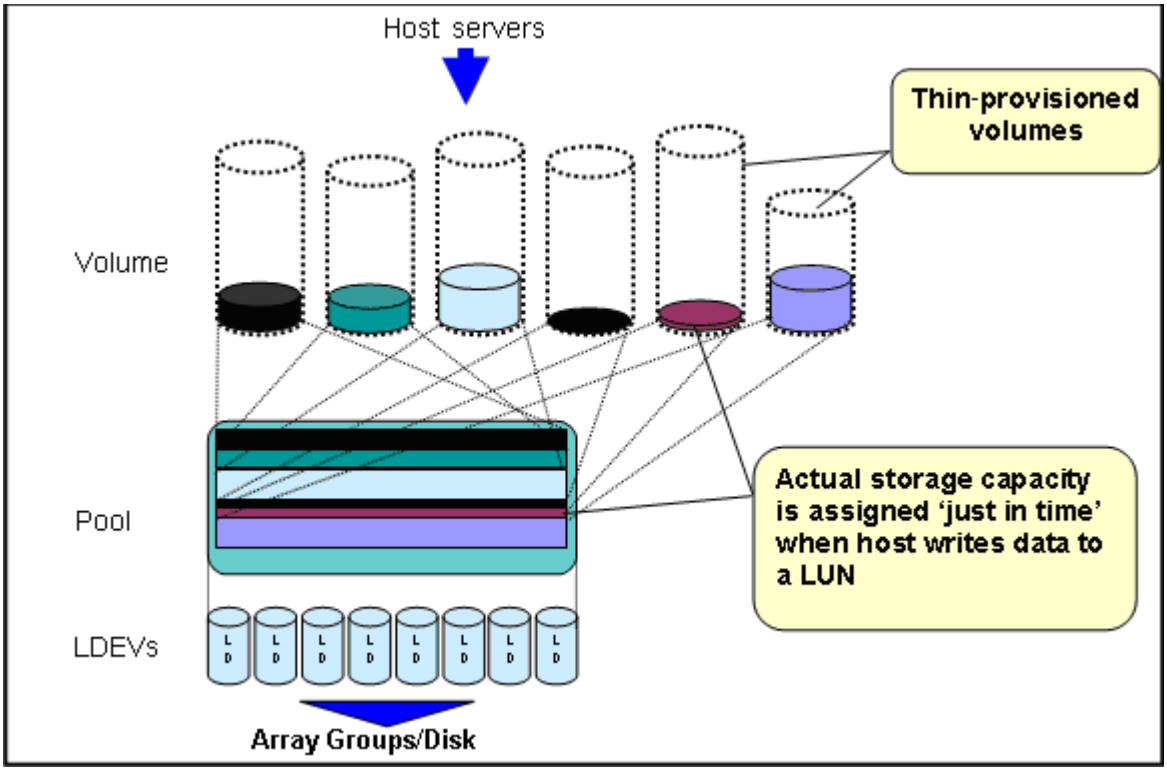
Dynamic Provisioning requires the use of DP-VOLs, which are virtual volumes with no physical memory space. In Dynamic Provisioning, multiple DP-VOLs can be created.

A DP-VOL is a volume in a thin provisioning storage system. It is the virtual volume from a DP pool. Data in the DP pool is used via a DP-VOL. A DP-VOL is a virtual LU to some hosts.

Relationship between a pool and DP-VOLs

Before you can use Dynamic Provisioning, a DP-VOL and a pool are required. Dynamic Provisioning uses the pool volumes in a pool through the DP-VOLs.

The following figure shows the relationship between a pool and DP-VOLs.



DP-VOL protection function

The DP-VOL protection function enables you to protect the DP-VOLs using a pool from read and write requests when problems occur in the pool or pool volumes. For example, in a pool comprised of pool volumes assigned by parity groups with accelerated compression enabled, the access attribute of the DP-VOL changes to Protect when the capacity reserved for writing is depleted.

You can use the Create Pools window or the Edit Pools window to set the following DP-VOL protection options:

- Protect V-VOLs when I/O fails to Full Pool: Enable this option to protect the DP-VOLs using the pool from read and write requests when the pool usage reaches the full size.
- Protect V-VOLs when I/O fails to Blocked Pool VOL: Enable this option to protect the DP-VOLs using the pool from read and write requests when the pool-VOL is blocked.

The requirements for using the DP-VOL protection function are:

- Data Retention Utility must be installed.

- The pool type must be Dynamic Provisioning or Dynamic Tiering.

When the access attribute of V-VOL was changed to Protect, if you change the access attribute other than Protect, see Protecting volumes using Data Retention Utility on page 303. The setting by the DP-VOL protection function has no connection to the access attribute status of DP-VOL. For example, even if you disabled the DP-VOL protection function to the pool while the Protect attribute was being enabled on DP-VOL, the Protect attribute would still be enabled on DP-VOL.

If you remove the Data Retention Utility feature, the V-VOL protection function settings remain set in the pool but are no longer active. In this case, if you reinstall Data Retention Utility, the protection function settings made before Data Retention Utility was removed are reactivated in the pool.

Caution: If you use the DP-VOL protection function, you cannot simultaneously use the following host mode options. You cannot use the DP-VOL protection function for V-VOLs associated with the host group for which one or both of the following host mode options are enabled:

- Host mode option 63 ((VAAI) Support Option for vStorage APIs based on T10 standards)
- Host mode option 73 (Support Option for Windows Server 2012)

Enabling and disabling the DP-VOL protection function options

Use this procedure to enable or disable the DP-VOL protection function options on an existing pool. The DP-VOL protection function options are:

- Protect V-VOLs when I/O fails to Full Pool: Enable this option to protect the DP-VOLs using the pool from read and write requests when the pool usage reaches the full size.
- Protect V-VOLs when I/O fails to Blocked Pool VOL: Enable this option to protect the DP-VOLs using the pool from read and write requests when the pool-VOL is blocked.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The pool must meet all of the following conditions:
  - Data Retention Utility is installed.
  - The pool type is Dynamic Provisioning, Dynamic Tiering with Multi-Tier Pool enabled, or Active Flash.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** table, select the pool for which you want to enable or disable the DP-VOL protection function options.

4. Click **More Actions**, and select **Edit Pools**.
5. In the **Edit Pools** window, select the desired options for **Protect V-VOLs when I/O fails to Blocked Pool VOL** and **Protect V-VOLs when I/O fails to Full Pool**.
6. Click **Finish** on the **Edit Pools** window.

   The **Confirm** window opens.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If **Go to tasks window for status** is selected, the **Tasks** window opens automatically.

Creating DP-VOLs

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- If you are creating DP-VOLs for active flash, pool volumes whose drive type is SSD must be installed in advance.

Procedure

1. Click **Create LDEVs**.

   The **Create LDEVs** window appears.
2. From the **Provisioning Type** list, confirm **Dynamic Provisioning** is selected.

   If not, select **Dynamic Provisioning** from the list.
3. To use the capacity saving function, in **Capacity Saving**, select **Compression** or **Deduplication and Compression**. If you select **Deduplication and Compression**, you will not be able to change the setting to **Compression** later.
   If Deduplication is Not Available in the target pool, or if the LDEV status of the deduplication system data volume in the selected pool is other than Normal, **Deduplication and Compression** cannot be selected.

   Capacity Saving is set to **Disabled** in the following cases:
   - **Data Direct Mapping** is set to **Enable**.
   - The dedupe and compression license is not installed.
   - **Multi-Tier Pool** is set to **Enable**.

   Caution: If a pool has LDEVs in a parity group with accelerated compression enabled, select **Deduplication and Compression** if you want to enable capacity saving. Selecting **Compression** might

result in lower I/O performance than using accelerated compression only.

Do not use capacity saving and NAS deduplication on the same volumes, because the additional processing decreases the I/O performance substantially. For information about the NAS deduplication function, see the *File Services Administration Guide*.

4. If you want to create a V-VOL for Dynamic Tiering, select **Enable** from the **Multi-Tier Pool** field. If not, select **Disable**.
   If no pool is set to **Enable** in Dynamic Tiering, **Disable** is fixed.
5. If the pool is to be used by active flash, select **Active Flash**.

Note: To use active flash, pool volumes whose drive type is SSD must already be installed. If there are no pool volumes whose drive type is SSD, this checkbox cannot be selected.

6. Select the pool as follows:
   a. From the **Drive Type/RPM** list in **Pool Selection**, select the data drive type and RPM.
   b. From the **RAID level** list, select the RAID level.
   c. Click **Select Pool**.
      The **Select Pool** window appears.
   d. In the **Available Pools** table, select a pool.

Note: You can specify a pool when creating DP-VOLs if the pool status is one of the following:
- Normal
- Exceeded Threshold
- In progress of pool capacity shrinking

You can select only one pool. When **Enable** is selected in step 6, the Dynamic Tiering pools appear, and when **Disable** is selected, only the non-Dynamic Tiering pools appear.

Perform the following if necessary:
- Click **Filter** to open the menu, specify the filtering, and then **Apply**.
- Click **Options** to specify the units of pools or the number of rows to be displayed.

   e. Click **OK**.
      The **Select Pool** window closes. The selected pool name appears in **Selected Pool Name (ID)**, and the total capacity of the selected pool appears in **Selected Pool Capacity**.

7. If you want to offset the specified LDEV capacity by boundary, change the default **Capacity Compatibility Mode (Offset boundary)** from **OFF** to **ON**.
8. In the **LDEV Capacity** text box, enter the DP-VOL capacity to be created.

   You can enter the capacity within the range of figures displayed below the text box. You can enter the number with 2 digits after the decimal point. You can change the capacity unit from the list.
9. In the **Number of LDEVs** text box, enter the number of LDEVs to be created.

   You can enter the number of LDEVs within a range of the figures displayed below the text box.
10. In the **LDEV Name** text box, enter the DP-VOL name.

    In the **Prefix** text box, enter the alphanumeric characters, which are fixed characters of the head of the DP-VOL name. The characters are case-sensitive.

    In the **Initial Number** text box, type the initial number following the prefix name, which can be up to 9 digits.

    You can enter up to the 32 characters including the initial number.
11. Click **Option**.
12. In the **Initial LDEV ID** field, make sure that LDEV ID is set.

    To confirm the used number and unavailable number, click **View LDEV IDs** to display the **View LDEV IDs** window.

    In the table, used LDEV numbers appear in blue, unavailable numbers appear in gray, and unused numbers appear in white. LDEV numbers that are unavailable may already be in use or already assigned to another emulation group (group by 32 LDEV numbers).
13. From the **Cache Partition** list, select CLPR.
14. From the **MP Unit** list, select a MP unit.

    Select an MP unit to be used by the LDEVs. If you assign a specific MP unit, select the ID of the MP unit. If you can assign any MP unit, click **Auto**.
15. From the **Full Allocation** field, select **Enable** or **Disable**. To reserve pages in the pool that are the same size as the LDEV capacity, select **Enable**.

    If **Compression** or **Deduplication and Compression** is set for **Capacity Saving**, **Disable** is set for **Full Allocation**.
16. From the **Tiering Policy** field, select the tiering policy to be used by the LDEVs.

    If you assign a specific tiering policy, select any policy. All(0) is selected by default. You can change a level from Level1(1) to Level5(5) or from Level6(6) to Level31(31). You can specify the function when the **Multi-Tier Pool** is enabled.

From Level6(6) to Level31(31), the names of tiering policies can be changed. If these names have changed, the new names appear.

For a DP-VOL with capacity saving enabled, you can select All(0) or Level1(1) through Level5(5).

17. From the **New Page Assignment Tier** list, select a new page assignment tier. You can select from levels **High**, **Middle**, and **Low**.
    You can specify the function when the **Multi-Tier Pool** is enabled.
18. In the **Relocation Priority** option, select a priority.
    To relocate the LDEV preferentially, set **Prioritize**. You can select **Default** or **Prioritize**. You can specify this function when the **Multi-Tier Pool** is enabled.
19. In **T10 PI**, select **Enable** or **Disable**.
    The T10 PI attribute can be specified when the emulation type is OPEN-V.

    Caution: The T10 PI attribute can only be defined during the initial creation of LDEVs. The defined attribute cannot be removed from LDEVs on which it is already set.

20. If necessary, change the settings of the V-VOLs.
    - Click **Change LDEV Settings** to open the **Change LDEV Settings** window.
21. If necessary, delete a row from the **Selected LDEVs** table.
    Select a row to be deleted, then click **Remove**.
22. Click **Add**.
    The created V-VOLs are added to the right **Selected LDEVs** table. If invalid values are set, an error message appears.

    The **Provisioning Type**, **Pool Selection**, **Drive Type/RPM**, **RAID Level**, **LDEV Capacity**, and **Number of LDEVs** fields must be set. If these required items are not registered, you cannot click **Add**.
23. Click **Finish**.
    The **Confirm** window appears.

    To continue the operation for setting the LU path and define LUN, click **Next**.
24. In the **Task Name** in the text box, enter the task name.
    You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "yymmdd-window name" is entered as a default.
25. Click **Apply**.
    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing DP-VOL settings

Before registering a DP-VOL, you may need to change the DP-VOL settings.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click **Create LDEVs**.
4. In the **Selected LDEVs** table of the **Create LDEVs** window, select an LDEV, and then click **Change LDEV Settings**.
5. In the **Change LDEV Settings** window, you can change the setting of **LDEV Name**, **Initial LDEV ID**, or **MP Unit**.
   - If you change **LDEV Name**, specify the prefix characters and the initial number for this LDEV.
   - If you change **Initial LDEV ID**, specify the number of LDKC, CU, DEV, and Interval. To check used LDEVs, click **View LDEV IDs** to confirm the used LDEVs.
   - If you change **MP Unit**, click the list and specify the MP unit ID. If the specific MP unit is specified, select the MP unit ID. If any MP unit is specified, click **Auto**.
6. Change the settings, then click **OK**.
7. In the **Create LDEVs** window, click **Finish**.
8. In the **Confirm** window, click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Removing the DP-VOL to be registered

If you do not want to register the DP-VOL, you can remove it from the registering task.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click **Create LDEVs**.
4. In the **Selected LDEVs** table of the **Create LDEVs** window, select the LDEV, then click **Remove**.

   The message appears asking whether you want to remove the selected row or rows. If you want to remove the row. Click **OK**.
5. Click **Finish**.
6. In the **Confirm** window, click **Apply**.

   The LDEV is removed.

If **Go to tasks window for status** is checked, the **Tasks** window opens.

Monitoring capacity and performance

Monitoring pool capacity

The storage system monitors the pool's free capacity in accordance with threshold values defined when you create pools. If the pool capacity reaches the threshold values, warnings are issued as SIMs and as SNMP traps to the open-systems host.

You can provision a larger virtual capacity beyond the pool capacity by using DP-VOLs of Dynamic Provisioning or Dynamic Tiering. However, when the pool's free capacity is depleted, you can lose access to DP-VOLs that require more pool capacity. For example, if the pool usage rate is 100% due to increased write operations, then I/O is not accepted and I/O will be stopped for a DP-VOL that failed to receive needed pool capacity. Therefore, you should carefully monitor the pool usage or pool free capacity, as well as the level of provisioned virtual capacity.

Protecting data during pool shortages

To protect data from reading and writing to the DP-VOL when the pool is full, you can apply access attributes to a volume. To do this, you need to enable the Hitachi Data Retention Utility by ensuring the license is installed and by using system option mode 729. This protection method applies a Protect attribute to the DP-VOL to protect volumes against write operations when the pool is full. See Assigning an access attribute to a volume on page 306 for more details.

The Protect attribute is applied to the DP-VOL and is used in conjunction with other software products. When the Protect attribute is applied to the DP-VOL, Permitted appears in the S-VOL field and 0 day appears in the Validation field of the Hitachi Data Retention Utility window. However, when the Protect attribute is added to the DP-VOL with the S-VOL unacceptable attribute available in the Hitachi Data Retention Utility, Not Permitted appears in the S-VOL field in the **Data Retention** window.

Monitoring performance

You can monitor system performance using Performance Monitor. For more information, see the *Performance Guide*.

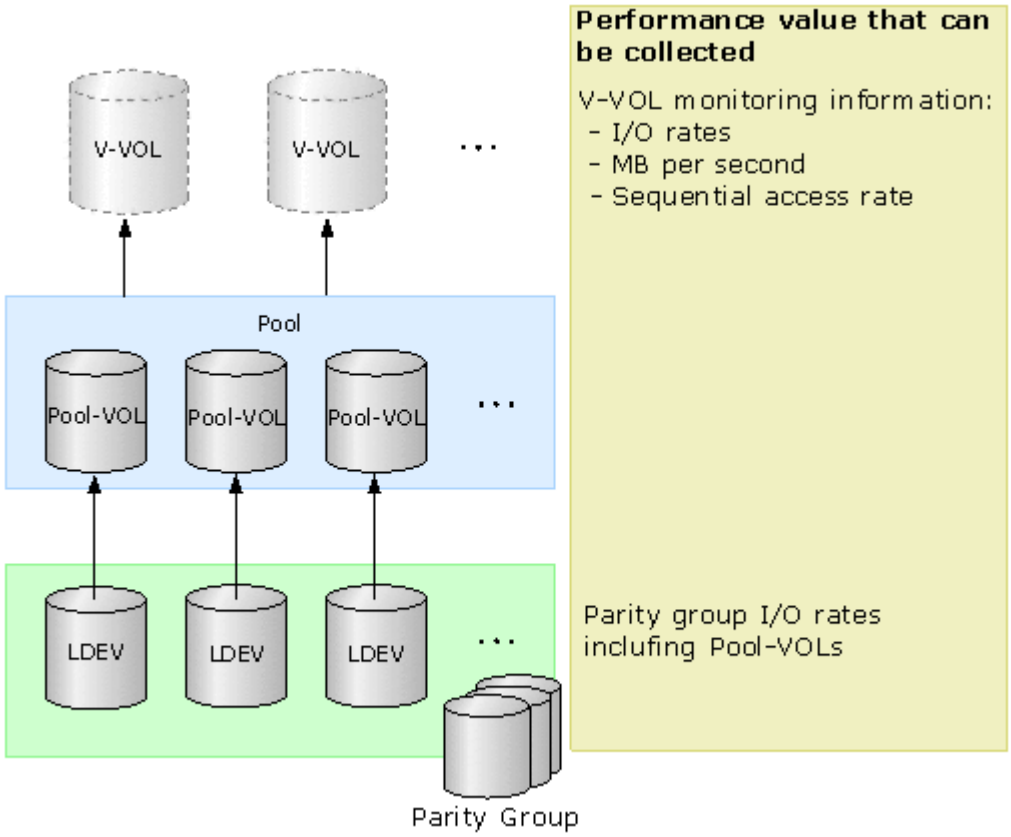
You can monitor information about pools and DP-VOLs using Command Control Interface (CCI). For more information, see the *Command Control Interface User and Reference Guide*.

The following activities help you to monitor and control performance of DP-VOLs. Collecting monitor information and subsequent tuning may increase throughput and the operating rates.

- **Collecting monitor information:**
  Collecting the following monitor information helps you determine the pool load (including the access frequency, and the access load upon data drives) and DP-VOL load (including the access frequency). You can then use this monitor information to tune the appropriate allocation.
  - Access frequency of DP-VOL, read hit rates, and write hit rates (using Performance Monitor)
  - Usage rates of parity groups of pools (using Performance Monitor)
  - Pool usage (using Hitachi Device Manager - Storage Navigator)
  - DP-VOL usage (using Hitachi Device Manager - Storage Navigator)
  - Dynamic Tiering performance monitoring of pool storage
- **Possible tuning actions (without Dynamic Tiering):**
  The following techniques using ShadowImage or Hitachi Tiered Storage Manager will move a DP-VOL:
  - The DP-VOL is copied using ShadowImage from a pool with an I/O bottleneck. For more information, see the *Hitachi ShadowImage® User Guide*.
  - When normal volumes exist in the same parity group as the pool-VOL, Hitachi Tiered Storage Manager can be used to move the normal volume to another parity group that is not shared with a pool-VOL.
  - ShadowImage copies a DP-VOL with a high I/O load to a pool with a lower access level to adjust the pool load.

Managing I/O usage rates example

The following figure illustrates an example of managing I/O usage rates.



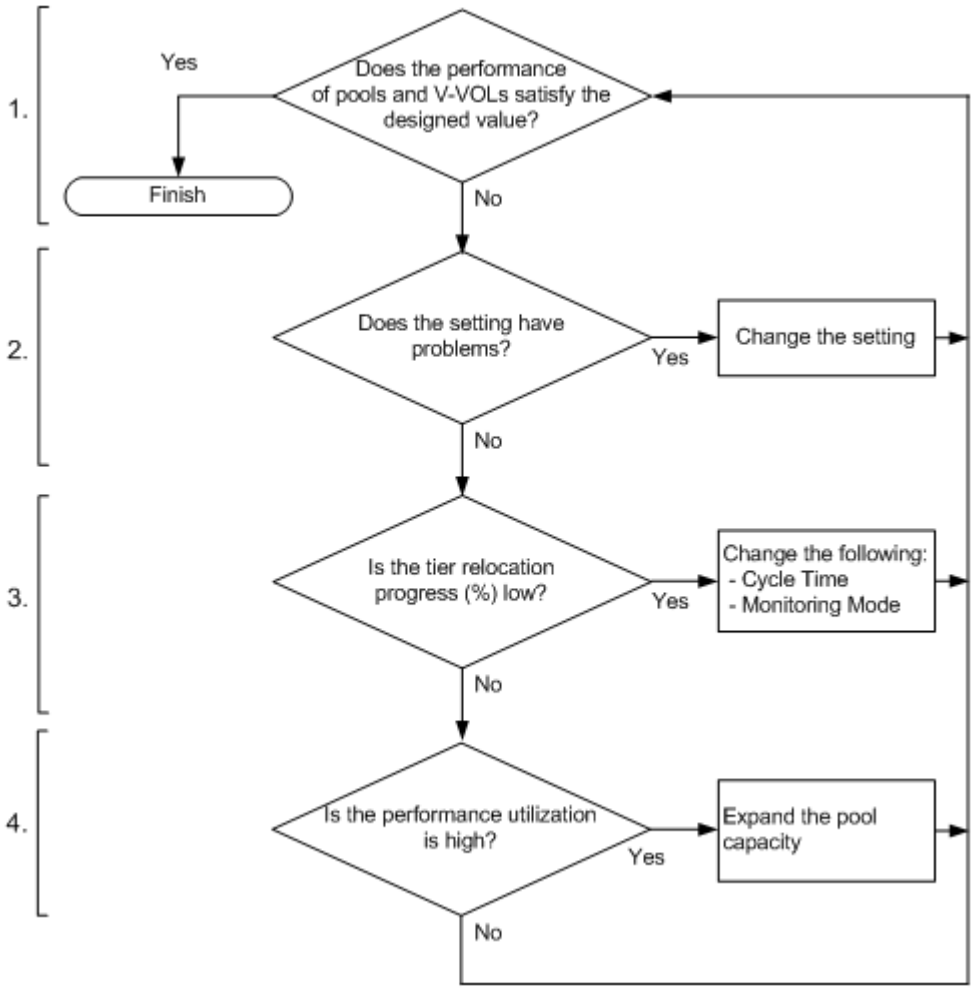
Tuning with Dynamic Tiering

If Dynamic Tiering is active on your storage system, you can monitor access frequency and performance while Dynamic Tiering automatically relocates data to the most suitable data drive (tier). You can configure monitoring to be automatic or manual. In both cases, relocation of the data is automatically determined based on monitoring.

For details, see Dynamic Tiering and active flash on page 162

Improving performance by monitoring pools

When the multi-tier pool is enabled, and the performance of the pools and DP-VOLs is not as expected, use the workflow below to detect problems and improve the performance.



1. Confirm the performance of pools and DP-VOLs

Using Performance Monitor, confirm the performance of pools and DP-VOLs. If the performance of pools and DP-VOLs is poor, go to Step 2.

2. Confirm the Dynamic Tiering setting

Using Hitachi Device Manager - Storage Navigator or Command Control Interface, confirm the Dynamic Tiering setting. If the values are set but do not conform to the design of pools or LDEVs, change the settings. If the values are set and conform to the design of pools or LDEVs, go to Step 3.

3. Confirm and improve the progress of tier relocation processing

Confirm the progress of tier relocation processing in Completed Rate (%) in the tier relocation log file. If the progress of the tier relocation process is low, there might be many pages where the page allocation is not optimized. In this case, change the Monitoring Mode or Cycle Time setting. The recommended values are as follows:

Monitoring Mode: If Period Mode is set, change to Continuous Mode.

Cycle Time: Set a longer period than the current setting.

If the recommended values are already set or if the progress of tier relocation processing is still low even after the settings are changed, go to Step 4.

4. Confirm Performance Utilization of each tier

You can confirm the performance utilization of each tier in the **View Tier Properties** window or with the **`raidcom get dp_pool`** command. The performance utilization is the ratio (%) of the number of I/Os against the performance potential of the tier. For example, if the performance utilization is 90% or more, a workload greater than the processing capacity of the tier is being applied to the tier.

If Performance Utilization is 90% or more on one or more of the tiers, or if Performance Utilization is 60% on all tiers, add drives and expand the pool capacity.

1. In the case that Performance Utilization is 90% or more on a tier:

Add drives to the tier where Performance Utilization is 90% or more and confirm the usage ratio of the capacity. The recommended drives to be added are as follows:

Drives to be added to the tier where Performance Utilization is 90% or more	Recommended pool volumes to be added
SSD	Add SSD pool volumes.
SAS10K or SAS15K	If the performance is given greater priority than the bit-cost: Add SSD pool volumes. If the bit-cost is given greater priority than the performance: Add SAS10K or SAS15K pool volumes. However, add SSD pool volumes if the capacity utilization of the SAS tier (SAS10K or SAS15K) is low.
SAS7.2K	If the performance is given greater priority than the bit-cost: Add SAS (SAS10K or SAS15K) pool volumes. If the bit-cost is given greater priority than the performance: Add SAS7.2K pool volumes. However, add SAS (SAS10K or SAS15K) pool volumes if the capacity utilization of the SAS 7.2K tier is low.

2. In the case that Performance Utilization is 90% or more on two or more tiers:

a. Collect the frequency distribution on the **View Tier Properties** window.

b. From the frequency distribution and the performance limit of each tier, seek the ratio of the most suitable tier capacity.

The performance limit of tier 2 is the maximum average IOPH on one page that the drive related to tier 2 can process. The performance limit of tier 3 is the maximum average IOPH on one page that the tier 3 drive can process. Based on these values, calculate the most suitable tier capacity for the tier 1, tier 2, and tier 3.

The most suitable tier capacity for tier 1: The capacity from 0 GB to the capacity related to the performance limit of tier 2

The most suitable tier capacity for tier 2: The capacity from the performance limit of tier 2 to tier 3 of that capacity.

The most suitable tier capacity for tier 3: The capacity from the performance limit of tier 3 to the maximum capacity of tier 3

Then, based on the most suitable tier capacity for each tier, calculate the most suitable capacity ratio of tier 1, tier 2, and tier 3 as follows:

The most suitable tier capacity for tier 1 : The most suitable tier capacity for tier 2 : The most suitable tier capacity for tier 3

c. Compare the ratio of the real tier capacity to the ratio of the most suitable tier capacity.

Comparing the ratio of tier capacity	Pool volumes suggested to be added
The ratios of the most suitable tier capacity and real tier capacity are different.	Add pool volumes to the tier that is lacking capacity.
The ratios of the most suitable tier capacity and real tier capacity are the same.	If the performance is given greater priority than the bit-cost: Add SSD or SAS (SAS10K or SAS15K) pool volumes. If the bit-cost is given greater priority than the performance: Add SAS (SAS10K or SAS15K) pool volumes. However, add SSD pool volumes if the capacity utilization of the SAS tier (SAS10K or SAS15K) is low.

d. Add drives and expand the pool capacity.

3. In the case that Performance Utilization is 60% on all tiers:

Add drives in the upper tier and expand the pool capacity.

Thresholds for monitoring pools

Dynamic Provisioning monitors pool capacity using thresholds. A threshold is the proportion (%) of the used capacity of the pool to the total capacity of the pool, or the proportion (%) of the physical used capacity of the pool to the total capacity reserved for writing of the pool.

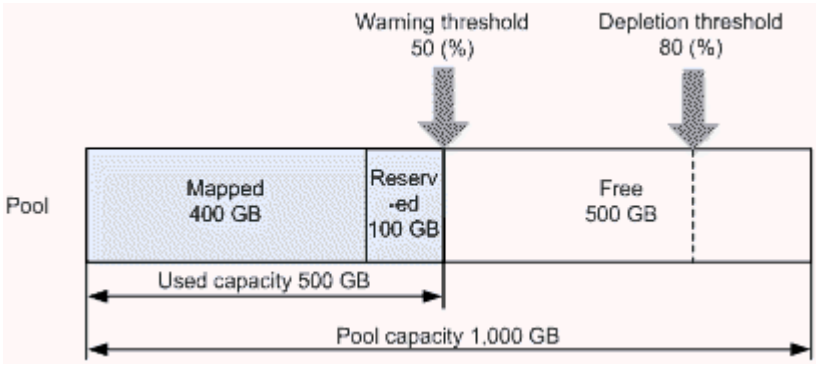
Pool utilization thresholds

The following threshold values can be set for each pool:

- Warning Threshold: Range = 1% to 100%, in 1% increments. Default = 70%.
- Depletion Threshold: Range = 1% and 100%, in 1% increments. Default = 80%. The Depletion Threshold must be higher than the Warning Threshold.

If either threshold is exceeded by the used capacity of the pool, a service information message (SIM) is issued by the storage system. SIMs are displayed by Device Manager - Storage Navigator and other management software and reported to the open-system hosts as SNMP traps.

The following figure shows a pool with a total pool capacity of 1,000 GB, a Warning Threshold of 50%, and a Depletion Threshold of 80%. If the used capacity of the pool is larger than 50% (500 GB) of the total pool capacity, a SIM and an SNMP trap are reported. If the used capacity of the pool increases further and exceeds the Depletion Threshold (80%), another SIM and SNMP trap are reported.



Note that if the actual pool usage percentage is 50.1%, only 50% appears on the Device Manager - Storage Navigator window because the capacity amount is truncated after the decimal point. If the threshold is set to 50%, a SIM and an SNMP trap are reported even though the pool usage percentage displayed on the window does not indicate an exceeded threshold.

Pool subscription limit

The value of using a subscription limit is to manage the maximum amount of over-provisioning that is acceptable for a pool. By managing the pool subscription limit, you can control the potential demand for storing data that might exceed the pool capacity.

Note: If you are using the pool comprised of pool-VOLs assigned by accelerated compression-enabled parity groups, the pool subscription limit is defined with respect to the pool capacity not reserved for writing. In this

case, the free area of the pool must be monitored even if the subscription limit is defined to 100%.

If you do not want to monitor the free area of the pool, specify the subscription limit conforming to the following formula:

```
Pool capacity / Pool capacity reserved for data writing ×
Subscription limit = 100%
```

For example, if 100 TB of the pool capacity and 80 TB of the pool capacity reserved for writing exist, specify 80% as the subscription limit.

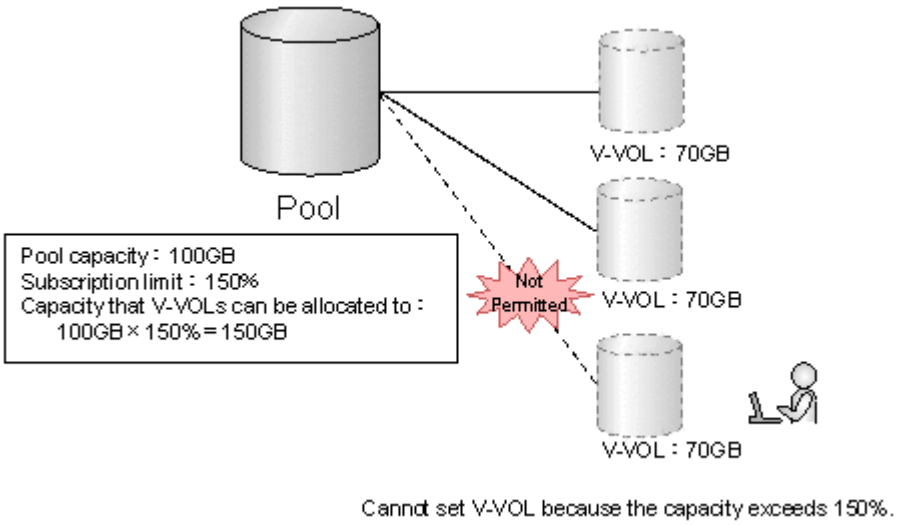
The subscription limit is the ratio (%) of the total DP-VOL capacity that has been configured to the total capacity of the pool. When the subscription limit is set, you cannot configure another DP-VOL if the new DP-VOL capacity would cause the subscription limit to be exceeded.

The subscription limit includes pages required to store user data and control information. The total capacity of DP-VOLs that are created from the pool is smaller than the subscription limit capacity. The formula used to calculate the required pages for one DP-VOL includes the control information. To determine the total pages required in a pool, multiply the number of calculated pages by the number of DP-VOLs. The value enclosed in ceil( ) must be rounded up to the nearest whole number. The number of pages for the DP-VOL including the control information equals:

```
Number of pages for the
    DP-VOL including the control information = ceil((One
          DP-VOL capacity (MB) + ceil(One
          DP-VOL capacity (MB) / 3,145,548 (MB)) * 4 (Pages) *
42 (MB)) / 42 (MB))
```

For example, if the pool capacity is 100 GB and the subscription limit is 150%, you can configure up to a total of 150 GB of capacity to the DP-VOLs related to the pool.

The following figure depicts setting the subscription limit of pool capacity.



Cannot set V-VOL because the capacity exceeds 150%.

Monitoring total DP-VOL subscription for a pool

You can configure the subscription limit of total DP-VOL capacity to pool capacity. This prevents a new DP-VOL capacity that exceeds the configured subscription limit from being allocated and is associated with the pool. If you specify more than 100% as the subscription limit or the subscription limit is not set, you must monitor the free capacity of the pool because it is possible that writes to the DP-VOLs may exceed pool capacity.

The used value displayed in the cell for Current in the Subscription (%) is truncated after the decimal point of the calculated value. Therefore, the actual percentage of DP-VOL assigned to the pool may be larger than the value displayed in the window. If you create a new DP-VOL of the same size as the existing DP-VOL, the larger capacity which is displayed in the Current cell is necessary.

For example, if 3 GB V-VOL is related to an 11.89 GB pool, the capacity (%) is calculated as follows:

```
(( ceil(3,072 (MB) / 3,145,548 (MB)) * 4 (Pages) * 42 (MB)) +
3,072 (MB)) / 12,175.36 (MB)) * 100 = 26.61....(%)
```

In this case, 26% is displayed in the cell for Current in the Subscription (%). If you create a new V-VOL of the same size as the existing V-VOL, 27% or more remaining capacity is necessary.

Related references

- Create Pools window on page 573

Changing pool thresholds

Use this procedure to change the threshold of a pool.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool with the threshold you want to change.
4. Click **More Actions**, and then select **Edit Pools**.
5. In the **Edit Pools** window, check **Warning Threshold** or **Depletion Threshold**.
6. Type the threshold values in the text box.

   The threshold value can be within the range of values indicated below the text box. The **Depletion Threshold** value can be equal to or greater than the **Warning Threshold**.
7. Click **Finish**.

   The **Confirm** window appears.
8. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing the pool subscription limit

Use this procedure to change the pool subscription limit.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool with the threshold you want to change.
4. Click **More Actions**, and then select **Edit Pools**.
5. In the **Edit Pools** window, check **Subscription Limit**, then type the subscription limit percentage.

   If the subscription limit is blank, then it is disabled, and any number of DP-VOLs can be created regardless of the pool free capacity.
6. Click **Finish**.

   The **Confirm** window appears.

Caution: If you are using a pool comprised of pool volumes assigned by accelerated compression-enabled parity groups, you can create a DP-VOL with a capacity larger than the pool capacity and writing is assured even if the subscription limit is defined to 100% or less. In this case, the free area of the pool must be monitored.

The pool subscription limit is not a requirement for monitoring the free area of the pool, but if you want to specify the pool subscription limit, specify a value lower than the value calculated by the following formula:

```
100 % * ( Pool physical capacity / Pool capacity )
```

7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Working with SIMs

About SIMs

Dynamic Provisioning and Dynamic Tiering provide Service Information Messages (SIMs) to report the status of the DP-VOLs and pools. If an event associated with a pool occurs, a SIM and an SNMP trap are reported.

An example of a SIM condition is if the actual pool usage rate is 50.2%, but only 50% is displayed because the capacity amount is truncated after the decimal point. If the threshold is set to 50%, a SIM and an SNMP trap are reported, even though the pool usage rate displayed on the GUI does not indicate the threshold is exceeded.

SIM reference codes

The following table provides information about SIM reference codes associated with Dynamic Provisioning and Dynamic Tiering.

SIM code (SIM level)	Event	Thresholds or values	Types of reports		Solutions
			Sent to host?	User operations required?	
620xxx* (Moderate)	Dynamic Provisioning pool usage level (Used (1%)) exceeded the Warning Threshold	1% to 100% (in 1% increments) Default: 70%	Yes	No	Solutions • Add some pool-VOLs to the pool. • Reclaim zero pages to release pages in which zero data are stored.
622xxx (Moderate)	Dynamic Provisioning pool is full	100%	Yes	No	Solutions • Add some pool-VOLs to the pool. • Reclaim zero pages to release pages in which zero data are stored. The Protect attribute of Data Retention Utility might have been set to the DP-VOLs. After performing above solutions, release the Protect attribute of the DP-VOLs.
623xxx (Moderate)	Error occurred in the Dynamic Provisioning pool	Not applicable	Yes	Yes	Contact customer support.
624000 (Moderate)	No space in the shared memory	Not applicable	Yes	Yes	Solutions • Remove pools that are not used. • Remove DP-VOLs that are not used. • Remove Thin Image pairs that are not used. • Shrink the pool capacities.
625000 (Moderate)	Dynamic Provisioning pool usage level (Used	Highest pool threshold of	Yes	No	Solutions

SIM code (SIM level)	Event	Thresholds or values	Types of reports		Solutions
			Sent to host?	User operations required?	
	(1%)) continues to exceed the highest pool threshold. SOM 734 must be enabled.	Dynamic Provisioning			• Add some pool-VOLs to the pool. • Reclaim zero pages to release pages in which zero data are stored.
626xxx (Moderate)	Dynamic Provisioning Pool usage level (Used (1%)) exceeded the Depletion Threshold	1% to 100% (in 1% increments) Default: 80%	Yes	No	Solutions • Add some pool-VOLs to the pool. • Reclaim zero pages to release pages in which zero data are stored.
627xxx (Moderate)	Pool-VOL is blocked	Not applicable	Yes	Yes	Contact customer support.
628000 (Service)	Protect attribute of Data Retention Utility is set	Not applicable	Yes	Yes	Solutions • Add pool-VOLs to the pool to increase the free space in the pool. • Reclaim zero pages to release pages in which zero data are stored. • Contact customer support to restore the pool-VOL. • If the blocked pool-VOL is an external volume, verify the status of the path blockade and the external storage system. After performing the above solutions, release

SIM code (SIM level)	Event	Thresholds or values	Types of reports		Solutions
			Sent to host?	User operations required?	
					the Protect attribute (Data Retention Utility) of the DP-VOL.
629xxx (Moderate)	In the Dynamic Provisioning pool, the used capacity reserved for writing exceeded the Warning Threshold. This SIM is reported if the Dynamic Provisioning pool contains one or more LDEVs in the parity group with accelerated compression enabled.	1% to 100% (in 1% increments) Default: 70%	Yes	No	Estimate the FMC capacity to be added, and then add the FMC capacity.
62Axxx (Moderate)	In the Dynamic Provisioning pool, the capacity reserved for writing is full. This SIM is reported if the Dynamic Provisioning pool contains one or more LDEVs in the parity group with accelerated compression enabled.	100%	Yes	No	Estimate the FMC capacity to be added, and then add the FMC capacity.
62B000 (Moderate)	In theDynamic Provisioning pool, the used capacity reserved for writing continues to exceed the highest pool threshold. SOM 734 must be enabled. This SIM is reported if the Dynamic Provisioning pool	Highest pool threshold of Dynamic Provisioning	Yes	No	Estimate the FMC capacity to be added, and then add the FMC capacity.

SIM code (SIM level)	Event	Thresholds or values	Types of reports		Solutions
			Sent to host?	User operations required?	
	contains one or more LDEVs in the parity group with accelerated compression enabled.				
62Cxxx (Moderate)	In the Dynamic Provisioning pool, the used capacity reserved for writing exceeded the Depletion Threshold. This SIM is reported if the Dynamic Provisioning pool contains one or more LDEVs in the parity group with accelerated compression enabled.	1% to 100% (in 1% increments) Default: 80%	Yes	No	Estimate the FMC capacity to be added, and then add the FMC capacity.
62Dxxx (Moderate)	In the Dynamic Provisioning pool, the used capacity reserved for writing exceeded the Prefixed Depletion Threshold. This SIM is reported if the Dynamic Provisioning pool contains one or more LDEVs in the parity group with accelerated compression enabled.	90%	Yes	No	Estimate the FMC capacity to be added, and then add the FMC capacity.
641xxx (Service)	In the Dynamic Tiering pool, the tier relocation operation is suspended by the system. This SIM can be displayed if "Notify an alert when tier relocation is	Not applicable	Yes	Yes	Determine why the tier relocation was suspended.

SIM code (SIM level)	Event	Thresholds or values	Types of reports		Solutions
			Sent to host?	User operations required?	
	suspended by system" is enabled on the "Edit Advanced System Settings" window.				
* xxx = hexadecimal pool number					

Managing pools and DP-VOLs

Observe the following cautions when working with pools.

Caution:

- In one pool, if you need to perform two or more operations to edit several items, wait until the first task has been applied before performing the next task. If the next task is performed while the first task is being applied, the first task is canceled and the next task is applied to the storage system.
- If you modified pool parameters by using Command Control Interface and then use Device Manager - Storage Navigator, click File > Refresh All to display the latest pool information before performing the next operation by using Device Manager - Storage Navigator. If you use Device Manager - Storage Navigator without refreshing the windows, the information updated by Command Control Interface might not yet be displayed on the Device Manager - Storage Navigator windows, so if you perform an operation the result might be different from what you expect.

Viewing pool information

Follow these steps to view pool information.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. View the pool information.

   For details about the window for pool information, see Pools window on page 551 and Pools: Volume tabs on page 559.

Viewing used pool capacity

The Storage Administrator (Provisioning) role is required to perform these tasks.

Viewing the used capacity for each pool

Procedure

1. View the used pool capacity of pools as they appear on the **Used** column in the **Pools** tab.

   For details about the window for pool information, see Pools window on page 551.

Viewing the used physical capacity for each pool

Procedure

1. View the used pool capacity of pools as they appear on the **Physical Capacity** column in the **Pools** tab.

   For details about the window for pool information, see Pools window on page 551.

Viewing the used pool capacity of a Thin Image root volume

Use this procedure to view the used pool capacity of a Thin Image root volume.

Procedure

1. Review the **Used Pool Capacity** listed in the **Root Volumes** table.

Viewing formatted pool capacity

Use this procedure to view the formatted pool capacity.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, click the row of a pool with the free pool capacity you want to check.
4. Click **More Actions** to select **View Pool Management Status**.

   The **View Pool Management Status** window appears.

Reasons to check pool capacity

The following are cases in which the free space of the pool is not formatted. In these cases, the free space of the pool may not increase:

- Pools other than the selected pool are being formatted.
- The pool usage level reaches up to the warning threshold or the depletion threshold.
- The selected pool is blocked.
- I/O loads to the storage system are high.
- The cache memory is blocked.
- Pool-VOLs in the selected pool are blocked.
- Pool-VOLs which are external volumes in the selected pool are blocked.
- Correction access executes to the pool-VOL in the selected pool.

Note: The following are cases in which the formatted pool capacity may decrease:

- New pages are being allocated.
- LDEV format is being performed on the pool-VOL.
- Correction copy is being executed.

Viewing the progress of rebalancing the usage level among parity groups

Use this procedure to view the progress of rebalancing the usage level among parity groups of a pool.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, click the row of a pool with you want to check the progress of rebalancing the usage level among parity groups.
4. Click **More Actions** to select **View Pool Management Status**.
   The **View Pool Management Status** window appears.

Note: The following are cases in which the progress ratio may not increase:

- The usage level is being rebalanced among the parity groups in pools other than the selected pool.
- Tier relocation is performed.

Increasing pool capacity

To increase the capacity of a pool, you add pool-VOLs to the pool.

Note:
- You cannot increase the pool capacity while the pool is being shrunk.
- When you add pool volumes with available monitoring information to a Dynamic Tiering pool, tier relocation is performed. When you add pool volumes without available monitoring information to a pool, the page usage rate is averaged in the tier.
- When you add pool volumes to a Dynamic Tiering pool, tier relocation activities that are in process are stopped.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool with the capacity you want to increase. You cannot increase pool capacity for multiple pools.
4. Click **Expand Pool**.
5. In the **Expand Pool** window, select the pool-VOL.
   a. Click **Select Pool VOLs**.
   b. In the **Select Pool VOLs** window, from the **Available Pool Volumes** table, select the pool-VOL you want to assign, and then click **Add**.

      The selected pool-VOLs are registered in the **Selected Pool Volumes** table.

      Up to 1024 volumes can be added including the volumes already in the pool. You can use the **Filter option** to choose volumes by parameter.

      Caution: For details about adding of LDEVs carved from accelerated compression-enabled parity groups, see Guidelines for pools when accelerated compression is enabled on page 417.

      Note: If necessary, perform the following steps:
      - From **Filter option**, select **ON** to filter the rows.
      - Click **Select All Pages** to select pool-VOLs in the table. To cancel the selection, click **Select All Pages** again.

- Click **Options** to specify the unit of volumes or the number of rows to be viewed.
- To set the tier rank of an external volume to a value other than **Middle**, select a tier rank from **External LDEV Tier Rank**, then click **Add**.
- For a pool, you can add volumes whose **Drive Type/RPM** settings are the same and whose RAID Levels are different. For example, you can add the following volumes to the same pool:
  Volume whose **Drive Type/RPM** is SAS/15K and whose **RAID Level** is 5 (3D+1P)
  Volume whose **Drive Type/RPM** is SAS/15K and whose **RAID Level** is 5 (7D+1P)
- When assigning a pool with DP-VOL enabled with full allocation, LDEVs cannot be added in the parity group with accelerated compression enabled.

c. Click **OK**.
   The **Select Pool VOLs** window closes. The number of the selected pool volumes appears in **Total Selected Pool Volumes**, and the total capacity of the selected pool-VOL appears in **Total Selected Capacity**.

6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing a pool name

Use this procedure to change a pool name.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool with the name you want to change.

4. Click **More Actions**, and then select **Edit Pools**.
5. In the **Edit Pools** window, in **Pool Name**, specify a name for this pool.
   a. In **Prefix**, type the characters that will become the fixed characters for the beginning of the pool name. The characters are case-sensitive.
   b. In **Initial Number**, type the initial number that will follow the prefix name.
6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling deduplication on an existing pool

When you enable deduplication on a pool, the deduplication system data volume (DSD volume) for the pool is created. You must enable deduplication on a pool before you can enable deduplication on DP-VOLs assigned to the pool.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The dedupe and compression license must be installed.
- A sufficient number of cache management devices must be available to create the deduplication system data volume. Each deduplication system data volume uses 14 cache management devices.
- The status of the pool must be Normal.
- Data Direct Mapping must be disabled.
- Multi-tier pool must be disabled.
- A sufficient number of LDEV IDs must be available.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** table, select the pool for which you want to change the deduplication setting.
4. Click **More Actions**, and select **Edit Pools**.
5. In the **Edit Pools** window, click **Deduplication** and then select **Enable**.
6. If you want to edit the assigned deduplication system data volume, click **Edit Deduplication System Data Volume**.
   The **Edit Deduplication System Data Volume** window opens.

7. If you want to change the deduplication system data volume options, click **Change Deduplication System Data Volume Options**. In the **Change Deduplication System Data Volume Options** window:
   a. If you want to change the LDEV name or LDEV ID of a deduplication system data volume, select the volume, and then click **Change Deduplication System Data Volume Options**.

      To change the LDEV name, specify the prefix characters and the initial number for the selected LDEV, and then click **OK**.

      To change the Initial LDEV ID, specify the number of LDKC, CU, LDEV, and Interval, and then click **OK**. To confirm the used LDEV IDs, click **View LDEV** IDs.
   b. When you are done changing the deduplication system data volume options, click **OK** in the **Change Deduplication System Data Volume Options** window.
8. Click **Finish** in the **Edit Pools** window.

   The **Confirm** window opens.
9. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
10. Click **Apply**.

    If **Go to tasks window for status** is selected, the **Tasks** window opens automatically.

Disabling deduplication on a pool

Use this procedure to disable the deduplication function on a pool.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- DP-VOLs with Deduplication and Compression enabled must not be assigned to the target pool.
- For the target pool, the value of Saving Effect > Deduplication (%) must be 0%.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. In the **Pools** table, select the pool for which you want to change the deduplication setting.
4. Click **More Actions**, and select **Edit Pools**.
5. In the **Edit Pools** window, click **Deduplication** and then select **Disable**.
6. Click **Finish**.

   The **Confirm** window appears.

7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Recovering a blocked pool

You can perform failure recovery of a blocked pool. Ordinarily, you should not need to use this procedure. A recovered pool can be used, but the former data is lost.
The recovery time for pools varies depending on pool usage or DP-VOL usage. Allow roughly 20 minutes of recovery time for every 100 TB of pool or DP-VOL usage. Recovery time may vary depending on the workload of the storage system at the time of recovery.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, select the pool to be recovered.
4. Click **More Actions**, and then select **Restore Pools**.
5. In the **Confirm** window, confirm the settings.
6. Enter a unique **Task Name** or accept the default.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Decrease pool capacity

About decreasing pool capacity

You can decrease pool capacity by deleting pool volumes.

When a pool-VOL is removed from a pool, all the used pages in the pool volume are moved to other pool volumes.

For the pool that owns DP-VOL with a disabled data direct mapping attribute, if a pool volume is released after the pool shrinking, the released pool volumes (LDEVs) will be blocked. If the pool volumes (LDEVs) are blocked, format them before using them.

If the blocked pool volume is an external volume, use Normal Format when formatting the volume.

If the pool volume being deleted is the external volume and is disconnected during deletion, reconnect the external volume and then retry deleting the pool volume.

You can decrease pool capacity for up to eight tasks at the same time. Do not issue a Command Control Interface command to decrease the capacity of a pool whose capacity is already in the process of being decreased.

You cannot decrease pool capacity while doing any of the following to a pool:

- Creating the pool
- Deleting the pool
- Increasing the pool
- Decreasing the pool
- Recovering the pool
- Stopping decreasing the pool
- Changing the threshold
- Reclaiming zero pages
- Creating DP-VOLs
- Increasing DP-VOL capacity

If the shrink pool operation has abnormally ended, it might be caused by one of the following:

- Maintenance of a cache memory is performed while the pool capacity is being reduced.
- Errors occur on a cache memory while the pool capacity is being reduced.
- The I/O load to DP-VOLs related to the pool is too high.
- DP-VOLs related to the pool are being blocked.

If the shrink pool operation has abnormally ended, perform one or more of the following operations:

- Restore a cache memory, and then perform the shrink pool operation again.
- When the I/Os load to DP-VOLs related to the pool is too low, perform the shrink pool operation again.
- Delete or format DP-VOLs related to the pool, and then perform the shrink pool operation again.

Note: You cannot perform the following operations on a pool while the pool volume capacity is in the process of shrinking. Wait until shrinking completes or stop the shrinking process.

- Expand Pool
- Shrink Pools
- Edit Pools
- Restore Pools

If you delete the pool volume with the pool's system area, the used capacity and the management area will move to other pool volumes. If you delete the pool volume with system area, a different system area pool volume will be assigned automatically according to the priority shown in the following table. A pool must include one or more pool volumes.

Priority	Data drive type
1	SAS7.2K
2	SAS10K
3	SAS15K
4	SSD
5	External volume

If multiple pool volumes of the same data drive type exist, the priority of each is determined by internal index of the storage system.

If pool capacity is decreased soon after creating a pool or adding a pool volume, processing may take a while to complete.

Notes on using Dynamic Provisioning

You cannot delete a pool volume under these conditions.

- If the pool volume is deleted, the total of the used pool capacity exceeds the pool threshold.
- If the pool volume is deleted, the subscription rate of the total DP-VOL capacity including the control information exceeds the subscription limit. For details about the formula used to calculate the required pages for one DP-VOL including the control information, see Pool subscription limit on page 258.
- If the pool volume with system area is deleted, more than 4.2 GB of free space is necessary in the pool.
- In the case that pool volumes assigned to the accelerated compression-enabled parity group are deleted, the pool volumes cannot be deleted if the used capacity reserved for writing (after the deletion of pool volumes) exceeds the threshold due to deleting pool volumes.
  The used capacity reserved for writing (after deleting pool volumes) is calculated as follows:
  Used capacity reserved for writing (after deleting pool volumes) = Used capacity reserved for writing (before deleting pool volumes) + Total used capacity of pool volumes to be deleted × FMC saving ratio
  The used capacity reserved for writing (after deleting pool volumes) is larger than the used capacity reserved for writing (before deleting pool volumes). Because data stored in pool volumes belonging to the accelerated compression-enabled parity group is migrated in the following parity groups due to the shrinking of pool:

- Parity group with accelerated compression is not supported (for instance, SAS drives)
- Parity group with accelerated compression is disabled

Notes on using Dynamic Tiering

- You cannot delete a pool volume under these conditions.
  - If the pool volume is deleted, the total of the used pool capacity of the pool volume exceeds the pool threshold.
  - If the pool volume is deleted, the subscription rate of the total DP-VOL capacity including the control information exceeds the subscription limit. For details about the formula used to calculate the required pages for one DP-VOL including the control information, see Pool subscription limit on page 258.
  - If the pool volume with system area is deleted, more than 4.2 GB of free space is necessary in the pool.
- When the pool volume is deleted, the pages contained in the deleted pool volume transfer to another pool volume in the same tier. If the used capacity in the tier exceeds Rate of Free Space Newly Allocated to, the overflowing pages transfer to another tier.
- When pool volumes in the tier are empty, the appropriate tier is deleted.
- Deleting the pool volume stops the tier relocation. The process resumes after the pool volume is deleted.

Notes on using Thin Image

You cannot delete a pool volume under these conditions.

- If the pool volume is deleted, the used capacity of the pool volume exceeds the pool threshold.
- If the pool volume with system area is deleted, more than 4.2 GB of free space is necessary in the pool.

Decreasing pool capacity

Use this procedure to decrease pool capacity.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Select the pool that contains the pool-VOLs to be deleted.
4. From the **Pool volumes**, select the pool-VOL to be deleted.
   You cannot delete pool-VOLs unless **Shrinkable** is applied.
5. Click **Shrink Pool**.

The **Shrink Pool** window opens.

The details of **Before Shrinking** and **After Shrinking**, including the pool capacity, the used pool capacity and the free pool capacity, appears in **Prediction of Shrinking**.

6. Click Finish.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Stopping the decrease of pool capacity

Use this procedure to stop the decrease of pool capacity.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools**, select the pool with the capacity you want to stop decreasing.
4. Click **Stop Shrinking Pools**.
5. Click **Finish**.

   The **Confirm** window appears.
6. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

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

Deleting a tier in a pool

You must delete all the pool-VOLs in the tier to be deleted. When pool-VOLs in the tier are empty, the appropriate tier is deleted.

If you delete a pool, its pool-VOLs (LDEVs) will be blocked. If they are blocked, format them before using them.

You cannot delete the pool-VOL when:

- Creating the pool.
- Deleting the pool.
- Increasing the pool capacity.
- Decreasing the pool capacity.
- Restoring the pool.
- Stopping decreasing the pool capacity.
- Changing the threshold.
- Initializing the pool capacity.
- Changing the external LDEV tier rank.

Notes on deleting a tier in a pool

You cannot delete a pool-VOL under these conditions.

- The used capacity of the pool-VOL would exceed the pool threshold if the pool-VOL were deleted.
- The subscription rate of the total V-VOL capacity including the control information would exceed the subscription limit if the pool-VOL were deleted. For details about the formula used to calculate the required pages for one DP-VOL including the control information, see Pool subscription limit on page 258.
- The pool-VOL with system area has less than 4.2 GB of free space. There must be 4.2 GB of free space in the pool in order to delete the pool-VOL with system area.

Deleting the pool-VOL stops the tier relocation. The process resumes after the pool-VOL is deleted.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Select the pool that contains the pool-VOLs to be deleted.
4. Select the **Pool volumes** tab and select all the pool-VOLs contained in the tier to be deleted.

   You cannot delete a pool-VOL unless **Shrinkable** has been applied.
5. Click **Shrink Pool**.
6. In the **Shrink Pool** window, verify the changes.

   The details of **Before Shrinking** and **After Shrinking**, including the pool capacity, the used pool capacity and the free pool capacity, appears in **Prediction of Shrinking**.

7. Click **Finish**.

   The **Confirm** window appears.
8. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Deleting a pool

Use this procedure to delete a pool.

For a pool that contains a DP-VOL with a disabled data direct mapping attribute, if pool-VOLs are released after the pool shrinking, the released pool-VOLs (LDEVs) will be blocked.

If the pool-VOLs are blocked, they must be formatted before they can be reused. If the blocked pool-VOL is an external volume, select Normal Format when formatting the volume. You can delete a pool only when all of the DP-VOLs have been deleted.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- No DP-VOLs other than the deduplication system data volume must be associated with the target pool.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, select the pool to be deleted.
4. Click **More Actions**, and then select **Delete Pools**.

   The **Delete Pools** window opens.
5. Click **Finish**.

   The **Confirm** window opens.

   To continue with the shredding operation and delete volume data, click **Next**. For details about the shredding operation, see the *Hitachi Volume Shredder User Guide.*

   If the pool is blocked, you might not be able to perform shredding operations.
6. In the **Task Name** text box, type a unique name for the task or accept the default.

You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

7. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Note: When the pool-VOLs of a pool are empty, the appropriate tier is deleted.

Changing external LDEV tier rank

Use this procedure to change the tier rank of an external LDEV.

Note: This operation cannot be performed in the following cases:
- The pool contains DP-VOLs with capacity saving enabled.
- The pool contains a deduplication system data volume.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pool volumes** table, select the pool-VOL that has the external LDEV tier rank you want to change.
   You cannot change the external LDEV tier rank of a pool-VOL if **External Volume** is not displayed in the **Drive Type/RPM** column.
4. Click **More Actions** and select **Edit External LDEV Tier Rank**.
5. From the **Selected Pool volumes** table, select the pool-VOL with the external LDEV tier rank you want to change.
6. Click **Change** and select the tier rank.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "date-window name" is entered by default.
9. In the **Confirm** window, click **Apply** to register the setting in the task.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Increasing DP-VOL capacity

Use this procedure to increase the capacity of a DP-VOL.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Select the pool associated with the DP-VOL that has the capacity that you want to increase.
4. Select the **Virtual Volumes** tab.
5. From the table, select the DP-VOL with the capacity you want to increase.
6. Click **Expand V-VOLs**.

   The **Expand V-VOLs** window opens. If the DP-VOL is selected from the **LDEV** table in the **Logical Devices** window, click **More Actions**, and then click **Expand V-VOLs**.
7. Select **Specify total capacity** or **Specify additional capacity**.
8. If you want to offset the specified LDEV capacity by boundary, change the default **Capacity Compatibility Mode (Offset boundary)** from **OFF** to **ON**.
9. In **Capacity**, type the capacity amount.

   Enter the LDEV capacity to two decimal places within the range of values indicated below the text box.
10. Click **Finish**.

    The **Confirm** window appears.
11. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
12. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing the name of a DP-VOL

Use this procedure to change the name of a DP-VOL.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.

3. In the **Pools** window, click the link of the **Pool Name** associated with the DP-VOL you want to rename.
4. Select the **Virtual Volumes** tab, click **More Actions**, and then **Edit LDEVs**.
5. Check **LDEV Name** and change the LDEV name, if necessary.
   a. In **Prefix**, type the characters that will become the fixed characters for the beginning of the LDEV name. The characters are case-sensitive.
   b. In **Initial Number**, type the initial number that will follow the prefix name.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

About releasing pages in a DP-VOL

Releasing pages in a DP-VOL frees up pool capacity. When a page in the DP-VOL contains zero data, the free capacity of a pool increases after the pages are released. You can reclaim zero pages on each V-VOL and then monitor the progress on the View Pool Management Status window. If you stop the reclaim zero pages operation, the zero pages that have already been reclaimed cannot be restored.

Logically, there is no difference between a page with zero data and the area of a DP-VOL without a page allotted. Both are effectively identical. However, a page with zero data uses pool capacity, whereas a DP-VOL without a page allotted does not use pool capacity.

Zero pages can be reclaimed when all the following conditions are satisfied:

- The DP-VOL is not used in conjunction with another storage system software product that does not support reclaiming zero pages.
  See Using Dynamic Provisioning or Dynamic Tiering or active flash with other software products on page 152.
- LDEV formatting is not being performed on the DP-VOL.
- The DP-VOL is not blocked.
- The DP-VOL does not have the data direct mapping attribute enabled.
- The DP-VOL is not a deduplication system data volume.
- The DP-VOL is associated with a pool.
- The pool associated with the DP-VOL is not blocked, or is full and blocked.
- The LUN path is not defined between DP-VOL and the host group enabled with host mode option 97.

Pages that include control cylinders are not processed when releasing pages in a DP-VOL.

Pages that include file system metadata cannot be reclaimed. Refer to Operating system and file system capacity on page 150 for a table of the Pool Capacity Consumed by the file system.

While releasing pages from a DP-VOL, performance of the host I/O to the DP-VOL may temporarily decrease due to scanning for non-zero data.

If you stop an operation to reclaim zero pages in mid-stream, the pages that have been released will remain as free pool capacity.

After an operation to reclaim zero pages, Dynamic Provisioning automatically balances usage levels among parity groups in the pool. This rebalancing is performed on parity groups related to the pool. If you do not want automatic balancing of the usage levels of parity groups, call the customer support to change your configuration.

Note: If an operation to reclaim zero pages performs on pools comprised of pool volumes assigned by parity groups with accelerated compression enabled, the capacity reserved for writing data may not be reduced in comparison with the reduced pool capacity.

Dynamic Provisioning does not automatically balance the usage levels among parity groups if the cache memory is not redundant or if the pool usage reaches the threshold.

If all the tracks that belong to a page assigned to a DP-VOL have no records written, you can reclaim the page and return it to the pool's available capacity.

Caution: In the following cases, an operation of the reclaim zero pages stops and DP-VOL pages might not be released.

- The pool-VOL accessed by the target DP-VOL is blocked.
- The pool associated with the target DP-VOL is blocked while the operation to reclaim zero pages is in progress.
- Cache memory failure occurs while the operation to reclaim zero pages is in progress.
- While the operation to reclaim zero pages is in progress, the initial copy operation of the TrueCopy pair, the Universal Replicator pair, the global-active device pair, or the ShadowImage pair is performed on the DP-VOL.
- The LUN path is defined between DP-VOL and the host group enabled with host mode option 97 while the operation to reclaim zero pages is in progress.

Releasing pages in a DP-VOL

You can reclaim pages in a DP-VOL to free pool capacity. If a page assigned to a DP-VOL contains only zero binary data, you can reclaim the page by

performing the operation to release zero pages. Reclaiming the page decreases the used capacity of the pool. Before releasing pages in a DP-VOL, see About releasing pages in a DP-VOL on page 283. If the operation to release zero pages is performed on V-VOLs enabled for full allocation, the used capacity of the pool is not changed before the operation to release zero pages is performed.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the table, select the **LDEV ID** of the volume with the pages you want to release.
4. Click **More Actions**, and then select **Reclaim Zero Pages**.
   The **Reclaim Zero Pages** window opens.

   You cannot release pages in a DP-VOL when the DP-VOL is not in a normal status or the DP-VOL is in the process of reclaiming zero pages.
5. Click **Finish**.
   The **Confirm** window appears.
6. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.
   After the operation to reclaim zero pages is complete, refresh the display to update the **Page Status**. If the **Page Status** is not immediately updated, wait a while, then refresh the display again.

Note: `Completed` is displayed as the **Page Status** even when no pages can be reclaimed.

If you have started the reclaiming zero pages operation, and the storage system is powered off the reclaiming zero pages operation will not automatically continue after the storage system restarts.

In any of the following cases, the reclaiming zero pages will stop, and DP-VOL pages will not be released:

- LDEV formatting was performed while reclaiming zero pages.

- The pool-VOL that is being accessed by the target DP-VOL was blocked.
- The pool associated with the target DP-VOL was blocked while reclaiming zero pages.
- Cache memory failure occurred while reclaiming zero pages.
- The DP-VOL was deleted when zero pages were reclaimed.
- The initial copy operation between the TrueCopy pair or the Universal Replicator pair was performed on the DP-VOL in which zero pages were being reclaimed.

Stopping the release of pages in a DP-VOL

Use this procedure to stop the release of pages in a DP-VOL.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Select the pool associated with the DP-VOL with pages you want to stop from being released.
4. Select the **Virtual Volumes** tab.
5. From the table, select the DP-VOL with pages you want to stop from being released.
6. Click **More Actions**, and then select **Stop Reclaiming Zero Pages**.
   The **Stop Reclaiming Zero Pages** window opens.

   You cannot stop releasing the pages in a DP-VOL in which zero pages are not being reclaimed.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing full allocation settings in DP-VOLs

Use the following procedure to change full allocation settings in DP-VOLs.

Caution: This operation cannot be performed on the following types of DP-VOLs:

- Deduplication system data volumes
- DP-VOLs with a capacity saving function enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click the link of the **Pool Name** associated with the volume that has settings that you want to change.
4. Select the **Virtual Volumes** tab, click **More Actions**, then **Edit LDEVs**.
   The **Edit LDEVs** window opens.
5. In the **Edit LDEVs** window, check **Full Allocation** and select **Enable** or **Disable**.
   - **Enable**: All pages of a DP-VOL are allocated to the current pool.
   - **Disable**: All pages of a DP-VOL might not be allocated to the current pool.

   Tip: If the pool of DP-VOL contains an LDEV enabled with accelerated compression in the parity group, the item of **Enable** is inactive.
6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling or disabling tier relocation of a DP-VOL

You can enable or disable tier relocation of individual DP-VOLs or on all DP-VOLs.

DP-VOLs on which tier relocation is disabled are excluded from the targets for the tier range calculation, and are not reflected in the performance information of pools. If tier relocation is disabled on all DP-VOLs in a pool,

performance information of a pool is unavailable in the **View Tier Properties** window.

Caution: This operation cannot be performed on the following types of DP-VOLs:

- Deduplication system data volumes
- DP-VOLs with a capacity saving function enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click the link of the **Pool Name** associated with the DP-VOL you want to rename.
4. Click the **Virtual Volumes** tab, select an LDEV ID, click **More Actions**, and then select **Edit LDEVs**.
5. In the **Edit LDEVs** window, check **tier relocation** and select **Enable** or **Disable**.

   Enable allows tier relocation to be performed to the DP-VOL.

   Disable does not allow tier relocation to be performed on the DP-VOL in the case of both automatic and manual tier relocation.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling capacity saving on DP-VOLs

Use this procedure to enable the capacity saving function (compression, or deduplication and compression) on an existing DP-VOL. If the DP-VOL is in a Dynamic Tiering pool with active flash enabled, you cannot enable the capacity saving function.

Requirements for enabling deduplication on a DP-VOL:

- The dedupe and compression license must be installed.
- The deduplication function must be enabled on the pool.
- The pool must not be blocked.

- A sufficient number of cache management devices must be available.
- The LDEV status of the DP-VOL must be Normal.
- The emulation type of the DP-VOL must be OPEN-V.
- The capacity saving status of the pool must not be Deleting Volume, Failed, or Rehydrating.
- Data Direct Mapping must be disabled.
- Full Allocation must be disabled.
- The DP-VOL must not be used as a Universal Replicator journal volume.

Caution: Do not use capacity saving and NAS deduplication on the same volumes, because the additional processing decreases the I/O performance substantially. For information about the NAS deduplication function, see the *File Services Administration Guide*.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane, select an LDEV ID, and click **Edit LDEVs**.
4. In the **Edit LDEVs** window, click **Capacity Saving**, and then select either **Compression** or **Deduplication and Compression**.

   Caution: If you enable **Deduplication and Compression** on a DP-VOL, you will not be able to change the setting from **Deduplication and Compression** to **Compression** later.

   Note:
   - If Deduplication is Not Available in the pool, **Deduplication and Compression** cannot be selected.
   - If the LDEV status of a deduplication system data volume in the pool is other than Normal, **Deduplication and Compression** cannot be selected.

5. Click **Finish**. The **Confirm** window appears.
6. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Disabling the capacity saving functions on DP-VOLs

When you disable the capacity saving setting, both the used capacity of the pool and the physical used capacity of the pool increase due to the process of expanding the data (rehydration). Do not disable the capacity saving function on DP-VOLs when pool capacity is depleted.

Use the following formulas to calculate what the used capacity and physical used capacity of the pool will be after the expanding process completes:

pool-used-capacity-size-after-expanding =
used-pool-capacity-size + (*used-DP-VOL-capacity* × *saving-ratio-of-the-pool-[%]*)

physical-pool-used-capacity-size-after-expanding =
*used-physical-pool-capacity-size** + (*used-DP-VOL-capacity* × *saving-ratio-of-the-pool-[%]*)

* If accelerated compression is used, you must confirm the physical used capacity of the pool.

Device Manager - Storage Navigator displays this information as follows:

- *used-pool-capacity-size*: Displayed as Capacity - Used on the Pools window.
- *used-physical-pool-capacity-size*: Displayed as Physical Capacity - Used on the Pools window.
- *saving-ratio-of-the-pool-[%]*: Displayed as Pool Saving (Post Process Data) - Saving (%) on the Pools window.
- *used-DP-VOL-capacity*: Displayed as Capacity - Used on the Virtual Volumes tab of each pool window.

Caution:

- The expanding process is suspended when the size of the used capacity or physical used capacity of a pool reaches the depletion threshold. If this occurs, you must resolve the causes of the SIM message. When enough pool capacity is ensured, the expanding process will start again.
- If the SVP or a Device Manager - Storage Navigator secondary window is in Modify mode while the rehydration processing of the capacity-saving-enabled DP-VOLs is in progress, a conflict occurs and the rehydration processing does not complete (Capacity Saving Status remains Rehydrating). In this case, change the SVP or secondary window to View mode.

Note: Disabling the capacity saving setting for DP-VOLs with deduplication and compression enabled might take a while to complete. After the

processing to disable the setting has started, it cannot be stopped. I/Os can be received during rehydration (Rehydrating status).

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The status of the pool must be other than Blocked by pool failure.
- The Capacity Saving status must be other than Deleting Volume or Failed.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane, select the desired LDEV ID, and click **Edit LDEVs**.
4. In the **Edit LDEVs** window, click **Capacity Saving**, and select **Disabled**.

   Note: If the LDEV status of the deduplication system data volume in the pool is other than Normal, you cannot change the setting from **Deduplication and Compression** to **Disabled**.

5. Click **Finish**. The **Confirm** window appears.
6. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

   If **Go to tasks window for status** is selected, the **Tasks** window opens automatically.

Deleting a DP-VOL

Use this procedure to delete a DP-VOL.

Note:

- You cannot delete a deduplication system data volume (DSD volume). The deduplication system data volume for a pool is deleted automatically when you disable the Capacity Saving setting for the pool or delete the pool.
- You cannot delete a DP-VOL if the status is online.
- If you are deleting a DP-VOL with Deduplication and Compression enabled, you must first disable Deduplication and Compression on the DP-VOL before beginning this procedure.
- If you are deleting DP-VOLs for which capacity saving is enabled, you can delete the DP-VOLs, or you can block and format the DP-VOLs and then

delete them. The total time to delete DP-VOLs for each method is approximately the same.
- Deleting DP-VOLs with deduplication and compression enabled might take a while to complete. Also, the pool usage might increase by the deleting processing. Once the deletion processing starts, it cannot be stopped.
- If you want to delete all DP-VOLs in a pool that have the capacity saving setting enabled, first block all DP-VOLs with the capacity saving enabled and the deduplication system data volume, and then format the deduplication system data volume. This procedure can reduce the DP-VOL format processing time and prevent the increase in pool usage.
- After you delete a DP-VOL for which capacity saving is enabled, if you perform other operations during or just after the DP-VOL deleting processing, those operations might fail. If this occurs, wait for a while, and then retry those operations.
- The LDEV deleting process is suspended when the size of the used capacity or physical used capacity of a pool reaches the depletion threshold. If this occurs, you must resolve the causes of the SIM message. When enough pool capacity is ensured, the deleting process will start again.

Caution: If the SVP or a Device Manager - Storage Navigator secondary window is in Modify mode while the rehydration processing of the capacity-saving-enabled DP-VOLs is in progress, a conflict occurs and the rehydration processing does not complete (Capacity Saving Status remains Rehydrating). In this case, change the SVP or secondary window to View mode.

Before you begin
- The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Select the associated row with the DP-VOL to be deleted.
4. Select the **Virtual Volumes** tab.
5. From the table, select the DP-VOL to be deleted.
   Do the following, if necessary.
   - In the **Filter** option, select **ON** to filter the rows.
   - Click **Select All Pages** to select all DP-VOLs in the list.
   - Click **Options** to specify the unit of volumes or the number of rows to view.
6. Click **More Actions**, and then select **Delete LDEVs**.
   The **Delete LDEVs** window opens.
7. Click **Finish**.
   The **Confirm** window appears.

8. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

9. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Deleting all capacity saving-enabled DP-VOLs in a pool

When a deduplication system data volume is assigned to a pool, use this workflow to delete all of the capacity saving-enabled DP-VOLs in the pool. If the pool does not have a deduplication system data volume, you must use the delete DP-VOL procedure.

This operation formats DP-VOLs. Its execution time is increased by one minute per total capacity 40TB of all DP-VOLs whose Deduplication Data status is Enabled.

```
Execution time = 5 [min.] + ceil(Total capacity [TB] ÷ 40 [TB])
```

For example, when the total capacity is 100 TB, the execution time is calculated as follows:

```
5 + ceil(100/40) = 5 + ceil(2.5) = 8[min.]
```

1. Block all of the following volumes that are allocated to the target pool using the **Block LDEVs** window. For instructions, see Blocking LDEVs on page 128.
   - All of the DP-VOLs whose Deduplication Data status is Enabled.
   - The deduplication system data volume for the pool.
2. Format the (blocked) deduplication system data volume using the **Format LDEVs** window. Make sure to specify only the single deduplication system data volume for the target pool. For instructions, see Formatting a specific LDEV on page 134.
3. Format all of the (blocked) DP-VOLs whose Deduplication Data status is Enabled in the pool using the **Format LDEVs** window. For instructions, see Formatting a specific LDEV on page 134.

   Note: The formatting operations for DP-VOLs whose Deduplication Data status is Enabled might take a lot of time.

4. Delete all of the (formatted) DP-VOLs whose Deduplication Data status is Enabled in the pool.

   You cannot delete a deduplication system data volume (DSD volume). The deduplication system data volume for a pool is deleted automatically when you disable the Capacity Saving setting for the pool or delete the pool.

Starting pool monitoring manually

Use this procedure to start pool monitoring manually.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click the row of a pool you want to start monitoring.
4. Click **More Actions**, and then select **Monitor Pools**.
5. In the **Task Name** text box of the **Monitor Pools** window, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "date-window name" is entered by default.
6. Click **Apply** to register the setting in the task.

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

Stopping pool monitoring manually

Use this procedure to stop pool monitoring manually.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools** table, click the row of a pool you want to stop monitoring.
4. Click **More Actions** to select **Stop Monitoring Pools**.
5. In the **Task Name** text box of the **Stop Monitoring Pools** window, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "date-window name" is entered by default.
6. Click **Apply** to register the setting in the task.

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

Starting tier relocation manually

Use this procedure to start tier relocation manually.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. On the **Pools** tab, click the row of a pool you want to start monitoring.
4. Click **More Actions** and select **Start Tier Relocation**.
5. In the **Task Name** text box of the **Start Tier Relocation** window, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "date-window name" is entered by default.
6. In the **Start Tier Relocation** window, click **Apply** to register the setting in the task.

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

Stopping tier relocation manually

Use this procedure to stop tier relocation manually.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. From the **Pools**, click the row of a pool you want to start monitoring.
4. Click **More Actions** to select **Stop Tier Relocation**.

   The **Stop Tier Relocation** window appears.
5. In the **Task Name** text box of the **Stop Tier Relocation** window, enter the task name.

   You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "date-window name" is entered by default.
6. In the **Stop Tier Relocation** window, click **Apply** to register the setting in the task.

If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling data direct mapping for external volumes, pools, and DP-VOLs

Creating external volumes with data direct mapping enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
4. In the **Create LDEVs** window, from the **Provisioning Type** list, select **External** as a provisioning type for the LDEV to be created.
5. In **Data Direct Mapping**, select **Enable**.
6. Click **Select Free Spaces**.
7. In the **Select Free Spaces** window, in the **Available Free Spaces** table, select the free space to be assigned to the volumes. Do the following, if necessary:
   - To specify the conditions and show the free space, click **Filter**, specify the conditions, and then click **Apply**.
   - To specify the unit for capacity and the number of rows to view, click **Options**.
8. Click **View Physical Location**.
9. In the **View Physical Location** window, confirm where the selected free space is physically located, and then click **Close**.
10. In the **Select Free Spaces** window, if the selected free spaces have no issues, click **OK**.
11. In the **Number of LDEVs per External Volume**, confirm that 1 is displayed.
12. In **LDEV Name**, specify a name for this LDEV.
    a. In **Prefix**, type the characters that will become the fixed characters for the beginning of the LDEV name. The characters are case-sensitive.
    b. In **Initial Number**, type the initial number that will follow the prefix name.
13. In **Format Type**, select the format type for the LDEV from the list.

    For an external volume, if you create the LDEV whose emulation type is the open system, select **Normal Format** or **No Format**.

If the external volume can be used as it is, select **No Format**. The created LDEV can be used without formatting.

If the external volume needs to be formatted, select **No Format** and then format the volume with the external storage system, or select **Normal Format**.

14. Click **Options** to show more options.
15. In **Initial LDEV ID**, make sure that an LDEV ID is set. To confirm the used number and unavailable number, click **View LDEV IDs** to open the **View LDEV IDs** window.
    a. In **Initial LDEV ID** in the **Create LDEVs** window, click **View LDEV IDs**. In the **View LDEV IDs** window, the matrix vertical scale represents the second-to-last digit of the LDEV number, and the horizontal scale represents the last digit of the LDEV number. The LDEV IDs table shows the available, used, and disabled LDEV IDs. In the table, used LDEV numbers appear in blue, unavailable numbers appear in gray, and unused numbers appear in white. LDEV numbers that are unavailable may be already in use, or already assigned to another emulation group (group by 32 LDEV numbers).
    b. Click **Close**.
16. In the **Create LDEVs** window, from the **MP Unit ID** list, select a MP unit to be used by the LDEVs.
    - If you assign a specific MP unit, select the ID of the MP unit.
    - If you can assign any MP unit, click **Auto**.
17. Click **Add**.

    The created LDEVs are added to the **Selected LDEVs** table.

    If these required items are not registered, you cannot click **Add**.
18. If necessary, change the following LDEV settings:
    a. Click **Change LDEV Settings** to open the **Change LDEV Settings** window.
19. If necessary, delete an LDEV from the **Selected LDEVs** table. Select an LDEV to delete, and then click **Remove**.
20. Click **Finish**. The **Confirm** window appears.

    To continue the operation for setting the LU path and defining a logical unit, click **Next**.
21. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
22. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Creating pools with data direct mapping enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. Click **Create Pools**.
4. From the **Pool Type** list, select **Dynamic Provisioning**.
5. From the **Multi-Tier Pool** field, select **Disable**.
6. From the **Data Direct Mapping** field, select **Enable**.
7. Follow the steps below to select pool-VOLs.
   a. From the **Drive Type/RPM** list, select a data drive type and RPM.
   b. From the **RAID Level** list, select RAID level.

      If you select **External Storage** from the **Drive Type/RPM** list, a hyphen (-) appears and you cannot select the RAID level.
   c. Click **Select Pool VOLs**.

      The **Select Pool VOLs** window appears.
   d. In the **Available Pool Volumes** table, select the pool-VOL row to be associated with a pool, then click **Add**.

      Select one or more volumes to use as pool-VOLs with system area. For the attribute of the volume, which can be used as the pool-VOLs with system area, a hyphen(-) appears in the **Attribute** column. In addition, the external volume of the data direct mapping attribute can be selected as an option. For the attribute of the external volume of the data direct mapping attribute, **Data Direct Mapping** appears in the **Attribute** column. After creating the pool, you can also add the external volume of the data direct mapping attribute.

      You can select a value other than **Middle** from **External LDEV Tier Rank** and click **Add** to set another tier rank for an external volume.

      The selected pool-VOL is registered in the **Selected Pool Volumes** table. Up to 1,024 volumes can be added to a pool.

      If LDEVs in an accelerated compression enabled parity group are used as pool-VOLs, these LDEVs can be assigned to only one pool. LDEVs in an accelerated compression enabled parity group cannot be assigned to multiple pools as pool-VOLs.

Tip: Perform the following steps if necessary:

- Click **Filter** to open the menu, specify the filtering conditions, and click **Apply**.

- Click **Select All Pages** to select all pool-VOLs in the table. To cancel the selection, click **Select All Pages** again.

e. Click **OK**.

The information in the **Selected Pool Volumes** table is applied to **Total Selected Pool Volumes** and **Total Selected Capacity**.

8. Enter the name in the **Pool Name** text box.
9. Click **Options**.
10. In the **Initial Pool ID** text box, type the number of the initial pool ID, from 0 to 127. When you specify a pool ID that was previously registered, the smallest available ID is displayed by default instead of the value you entered. If a pool ID unavailable, no number is displayed.
11. In the **Subscription Limit** text box, enter an integer value from 0 to 65534 as the subscription rate (%) for the pool.

    If no number is entered, the subscription rate is set to unlimited.
12. In **Protect V-VOLs when I/O fails to Blocked Pool VOL**, select **Yes** or **No**. If **Yes** is selected, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.
13. In **Protect V-VOLs when I/O fails to Full Pool**, select **Yes** or **No**. If **Yes** is selected, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute.
14. Click **Add**.

    The created pool is added to the **Selected Pools** table. If invalid values are set, an error message appears.

    The **Pool Type**, **Pool Volume Selection**, and **Pool Name** must be set. If the required items are not entered or selected, you cannot click **Add**.

    If you select a row and click **Detail**, the **Pool Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.
15. Click **Next**.

    The **Create LDEVs** window appears.

    If **Subscription Limit** of the created pool is set to 0%, the **Create LDEVs** window does not appear.
16. Click **Finish** and the **Confirmation** window appears.
17. Check the settings in the **Confirmation** window, and then enter the task name in **Task Name**. Select the pool radio button and then click **Details**. The Pool Properties window appears.
18. Click **Apply**

    The tasks are registered. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Creating DP-VOLs with data direct mapping enabled

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
4. In the **Create LDEVs** window, from the **Provisioning Type** list, select Dynamic Provisioning.
5. From the **Data Direct Mapping** field, select **Enable**.
6. From the Multi-Tier Pool field, select **Disable**.
7. From the **Available Volumes** table, select LDEV.
8. In the **LDEV Name** text box, enter the DP-VOL name.

   In the **Prefix** text box, enter the alphanumeric characters, which are fixed characters of the head of the DP-VOL name. The characters are case-sensitive.

   In the Initial Number text box, type the initial number following the prefix name, which can be up to 9 digits.

   You can enter up to the 32 characters including the initial number.
9. Click **Option**.
10. In the **Initial LDEV ID** field, make sure that LDEV ID is set.

    To confirm the used number and unavailable number, click **View LDEV IDs** to display the **View LDEV IDs** window.

    In the table, used LDEV numbers appear in blue, unavailable numbers appear in gray, and unused numbers appear in white. LDEV numbers that are unavailable may be already in use, or already assigned to another emulation group (group by 32 LDEV numbers).
11. From the **Cache Partition** list, select CLPR.
12. From the **MP Unit** list, select an MP unit.

    Select an MP unit to be used by the LDEVs. If you assign a specific MP unit, select the ID of the MP unit. If you can assign any MP unit, click **Auto**.
13. If necessary, change the settings of the V-VOLs.
    - Click **Change LDEV Settings** to open the **Change LDEV Settings** window.
14. If necessary, delete a row from the **Selected LDEVs** table.

    Select a row to be deleted, then click **Remove**.
15. Click **Add**.

    The created V-VOLs are added to the correct **Selected LDEVs** table. If invalid values are set, an error message appears: The **Provisioning**

Type, **Pool Selection**, **Drive Type/RPM**, **RAID Level**, **LDEV Capacity**, and **Number of LDEVs** fields must be set. If these required items are not registered, you cannot click **Add**.

16. Click **Finish**.

    The **Confirm** window appears. To continue the operation for setting the LU path and define LUN, click **Next**.

17. In the **Task Name** in the text box, enter the task name.

    You can enter up to 32 ASCII characters and symbols in all, except for \ / : , ; * ? " < > |. "yymmdd-window name" is entered as a default.

18. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Enabling and disabling the data direct mapping attribute for a pool

Use this procedure to enable or disable data direct mapping on an existing pool.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Pools**.
3. If you are enabling data direct mapping on a Dynamic Tiering or active flash pool, first enable the **Multi-Tier Pool** option on the pool and apply the setting to the storage system, and then continue with this procedure.
4. From the **Pools** table, select the pool for which you want to change the data direct mapping attribute.
5. Click **More Actions**, and then select **Edit Pools**.
6. Select **Data Direct Mapping**, and then select **Enable** or **Disable**.
7. Click **Finish**.

   The **Confirm** window opens.

8. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

6

Protecting volumes using Data Retention Utility

After provisioning your system, you can assign access attributes to open-system volumes to protect the volumes against read, write, and copy operations and to prevent users from configuring LU paths and command devices. Data Retention Utility software is required to assign access attributes to volumes.

About access attributes

Open-systems volumes, by default, are subject to read and write operations by open-systems hosts. With open-system volumes in this default condition, data might be damaged or lost if an open-systems host performs erroneous write operations. In addition, confidential data on open-systems volumes might be stolen if a malicious operator performs read operations on open-systems hosts.

Therefore, it is recommended that you change the default read and write conditions by assigning an access attribute to each logical volume. Access attributes can be set to read/write, read-only, or protect.

By assigning access attributes, you can:

- Protect a volume against both read and write operations of all hosts.
- Protect a volume against write operations of all hosts, but allow read operations.
- Protect a volume against erroneous copy operations, but allow other write operations.
- Prevent other users from configuring LU paths and command devices.

One of the following access attributes can be assigned to each logical volume:

- Read/write
  If a logical volume has the read/write attribute, open-systems hosts can perform both read and write operations on the logical volume.
  You can use replication software to copy data to logical volumes that have read/write attribute. However, if necessary, you can prevent copying data to logical volumes that have read/write attribute.
  All open-systems volumes have the read/write attribute by default.
- Read-only
  If a logical volume has the read-only access attribute, open-systems hosts can perform read operations but cannot perform write operations on the logical volume.
- Protect
  If a logical volume has the protect access attribute, open-systems hosts cannot access the logical volume. Open-systems hosts cannot perform either read nor write operations on the logical volume.

Access attribute requirements

To assign access attributes, the Hitachi Data Retention Utility software must be installed.

The Hitachi Data Retention Utility software performs on the secondary window of Hitachi Device Manager - Storage Navigator. For details about the setting for the secondary window, see the *System Administrator Guide*.

Access attributes and permitted operations

Access Attribute	Read Operations from Hosts	Write Operations from Hosts	Specified as P-VOL	Specified as S-VOL
Read/Write	Yes	Yes	Yes	Yes
Read-only	Yes	No	Depends on the replication software	No
Protect	No	No	Depends on the replication software	No
Read/Write and S-VOL disable	Yes	Yes	Yes	No

Access attribute restrictions

Some restrictions apply when you use the following VSP G200, G400, G600, G800 or VSP F400, F600, F800 products or functions on a volume that has an access attribute assigned to it.

Virtual LUN

- You cannot convert into spaces volumes that do not have the read/write attribute.
- You cannot initialize customized volumes that do not have the read/write attribute.

Command Control Interface

- You can use Command Control Interface to make some Data Retention Utility settings. You can view some of the CCI settings in the Data Retention Utility user interface.
- When viewing the **Data Retention** window, another user might be using CCI to change an access attribute of a volume. If the CCI user changes an access attribute of a volume when you are viewing the **Data Retention** window, you will be unable to change the access attribute of the volume by using Data Retention Utility. If you attempt to change the access attribute of the volume by using the Data Retention Utility, an error occurs. If the error occurs, refresh the display, then retry changing the access attribute of the volume.

Automatically started software

If any software that can start automatically is enabled, you must do one of the following:

- Perform Data Retention Utility operations when the program is not running.
- Cancel the setting of the program start time.

Some software is likely to start automatically at the time specified by the user. For example, if a Volume Migration user or a Performance Monitoring user specifies the time for starting the monitor, the monitor will automatically start at the specified time.

Access attributes workflow

Access attribute workflow includes the following steps:

1. Changing an access attribute to read-only or protect on page 307
2. Changing an access attribute to read/write on page 308
3. Enabling or disabling the expiration lock on page 309
4. Disabling an S-VOL on page 310
5. Reserving volumes on page 311

Assigning an access attribute to a volume

If you want to protect volumes against both read and write operations from hosts, change the access attribute to protect. To protect volumes against write operations from hosts and allow read operations, change the access attribute to read-only. In both ways, if you set the attribute to a volume using the GUI, S-VOL Disable is automatically set to prevent data in a volume from being overwritten by replication software. If you use Command Control Interface to set the attribute to a volume, you can select whether the S-VOL Disable is set or not. If you set the Protect attribute to the volume when the Dynamic Provisioning pool is full, the S-VOL Disable is not set to the volume.

After you change an access attribute to read-only or protect, the access attribute cannot be changed to read/write for a certain period of time. You can specify the length of this period (retention term) when changing the access attribute to read-only or protect. The retention term can be extended but cannot be shortened.

During the retention term

- Read-only access can be changed to protect or protect can be changed to read-only.
- If you need to change an access attribute to read/write, you must ask the maintenance personnel to do so.

After the retention term is over

- The access attribute can be changed to read/write.
- The access attribute remains read-only or protect until changed back to read/write.

Changing an access attribute to read-only or protect

When changing an access attribute to read-only or protect, observe the following:

- Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. Select Modify from the **Data Retention** secondary window to set access attributes and prevent other users or programs from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.
- Do not assign an access attribute to a volume if any job is manipulating data on the volume. If you assign an access attribute to such a volume, the job will possibly end abnormally.
- The volume must not be one of the following:
  - Volumes that do not exist
  - Volumes that are configured as command devices
  - TrueCopy secondary volumes*
  - Universal Replicator secondary volumes* or journal volumes
  - ShadowImage secondary volumes*
  - Thin Image secondary volumes*
  - Pool volume
  - Thin Image virtual volume
  - Volume assigned by the accelerated compression-enabled parity group
  - In a configuration that has a NAS module installed, volumes that are used from the NAS module.

  *Note: The access attribute of secondary volumes may be changed depending on the pair status.

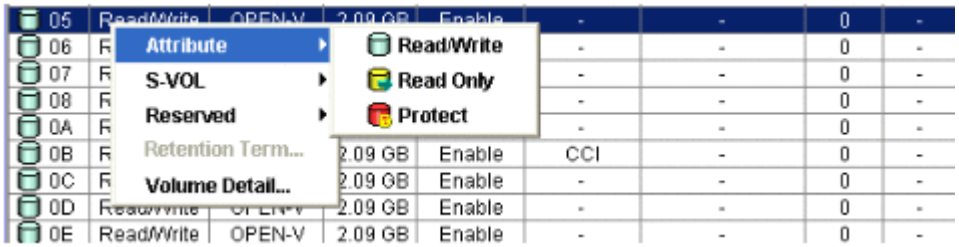
Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click  to change to **Modify** mode.
2. Select an LDKC number in the **LDKC** list, select a group that the CU belongs in the **CU Group** list, then click a CU in the tree.
3. Right-click a volume whose access attribute you want to change. You may select multiple volumes.

4. Click **Attribute**, and then select **Read Only** or **Protect**.



5. In the **Term Setting** dialog box, specify the retention term. During this period, the access attribute cannot be changed to read/write. You can enter the number of years and days, or select **Unlimited**. The retention term can be extended but cannot be shortened.
   - years: Specify the number of years within the range of 0 to 60. One year is counted as 365 days, whether the year is a leap year.
   - days: Specify the number of days within the range of 0 to 21900.

   For example, if 10 years 5 days or 0 years 3655 days is specified, the access attribute of the volume cannot be changed to read/write in the next 3,655 days.
6. Click **OK** to close the dialog box.
7. In the **Data Retention** window, click **Apply** to apply the setting.

   To extend the retention term later, open the **Data Retention** window, right-click the volume, and then select **Retention Term**.

Changing an access attribute to read/write

Before changing the access attribute from read-only or protect to read/write, considering the following:

- Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. Select Modify from the **Data Retention** secondary window to set access attributes and prevent other users or programs from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.
- Do not assign an access attribute to a volume if any job is manipulating data on the volume. If you assign an access attribute to such a volume, the job will possibly end abnormally.
- Make sure that the retention term is expired. If expired, the Retention Term column in the **Data Retention** window shows 0. To change the access attribute to read/write within the retention term, contact customer support.
- Make sure that Expiration Lock indicates Disable > Enable. If it indicates Enable > Disable, changing to read/write is restricted by an administrator for some reason. Contact the administrator of your system to ask if you

can change the access attribute. For details, see the *Provisioning Guide* for your storage system.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click  to change to **Modify** mode.
2. Select an LDKC number in the **LDKC** list, select a group in which the CU belongs in the **CU Group** list, then click a CU in the tree.
3. Right-click a volume for which you want to change access attributes. You may select multiple volumes, select **Attribute**, then click **Read/Write**.
4. Click **Apply** to apply the setting.

Related tasks

- Enabling or disabling the expiration lock on page 309

Enabling or disabling the expiration lock

The expiration lock provides enhanced volume protection. Enabling the expiration lock ensures that read-only volumes and protect volumes cannot be changed to read/write volumes, even after the retention term ends. Disabling the expiration lock changes the access attribute to read/write after the retention term ends. This setting applies to all volumes in the storage system with the read-only and protect attribute.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Data Retention** secondary window to enable or disable the expiration lock, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Before you begin
The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click  to change to **Modify** mode.
2. In the **Data Retention** window, verify which button appears beside **Expiration Lock**.
   - If **Disable > Enable** appears, go to the next step.

- If **Enable > Disable** appears, expiration lock is already enabled. You do not need to follow the rest of this procedure because attempts to change access attribute to read/write are already prohibited.

3. Click **Disable > Enable**. A confirmation message appears.
4. Click **OK**. The button changes to **Enable > Disable**, and the expiration lock is enabled.

   When the expiration lock is enabled, the access attributes of volumes cannot be changed to read/write even after the retention term ends.

   To disable the expiration lock, click **Enable > Disable**. The access attribute can then be changed to read/write after the retention term ends.

Disabling an S-VOL

Assigning a read-only or protect attribute is one of the ways to prevent data in a volume from being overwritten by replication software. Volumes having the read-only or protect attribute are not only protected against these copy operations, but are also protected against any other form of write operations.

To protect a volume only from copy operations, you must ensure that the volume has the read/write attribute then assign the S-VOL Disable attribute to the volume. This setting prohibits the volume from being used as a secondary volume for copy operations.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Data Retention** secondary window to disable an S-VOL, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The volume is other than the volume assigned by the accelerated compression-enabled parity group

Procedure

1. Click  to change to **Modify** mode.
2. Select an LDKC number in the **LDKC** list, select a group that the CU belongs in the **CU Group** list, and then click a CU in the tree.

3. Right-click a volume for which the **S-VOL** column shows **Enable**. You may select multiple volumes.
4. Select **S-VOL > Disable**.
5. Click **Apply** to apply the setting.

   To use a volume as an S-VOL, ensure that the volume has the read/write attribute then assign the S-VOL Enable attribute to the volume.

Reserving volumes

By default, all Hitachi Device Manager - Storage Navigator users with proper permissions can make LU path settings and command device settings. If you perform the following procedure in Hitachi Device Manager - Storage Navigator, all users, including yourself, will not be allowed to make LU path settings and command device settings on the specified volume. Command Control Interface users can still make LU path settings and command device settings on the volume.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Data Retention** secondary window to disable an S-VOL, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The volume is other than the volume assigned by the accelerated compression-enabled parity group

Procedure

1. Click  to change to **Modify** mode.
2. In the **Data Retention** window, select an LDKC number in the **LDKC** list, select a group that the CU belongs in the **CU Group** list, and then click a CU in the tree.
3. Select a volume where the **Reserved** column contains a hyphen. You may select multiple volumes.
4. Right-click the selected volume or volumes, and then select **Reserved > Set**.
5. Click **Apply** to apply the setting.

   To permit users to make LU path settings and command device settings on a volume, follow the steps above and select **Reserved > Release**. Then call customer support to ask for Storage Navigator settings.

Troubleshooting for Data Retention Utility

The following table provides troubleshooting information for Data Retention Utility.

Problems	Probable cause and solution
The Disable/ Enable or the Enable/Disable button on the **Data Retention** window is unavailable. Nothing happens when you click the button.	You have been making changes in the **Data Retention** window, but the changes have not been applied to the storage system. Apply the changes first, and then perform the extension lock operation. You can find the changes by: • Scrolling the current list up and down. • Selecting another CU from the tree and then scrolling the list up and down.
Open-systems hosts cannot read from or write to a volume.	• The volume is protected by the read-only attribute. Write failure is reported as an error message. • The volume is protected by the Protect attribute. Read (or write) failure is reported as an error message.
The number of days in Retention Term does not decrease	The number of days in Retention Term is calculated based on the operating time of the storage system. Therefore, the number of days in Retention Term might not decrease.

7

Managing logical volumes

After provisioning your system, you can begin to manage open-system logical volumes. Managing logical volumes includes tasks such as configuring hosts and ports, configuring LU paths, setting LUN security on ports, and setting up Fibre Channel authentication. LUN Manager is required to manage logical volumes.

- Adding CHAP users
- Editing CHAP users
- Removing CHAP users
- Removing target CHAP users
- Removing port CHAP users

LUN Manager overview

LUN Manager Function

Fibre security control and host group (Fibre Channel interface), or iSCSI security control and target (iSCSI interface).

- The Fibre security control function controls the access from specific hosts or specific commands.
- The host group function also enables the storage system to make a suitable response to each host connected, even within the same port, by grouping connected hosts within a port and setting the logical unit mapping and the host connection mode for each host group. Up to 255 host groups on a port basis can be set.
- The iSCSI security function controls the access from specified hosts or specific commands.
- The iSCSI target function enables the storage system to respond to each connected host, even within the same port, by grouping the connected hosts within a port and setting LUs and the host option mode for each group. Up to 255 iSCSI targets can be set for one port. Authentication can be performed for each target by using the CHAP authentication concurrently.

LUN Manager operations

The VSP G200, G400, G600, G800 and VSP F400, F600, F800 storage systems can be connected to open-system server hosts of different platforms (for example, UNIX servers and PC servers). To configure your storage system for operation with open-system hosts, use LUN Manager to configure logical volumes and ports.

One of the important tasks when configuring logical volumes is to define I/O paths from hosts to logical volumes. When paths are defined, the hosts can send commands and data to the logical volumes and can receive data from the logical volumes.

After the system begins operating, you might need to modify the system configuration. For example, if hosts or drives are added, you will need to add new I/O paths. You can modify the system configuration using LUN Manager when the system is running. You do not need to restart the system after modifying the system configuration.

Fibre Channel operations

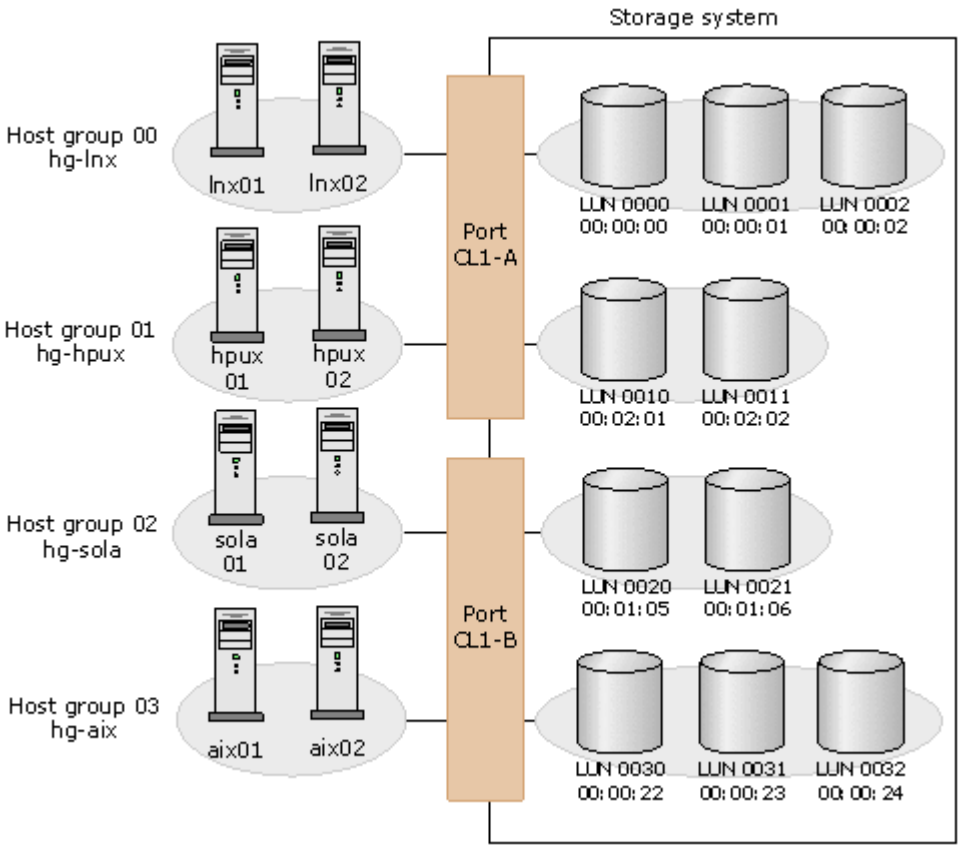
After open-system hosts and the storage system are physically connected by cables, hubs, and so on, use LUN Manager to establish I/O paths between the hosts and the logical volumes. This defines which host can access which

logical volume. Logical volumes that can be accessed by open-system hosts are referred to as logical units (LUs). The paths between the open-system hosts and the LUs are referred to as LU paths.

Before defining LU paths, you must classify server hosts by host groups. For example, if Linux hosts and Windows hosts are connected to the storage system, you must create one host group for the Linux hosts and another host group for the Windows hosts. Then, you must register the host bus adapters of the Linux hosts in the Linux host group. You must also register the host bus adapters of the Windows hosts in the `windows` host group.

A host group can contain only those hosts that are connected to the same port, and cannot contain hosts that are connected to different ports. For example, if two Windows hosts are connected to port 1A and three Windows hosts are connected to port 1B, you cannot register all five Windows hosts in one host group. You must register the first two Windows hosts in one host group, and then register the remaining three Windows hosts in another host group.

After server hosts are classified into host groups, you associate the host groups with logical volumes. The following figure illustrates LU paths configuration in a Fibre Channel environment. The figure shows host group `hg-lnx` associated with three logical volumes (00:00:00, 00:00:01, and 00:00:02). LU paths are defined between the two hosts in the `hg-lnx` group and the three logical volumes.



You can define paths between a single server host and multiple LUs. The figure shows that each of the two hosts in the host group `hg-lnx` can access the three LUs.

You can also define paths between multiple server hosts and a single LU. The figure shows that the LU identified by the LDKC:CU:LDEV number 00:00:00 is accessible from the two hosts that belong to the `hg-lnx` host group.

The figure also shows that the LUs associated with the `hg-lnx` host group are addressed by numbers 0000 to 0002. The address number of an LU is referred to as a LUN (logical unit number). When software manipulates LUs, the software use LUNs to specify the LUs to be manipulated.

You can add, change, and delete LU paths when the system is in operation. For example, if new disks or server hosts are added to your storage system, you can add new LU paths. If an existing server host is to be replaced, you can delete the LU paths that correspond to the host before replacing the host. You do not need to restart the system when you add, change, or delete LU paths.

If a hardware failure (such as a CHA failure) occurs, there is a chance that some LU paths are disabled and some I/O operations are stopped. To avoid such a situation, you can define alternate LU paths; if one LU path fails, the

alternate path takes over the host I/O. For information, see Defining LU paths on page 337 and Defining alternate LU paths on page 341.

LUN Manager license requirements

Use of LUN Manager on your storage system requires the following:

- A license key for LUN Manager software.

Rules, restrictions, and guidelines for managing LUs

Rules

- In a Fibre Channel environment, up to 2,048 LU paths can be defined for one host group, and up to 2,048 LU paths can be defined for one port.
- In an iSCSI environment, up to 2,048 LU paths can be defined for one iSCSI target, and up to 2,048 LU paths can be defined for one port.
- Up to 255 host groups can be created for one Fibre Channel port.
- Up to 255 iSCSI targets can be created for one iSCSI port.
- For an LDEV with the ALU attribute, you can define the LU path to only one host group.
- For an LDEV with the ALU attribute, you can define the LU path to only one iSCSI target.

Restrictions

- You cannot define an LU path to the following types of volumes:
  - Journal volumes
  - Pool volumes
  - External volumes with the data direct mapping attribute
  - LDEVs created from an accelerated compression-enabled parity group
  - Deduplication system data volumes
- When defining LU paths, you must not use Command Control Interface and Hitachi Device Manager - Storage Navigator at the same time. If both programs are used simultaneously, operations might not be performed in the expected order, and the storage configuration might be defined incorrectly.
- If an LDEV of the ALU attribute is binding to LDEVs with the SLU attribute, the LU path cannot be removed.
- To define an LU path between a port and an LDEV that has the T10 PI attribute enabled, the port must have T10 PI mode enabled.

Guidelines

- Queue depth: To ensure smooth processing at the ports and best average performance, the recommended queue depth setting (max tag count) for VSP Gx00 models and VSP Fx00 models is 1,024 per port and 32 per LDEV. Other queue depth settings, higher or lower than these recommended values, can provide improved performance for certain workload conditions.

Caution: Higher queue depth settings (greater than 1,024 per port) can impact host response times or cause failures such as job abend. Caution must be exercised in modifying the recommended queue depth settings.

- If you attempt to apply many settings in the LUN Manager windows, the SVP might be unable to continue processing. Therefore, you should make no more than approximately 1,000 settings. Note that many settings are likely to be made when defining alternate paths, even though only two commands are required for defining alternate paths.
- Do not perform the following when host I/O is in progress and hosts are in reserved status (mounted):
  - Remove LU paths
  - Disable LUN security on a port
  - Change the data transfer speed for Fibre Channel ports
  - Change AL-PAs or loop IDs
  - Change settings of fabric switches
  - Change the topology
  - Change the host modes
  - Remove host groups
  - Remove iSCSI targets
  - Setting command devices
- When a port has a path defined for an LDEV with the GAD reserve attribute and you need to configure the port (delete a host group, set a command device, or change the host mode, topology, AL-PA, or transfer speed), the operation might fail if you configure more than one port at a time. For ports that have a path defined for an LDEV with the GAD reserve attribute, perform these operations on one port at a time.

Managing logical units workflow

1. Configure the ports.
2. Configure the hosts.
3. Configure the LU paths.
4. Enable LUN security.
5. Set Fibre Channel authentication.
6. Manage the hosts.

Configuring hosts and Fibre Channel ports

When provisioning your system, configure hosts and Fibre Channel ports using LUN Manager. You can manage hosts, modify the host configuration, and modify the port configuration when the system is in operation.

- Configuring Fibre Channel ports on page 320

- Configuring hosts on page 326

Configuring Fibre Channel ports

Setting the data transfer speed on a Fibre Channel port

As system operation continues, you might notice that a large amount of data is transferred at some ports, but a small amount of data is transferred at other ports. You can optimize system performance on a Fibre Channel port by setting a faster data transfer speed on ports where a large amount of data is transferred, and setting a slower data transfer speed on ports where a smaller amount of data is transferred.

Caution: When a port has a path defined for an LDEV with the GAD reserve attribute and you need to change the transfer speed, the operation might fail if you configure more than one port at a time. For ports that have a path defined for an LDEV with the GAD reserve attribute, perform this operation on one port at a time.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. In the **Edit Ports** window, select the **Port Speed** check box, and then select the desired port speed.

   Select the speed of the Fibre Channel port in the unit of Gbps (Gigabit per second). If **Auto** is selected, the storage system automatically sets the speed to 2, 4, 8, or 16 Gbps.

   Caution: Observe the following cautions when setting speed on a Fibre Channel port:
   - If the host bus adapters (HBAs) and switches support 2 Gbps, use the fixed speed of 2 Gbps for the channel board for Fibre Channel (CHB(FC)) port speed. If they support 4, 8, or 16 Gbps, use 4, 8, or 16 Gbps for the CHB(FC) port speed, respectively.
   - If the Auto Negotiation setting is required, some links might not be up when the server is restarted. Check the channel lamp. If it is flashing, disconnect the cable, and then reconnect it to recover from the link-down state.

- If the CHB(FC) port speed is set to **Auto**, some equipment might not be able to transfer data at the maximum speed.
- When you start a storage system, HBA, or switch, check the host speed appearing in the Port list. If the transfer speed is different from the maximum speed, select the maximum speed from the list on the right, or disconnect, and then reconnect the cable.
- The available port speed which is specified in **Port Speed** is limited due to the combination of the type of the Fibre Channel port and the topology which is specified in **Connection Type**.

---

6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value <*date*>-<*window name*> is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Related references

- Combination of data-transfer speed and connection type on page 321

Combination of data-transfer speed and connection type

The available port speed specified in Port Speed is limited due to the combination of the type of Fibre Channel port and the topology specified in Connection Type. For the possible combinations, see following tables.

For the 8-Gbps Fibre Channel ports, the combinations between data-transfer speeds and connection types are as follows:

Connection Type	Port Speed					
	2 Gbps	4 Gbps	8 Gbps	16 Gbps	32 Gbps	Auto
FC-AL	Available	Available	Available	Not Available	Not Available	Available (Default)
P-to-P	Available	Available	Available	Not Available	Not Available	Available

For the 16-Gbps Fibre Channel ports and for 16-Gbps SFP added to the 4-port FC 32-Gbps package, the combinations between data-transfer speeds and connection types are as follows:

Connection Type	Port Speed					
	2 Gbps	4 Gbps	8 Gbps	16 Gbps	32 Gbps	Auto
FC-AL	Not Available	Available	Available	Not Available	Not Available	Available *1
P-to-P	Not Available	Available	Available	Available	Not Available	Available (Default *2)

For the 32-Gbps SFP added to the 4-port FC 32-Gbps package, the combinations between data-transfer speeds and connection types are as follows:

Connection Type	Port Speed					
	2 Gbps	4 Gbps	8 Gbps	16 Gbps	32 Gbps	Auto
FC-AL	Not Available	Not Available	Available	Not Available	Not Available	Available *1
P-to-P	Not Available	Not Available	Available	Available	Available	Available (Default *2)

*1: If this combination is specified, the maximum transfer speed that is automatically specified is 8 Gbps.

*2: If this default value is set, Fabric is set to ON automatically.

Setting the Fibre Channel port address

When configuring your storage system, set addresses for Fibre Channel ports. When addressing Fibre Channel ports, use AL-PA (arbitrated-loop physical address) or loop IDs as the addresses.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. In the **Edit Ports** window, select the **Address (Loop ID)** check box, and then select the address.
6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.

8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Addresses for Fibre Channel ports

The following addresses are available for setting Fibre Channel ports.

AL-PA	Loop ID (0~29)	AL-PA	Loop ID (30~59	AL-PA	Loop ID (60~89)	AL-PA	Loop ID (90~119)	AL-PA	Loop ID (120~125)
EF	0	B4	30	76	60	49	90	10	120
E8	1	B3	31	75	61	47	91	0F	121
E4	2	B2	32	74	62	46	92	08	122
E2	3	B1	33	73	63	45	93	04	123
E1	4	AE	34	72	64	43	94	02	124
E0	5	AD	35	71	65	3C	95	01	125
DC	6	AC	36	6E	66	3A	96	-	-
DA	7	AB	37	6D	67	39	97	-	-
D9	8	AA	38	6C	68	36	98	-	-
D6	9	A9	39	6B	69	35	99	-	-
D5	10	A7	40	6A	70	34	100	-	-
D4	11	A6	41	69	71	33	101	-	-
D3	12	A5	42	67	72	32	102	-	-
D2	13	A3	43	66	73	31	103	-	-
D1	14	9F	44	65	74	2E	104	-	-
CE	15	9E	45	63	75	2D	105	-	-
CD	16	9D	46	5C	76	2C	106	-	-
CC	17	9B	47	5A	77	2B	107	-	-
CB	18	98	48	59	78	2A	108	-	-
CA	19	97	49	56	79	29	109	-	-
C9	20	90	50	55	80	27	110	-	-
C7	21	8F	51	54	81	26	111	-	-
C6	22	88	52	53	82	25	112	-	-
C5	23	84	53	52	83	23	113	-	-
C3	24	82	54	51	84	1F	114	-	-
BC	25	81	55	4E	85	1E	115	-	-
BA	26	80	56	4D	86	1D	116	-	-
B9	27	7C	57	4C	87	1B	117	-	-
B6	28	7A	58	4B	88	18	118	-	-

AL-PA	Loop ID (0~29)	AL-PA	Loop ID (30~59	AL-PA	Loop ID (60~89)	AL-PA	Loop ID (90~119)	AL-PA	Loop ID (120~125)
B5	29	79	59	4A	89	17	119	-	-

Setting the fabric switch

When you configure your storage system, specify whether the hosts and the storage system are connected via a fabric switch.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/ISCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. Select a check box of **Fabric**, and select **ON** if you set the fabric switch. If you do not set the fabric switch, select **OFF**.
6. Click **Finish**.
   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Fibre Channel topology

The term Fibre Channel topology indicates how devices are connected to each other. Fibre channel provides the following types of topology:

- Fabric: Uses a fabric switch to connect a large number of devices (up to 16 million) together.
- FC-AL (Fibre Channel-Arbitrated Loop): A shared interface that can connect up to 126 devices (AL-ports) together.
- Point-to-point: The simplest fibre topology connects two devices directly together.

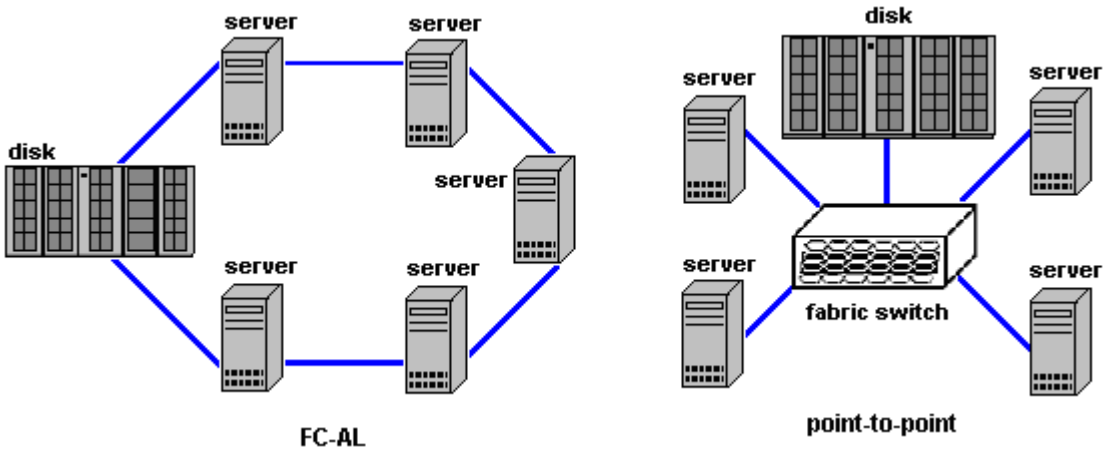
When configuring your storage system, use the LUN Manager window to specify whether the hosts and the storage system are connected using a fabric switch.

If a fabric switch is used, specify FC-AL or point-to-point in the LUN Manager window. If a fabric switch is used, consult the documentation for the fabric switch to learn whether FC-AL or point-to-point should be used. Some fabric switches require you to specify point-to-point to get the system running.

If no fabric switch is used, specify FC-AL.

The combination of the topology which is specified in Connection Type and the port speed which is specified in Port Speed is restricted. For details, see Combination of data-transfer speed and connection type on page 321.

Example of FC-AL and point-to-point topology



Setting the Fibre Channel topology

Use this procedure to set the topology (FC-AL or P-to-P) of a Fibre Channel port.

Caution: When a port has a path defined for an LDEV with the GAD reserve attribute and you need to change the topology, the operation might fail if you configure more than one port at a time. For ports that have a path defined for an LDEV with the GAD reserve attribute, perform this operation on one port at a time.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. Under **Connection Type**, select **FC-AL** or **P-to-P**.
6. Click **Finish**.
   The **Confirm** window opens.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value <*date*>-<*window name*> is entered by default.

8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Configuring hosts

You can configure hosts in your storage system. You can also modify the host configuration with LUN Manager when the system is in operation.

Read the following topics concerning host modes before configuring hosts:

- Host modes for host groups on page 326
- Host mode options on page 327

Configuring hosts includes the following tasks:

- How to find the WWN of a host bus adapter on page 332
- Creating a host group and registering hosts in the host group (Fibre Channel) on page 335)

Configure hosts workflow

1. Determine the host modes and host mode options you will use.
2. Determine the WWN of the host bus adapters that you will use.
3. Create host groups.
4. Register host groups.

Host modes for host groups

The following table lists the host modes that are available for use on your storage system. Carefully review and determine which host modes you will need to use when configuring your system and observe the cautions concerning using certain host modes. Host modes and host mode options must be set on the port before the host is connected. If you change host modes or host mode options after the host is connected, the host (server) will not recognize it.

Host mode	When to select this mode
00 Standard	When registering Red Hat Linux server hosts or IRIX server hosts in the host group. When connected to Hitachi NAS Platform (unified or external) version 12.5 or later, select 00 Standard for NAS Platform (User LU) ports and NAS Platform (System LU) ports.
01 VMware	When registering VMware server hosts in the host group[1]
03 HP	When registering HP-UX server hosts in the host group
05 OpenVMS	When registering OpenVMS server hosts in the host group

Host mode	When to select this mode
07 Tru64	When registering Tru64 server hosts in the host group
09 Solaris	When registering Solaris server hosts in the host group
0A NetWare	When registering NetWare server hosts in the host group
0C Windows	When registering Windows server hosts in the host group[2]
0F AIX	When registering AIX server hosts in the host group
21 VMware Extension	When registering VMware server hosts in the host group. If the virtual host on VMware recognizes LUs by the Raw Device Mapping (RDM) method, set the host mode related to OS of the virtual host. Example: If a LUN/LDEV is formatted as VMFS (where virtual machines and their VMDK's usually reside), it should be set with HMO 21. However, if a LUN/LDEV is formatted as a specific file system format (for example, NTFS) and has application requirements to be presented directly to a virtual machine as an RDM, it should be set to the HMO specific to that OS/ filesystem (e.g., such as HMO 2C for Windows). A common example of VM's with this mix would be: C: drive – OS VMDK on VMFS D: drive – RDM for application data In this example, 2 different Host Groups should be created for a single host with different HMO and LUN's assigned.
2C Windows Extension	When registering Windows server hosts in the host group.

Notes:

1. There are no functional differences between host mode 01 and 21. When you first connect a host, it is recommended that you set host mode 21.
2. There are no functional differences between host mode 0C and 2C. When you first connect a host, it is recommended that you set host mode 2C.

Host mode options

The following table lists the host mode options (HMOs) that are available to use for configuring hosts on your storage system.

No.	Host mode options	When to select this option
2	VERITAS Database Edition/ Advanced Cluster	When VERITAS Database Edition/Advanced Cluster for Oracle Real Application Clusters or VERITAS Cluster Server 4.0 or later (I/O fencing function) is used.
6	TPRLO	When all of the following conditions are satisfied: • The host mode `0C Windows` or `2C Windows Extension` is used. • The Emulex host bus adapter is used. • The mini-port driver is used. • TPRLO=2 is specified for the mini-port driver parameter of the host bus adapter.
7	Automatic recognition function of LUN	When all of the following conditions are satisfied: • The host mode `00 Standard` or `09 Solaris` is used.

No.	Host mode options	When to select this option
		• SUN StorEdge SAN Foundation Software Version 4.2 or later is used. • You want to automate recognition of increase and decrease of devices when genuine SUN HBA is connected. Enable this HMO when connected to Hitachi NAS Platform version 12.5 or later. **Note:** When you use Hitachi Storage Advisor to allocate storage to the NAS modules on ports 1A and 2A, this HMO is enabled automatically.
12	No display for ghost LUN	When all of the following conditions are satisfied: • The host mode `03 HP` is used. • You want to suppress creation of device files for devices to which paths are not defined.
13	SIM report at link failure[1]	When you want to be informed by SIM (service information message) that the number of link failures detected between ports exceeds the threshold.
14	HP TruCluster with TrueCopy function	When all of the following conditions are satisfied: • The host mode `07 Tru64` is used. • You want to use TruCluster to set a cluster to each of primary volume and secondary volume for TrueCopy or Universal Replicator.
15	HACMP	When all of the following conditions are satisfied: • The host mode `0F AIX` is used. • HACMP 5.1 Version 5.1.0.4 or later, HACMP4.5 Version 4.5.0.13 or later, or HACMP5.2 or later is used.
22	Veritas Cluster Server	When Veritas Cluster Server is used.
25	Support SPC-3 behavior on Persistent Reservation	When one of the following conditions are satisfied: • Using Windows Server Failover Clustering (WSFC) • Using Microsoft Failover Cluster (MSFC) • Using Symantec Cluster Server, also known as Veritas Cluster Server (VCS) • Using a configuration other than above with the PERSISTENT RESERVE OUT (Service Action=REGISTER AND IGNORE EXISTING KEY) command, change the status response from Reservation-Conflict to Good-Status when there is not a registered key to be deleted
33	Set/Report Device Identifier enable	When all of the following conditions are satisfied: • Host mode `03 HP` or `05 OpenVMS`[1] is used. • You want to enable commands to assign a nickname of the device. • You want to set UUID to identify a logical volume from the host.
39	Change the nexus specified in the SCSI Target Reset	When you want to control the following ranges per host group when receiving Target Reset: • Range of job resetting. • Range of UAs (Unit Attentions) defined.
40	V-VOL expansion	When all of the following conditions are satisfied: • The host mode `0C Windows` or `2C Windows Extension` is used.

No.	Host mode options	When to select this option
		• You want to automate recognition of the DP-VOL capacity after increasing the DP-VOL capacity.
41	Prioritized device recognition command	When you want to execute commands to recognize the device preferentially.
43	Queue Full Response	When the command queue is full in your storage system connecting with the HP-UX host, and if you want to respond `Queue Full`, instead of `Busy`, from the storage system to the host.
49	BB Credit Set Up Option1	When you want to adjust the number of buffer-to-buffer credits (BBCs) to control the transfer data size by the Fibre Channel, for example when the distance between MCU and RCU of the TrueCopy (or global-active device) pair is long (approximately 100 kilometers) and the Point-to-Point topology is used. Use the combination of this host mode option and the host mode option 50.
50	BB Credit Set Up Option2	When you want to adjust the number of buffer-to-buffer credits (BBCs) to control the transfer data size by the Fibre Channel, for example when the distance between MCU and RCU of the TrueCopy (or global-active device) pair is long (approximately 100 kilometers) and the Point-to-Point topology is used. Use the combination of this host mode option and the host mode option 49.
51	Round Trip Set Up Option[3]	If you want to adjust the response time of the host I/O, for example when the distance between MCU and RCU of the TrueCopy (or global-active device) pair is long (approximately 100 kilometers) and Point-to-Point topology is used.
54	(VAAI) Support Option for the EXTENDED COPY command	When the VAAI (vStorage API for Array Integration) function of VMware ESX/ESXi 4.1 or later is used.
63	(VAAI) Support Option for vStorage APIs based on T10 standards	When you connect the storage system to VMware ESXi 5.0 or later and use the VAAI function for T10. Use a combination of this host mode option and host mode option 54.
68	Support Page Reclamation for Linux	When using the Page Reclamation function from the environment which is being connected to the Linux host. When connected to NAS platform to allow the NAS host to retrieve Dynamic Provisioning information and support the SCSI UNMAP command. **Note:** When you use Hitachi Storage Advisor to allocate storage to the NAS modules on ports 1A and 2A, this HMO is enabled automatically.
71	Change the Unit Attention for Blocked Pool-VOLs	When you want to change the unit attention (UA) from `NOT READY` to `MEDIUM ERROR` during the pool-VOLs blockade.
72	AIX GPFS Support	When using General Parallel File System (GPFS) in the storage system connecting to the AIX host.
73	Support Option for WS2012	When using following functions provided by Windows Server 2012 (WS2012) from the environment which is being connected to the WS2012. • Dynamic Provisioning function • Offload Data Transfer (ODX) function

No.	Host mode options	When to select this option
78	The non-preferred path option	When all of following conditions are satisfied: • Global-active device is used in the configuration with the data centers (Metro configuration). • Hitachi Dynamic Link Manager is used as the alternative path software. • The host group is on the non-optimized path of Hitachi Dynamic Link Manager. • The performance deterioration of I/O responses can be avoided without I/O using the non-optimized path of Hitachi Dynamic Link Manager.
80	Multi Text OFF	By using the iSCSI interface, if the storage system connects with the host of which OS is not supported of the Multi Text function. For instance, connecting the storage system and the host of RHEL5.0 which does not support the Multi Text-function.
81	NOP-In Suppress Mode	In the environment by iSCSI connection, the delay replying of the Delayed Acknowledgment function which is located on the upper layer is restrained by sending NOP-IN of executing of sense commands such as Inquiry, Test unit ready, or Mode sense. However, select this option when connecting the storage system and the host which is not necessary of the NOP-IN sending. However, when connecting the storage system and the host which does not need of the NOP-IN sending, select this option. For instance: • When connecting the storage system and the Open Enterprise Server of Novell Co., Ltd. • When connecting the storage system and winBoot/i of emBoot Co., Ltd..
82	Discovery CHAP Mode	Select this option when the CHAP authentication is performed at the time of the discovery login In the iSCSI connection environment. For instance: When the CHAP authentication is performed at the time of the discovery login in the iSCSI environment of the VMware host and storage system
83	Report iSCSI Full Portal List Mode	When configuring alternate paths in the environment of connecting the VMware host and storage system: If waiting of replying of the target information from the host option mode 83 enabled port other than ports of discovery login, select this host mode option. Apply this host mode option when all of the following conditions are met: • Configuring alternate paths in the environment of connecting the VMware host and storage system. • Waiting for replying of the target information from the ports other than ports of discovery login.
88	Nondisruptive migration with HP-UX hosts	When converging multiple host-target ports used in the migration source storage system on the migration target storage system, and enable LUN path definition from a host group belonging to a virtual storage machine to an LDEV defined in a different virtual storage machine. • ON: LUN path definition is enabled. • OFF: LUN path definition is disabled.

No.	Host mode options	When to select this option
		Note: **1.** Apply this host mode option when all the following conditions are met: - You are using the nondisruptive migration function to migrate volumes in multiple old storage models that use the same server. - You need to reduce the number of Target ports used on the migration target storage system. - The host is an HP-UX server. **2.** Applying this option to a server other than HP-UX can cause the following: - Path addition from the server to the migration target storage system might fail. - Display of devices that the server recognizes might be invalid. **3.** If a LUN path is defined to an LDEV defined in a virtual storage machine different from the one to which the host group belongs, this option cannot be set to OFF.
91	Disable I/O wait for OpenStack Option	When manually creating host groups (for Fibre Channel) or iSCSI targets (for iSCSI) that are used as the I/O data paths for OpenStack.
96	Change the nexus specified in the SCSI Logical Unit Reset	When you want to control the following ranges per host group when receiving LU Reset: • Range of job resetting. • Range of UAs (Unit Attentions) defined.
97	Proprietary ANCHOR command support	When connecting to Hitachi NAS Platform.
100	Hitachi HBA (Fabric Emulation Mode) Connection Option[1]	Select this option when connecting the 8-Gbps channel port (in the storage system) and the adapter of BladeSymphony/HA8000 Hitachi Gigabit Fibre Channel by using the Fabric Emulation mode.
102	(GAD) Standard Inquiry Expansion for Hitachi Command Suite	When all of the following conditions are satisfied: • The OS of the host is Windows (host mode `0C Windows` or `2C Windows Extension`) or AIX (host mode `0F AIX`), and the MPIO function is used. • Global-active device (GAD) or nondisruptive migration (NDM) is used. • Hitachi Device Manager (HDvM) agent is used.
105	Task Set Full response in the event of I/O overload	When all of following conditions are satisfied: • The host mode 0C Windows or 2C Windows Extension is used. • You want to return Task Set Full response from the storage system to the host when an overload of I/Os occurs on the storage system.

Notes:

1. Configure these host mode options only when requested to do so.

2. Set the UUID when you set host mode option 33 and host mode `05 openvms` is used.

3. Set the host mode option 51 for ports on the remote site of the Hitachi TrueCopy® pair or the global-active device pair.

How to find the WWN of a host bus adapter

Before physically attaching the storage system to hosts, some preparation work needs to be performed. After you verify that the Fibre Channel adapters and device drivers are installed on the open-system hosts, you must find the World Wide Name (WWN) of each host bus adapter that will be connected to the storage system.

The WWN is a unique identifier (16 hexadecimal digits) for a host bus adapter in an open-systems host. The method for finding the WWN of a host adapter depends on the operating system of the host. Make sure to record the WWNs of the host adapters, because you will need to enter these WWNs in Device Manager - Storage Navigator windows when you specify the hosts connected to your storage system.

- Finding a WWN on a Windows host on page 332
- Finding a WWN on a Solaris host on page 333
- Finding a WWN on an AIX, IRIX, or Sequent host on page 333
- Finding a WWN on an HP-UX host on page 333

Finding a WWN on a Windows host

Emulex Fibre Channel adapters are supported in a Windows environment. For further information about Fibre Channel adapter support, or when using a Fibre Channel adapter other than Emulex, contact customer support for instructions on finding the WWN.

Before attempting to acquire the WWN of an Emulex adapter, confirm whether the driver installed in the Windows 2000 or Windows Server 2003 environment is an Emulex port driver or an Emulex mini-port driver, and then follow the driver instructions.

Procedure

1. Verify that the Fibre Channel adapters and device drivers are installed.
2. Log on to the Windows host with administrator access.
3. Go to the **LightPulse Utility** to open the **LightPulse Utility** window. If you do not have a shortcut to the utility:
   a. Go to the **Start** menu, select **Find** and choose the **Files and Folders** option.
   b. On the **Find** dialog box, in **Named** type **`lputilnt.exe`**, and from the **Look in** list, choose the data drive that contains the Emulex mini-port driver.
   c. Choose **Find Now** to search for the LightPulse utility.

      If you still cannot find the LightPulse utility, contact Emulex technical support.
   d. Select `lputilnt.exe` from the **Find: Files named** list, and then press **Enter**.

4. On the **LightPulse Utility** window, verify that any installed adapters appear in the tree.
5. In the **Category** list, choose the **Configuration Data** option.
6. In the **Region** list, choose the **16 World-Wide Name** option. The WWN of the selected adapter appears in the list on the right of the window.

Finding a WWN on a Solaris host

JNI Fibre Channel adapters are supported in a Solaris environment. For further information about Fibre Channel adapter support, or if using a Fibre Channel adapter other than JNI, contact customer support for instructions for finding the WWN.

Procedure

1. Verify that the Fibre Channel adapters and device drivers are installed.
2. Log on to the Solaris host with root access.
3. Use the `dmesg |grep Fibre` command to list the installed Fibre Channel devices and their WWNs.
4. Verify that the Fibre Channel adapters listed are correct, and record the listed WWNs.
   Example:

```
# dmesg |grep Fibre          <- Enter the dmesg command.
 :
fcaw1: JNI Fibre Channel Adapter model FCW
fcaw1: Fibre Channel WWN: 200000e0694011a4      <- Record the WWN.
fcaw2: JNI Fibre Channel Adapter model FCW
fcaw2: Fibre Channel WWN: 200000e06940121e     <- Record the WWN.
#
```

Finding a WWN on an AIX, IRIX, or Sequent host

To find the WWN in an IBM AIX, SGI Irix, or Sequent environment, use the fabric switch that is connected to the host. The method of finding the WWN of the connected server on each port using the fabric switch depends on the type of switch. For instructions on finding the WWN, see the manual of the corresponding switch.

Finding a WWN on an HP-UX host

You can find the WWN in an HP-UX environment.

Procedure

1. Verify that the Fibre Channel adapters and the Fibre Channel device drivers are installed.
2. Log in to the HP-UX host with root access.
3. At the command line prompt, type:
   `/usr/sbin/ioscan -fnC lan`

This will list the attached Fibre Channel devices and their device file names. Record the Fibre Channel device file name (for example, /dev/fcms0).

Note: When the A5158 Fibre Channel adapter is used, at the command line prompt, enter **/usr/sbin/ioscan -fnC fc** for the device name.

4. Use the **fcmsutil** command along with the Fibre Channel device name to list the WWN for that Fibre Channel device. For example, to list the WWN for the device with the device file name /dev/fcms0, type:

   /opt/fcms/bin/fcmsutil /dev/fcms0

   Record the Fibre Channel device file name (for example, /dev/td0).

   Note: When using the A5158 Fibre Channel adapter, list the WWN for the device with the device file name as follows: **/opt/fcms/bin/fcmsutil <device file name>**

5. Record the WWN and repeat the above steps for each Fibre Channel device that you want to use.

Result

```
# /usr/sbin/ioscan -fnC lan  <- 1
Class     I  H/W Path  Driver      S/W State   H/W Type
Description
==========================================================
lan         0  8/0.5     fcT1_cntl   CLAIMED    INTERFACE    HP
Fibre Channel Mass Storage Cntl
                         /dev/fcms0  <-2
lan         4  8/4.5     fcT1_cntl   CLAIMED    INTERFACE    HP
Fibre Channel Mass Storage Cntl
                         /dev/fcms4  <-2
lan         5  8/8.5     fcT1_cntl   CLAIMED    INTERFACE    HP
Fibre Channel Mass Storage Cntl
                         /dev/fcms5  <-2
lan         6  8/12.5    fcT1_cntl   CLAIMED    INTERFACE    HP
Fibre Channel Mass Storage Cntl
                         /dev/fcms6  <-2
lan         1  10/8/1/0  btlan4      CLAIMED    INTERFACE
PCI(10110009) -- Built-in #1
lan         2  10/8/2/0  btlan4      CLAIMED    INTERFACE
PCI(10110009) -- Built-in #2
lan         3  10/12/6   lan2        CLAIMED    INTERFACE
Built-in LAN
                         /dev/diag/lan3  /dev/ether3     /dev
/lan3
#
# fcmsutil /dev/fcms0 <-3
                Local N_Port_ID is = 0x000001
       N_Port Node World Wide Name = 0x10000060B0C08294
          N_Port Port World Wide Name = 0x10000060B0C08294 <- 4
                          Topology = IN_LOOP
                             Speed = 1062500000 (bps)
                       HPA of card = 0xFFB40000
                       EIM of card = 0xFFFA000D
                      Driver state = READY
```

```
            Number of EDB's in use = 0
            Number of OIB's in use = 0
Number of Active Outbound Exchanges = 1
   Number of Active Login Sessions = 2
#
1: Enter the ioscan.
2: Device name
3: Enter the fcmsutil command.
4: Record the WWN.
```

Creating a host group and registering hosts in the host group (Fibre Channel)

After discovering the WWNs of the host bus adapters in a Fibre Channel environment, use this procedure to create a host group and register the hosts in the host group.

You can connect multiple server hosts of different platforms to each port of your storage system. When configuring your storage system, you should group server hosts connected to the storage system by host groups. For example, if HP-UX hosts and Windows hosts are connected to a port, create one host group for HP-UX hosts and another host group for Windows hosts, and then register the HP-UX hosts to the HP-UX host group and register the Windows hosts to the Windows host group.

Note: This example applies to configurations in which all HP-UX hosts are on the same cluster.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- Before you can set LU paths, you must register the hosts in host groups. For example, if HP-UX hosts and Windows hosts are connected to a port, register HP-UX hosts and Windows hosts separately in two different host groups.
- When registering a host, you must also specify the WWN of the host bus adapters.
- When registering hosts in multiple host groups, set the security switch (LUN security) to enabled, and then specify the WWN of the host bus adapter.
- When registering a host, you can assign a nickname to the host bus adapter. If you assign a nickname, you can easily identify each host bus adapter in the LUN Manager window. Although WWNs are also used to identify each host bus adapter, the nickname that you assign will be more helpful because you can name host bus adapters after the host installation site or for the host owners.

Procedure

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

2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click **Create Host Groups**.
4. In the **Create Host Groups** window, enter the host group name in the **Host Group Name** box.
   - It is convenient if you name each host group after the host platform.
   - A host group name can consist of up to 32 ASCII characters (letters, numerals, and symbols). However, you cannot use the following symbols for host group names: \ / : , ; * ? " < > |
   - You cannot use space characters for the first and the last characters in host group names.
   - Host group names are case-sensitive. For example, the host group names `wnt` and `Wnt` represent different host groups.
5. Select the resource group in which a host group is created.

   If you select **Any**, ports to which you may add host groups within all ports assigned to a user are displayed in the **Available Ports** list. If you select other than **Any**, ports to which you may add host groups within the ports assigned to the selected resource group are displayed in the **Available Ports** list.
6. Select a host mode from the **Host Mode** list. When selecting a host mode, you must consider the platform and some other factors.
7. Select hosts to be registered in a host group.

   If the desired host has ever been connected with a cable to another port in the storage system, select the desired host bus adapter from the **Available Hosts** list.

   If there is no host to be registered, skip this step and move to the next step. Otherwise, a host group with no host would be created.

   If the desired host has never been connected via a cable to any port in the storage system, perform the following steps:

   a. Click **Add New Host** under the **Available Hosts** list.

      The **Add New Host** dialog box opens.
   b. Enter the desired WWN in the **HBA WWN** box.
   c. If necessary, enter a nickname for the host bus adapter in the **Host Name** box.
   d. Click **OK** to close the **Add New Host** dialog box.
   e. Select the desired host bus adapter from the **Available Hosts** list.
8. Select the port to which you want to add the host group. For details about host modes, see Host modes for host groups on page 326.

   If you select multiple ports, you may add the same host group to multiple ports by one operation.
9. If necessary, click **Option** and select host mode options. For details about host mode options, see Host mode options on page 327.

Note: When you click **Option**, the dialog box expands to display the list of host mode options. The **Mode No.** column indicates option numbers. Select an option you want to specify and click **Enable**.

10. Click **Add** to add the host group.
    By repeating steps from 2 to 8, you can create multiple host groups.

    If you select a row and click **Detail**, the **Host Group Properties** window appears. If you select a row and click **Remove**, the message appears asking whether you want to remove the selected row or rows. If you want to remove the row, click **OK**.
11. Click **Finish** to display the **Confirm** window.
    To continue to add LUN paths, click **Next**.
12. Confirm the settings and enter the task name in the **Task Name** box.
    A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.

    If you select a row and click **Detail**, the **Host Group Properties** window appears.
13. Click **Apply** in the **Confirm** window.
    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Configuring LU paths

When provisioning your storage system, and after configuring ports, hosts, and host groups, you must configure Fibre Channel LU paths. LUN Manager is required for these tasks. You can also modify the LU paths configuration when the system is in operation.

Configure LU paths workflow

- Define LU paths.
- Set a UUID, if desired.
- Define alternate LU paths.

Defining LU paths

In a Fibre Channel or iSCSI environment, you must define LU paths and associate host groups or iSCSI targets with logical volumes. For example, if you associate a host group or an iSCSI target consisting of three hosts with logical volumes, LU paths are defined between the three hosts and the logical volumes.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**, and select the target host group or iSCSI target.
3. Click **Add LUN Paths**.
4. In the **Add LUN Paths** window, select the desired LDEVs from the **Available LDEVs** table, and then click **Add**.

   Selected LDEVs are listed in the **Selected LDEVs** table.
5. Click **Next**.
6. In **Selection Object**, click **Fibre**.
7. Select the desired host groups from the **Available Host Groups** or **Available iSCSI Targets** table, and then click **Add**.

   Selected host groups are listed in the **Selected Host Groups** or **Available iSCSI Targets** table.
8. Click **Next**.
9. Confirm the defined LU paths.

   If the LDEV name or the LUN ID is edited, perform the following:
   1. Select the checkboxes of LDEV IDs that you want to change.
   2. Click **Change LDEV Settings**.
   3. In the **Change LDEV Settings** window, specify values in **Prefix** and **Initial Number**.
   4. Click **OK**.

   To change the LUN ID, perform the following:
   1. In the LUN ID column (Any number Sets of Paths), select the host groups (iSCSI Targets) checkboxes.
   2. Select the checkbox of the LDEV ID that you want to change.
   3. Click **Change LUN IDs**.
   4. In the **Change LUN IDs** window, specify the value in **Initial LUN ID**.
   5. Click **OK**.
10. Click **Finish**.
    The **Confirm** window appears.
11. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
12. Click **Apply**.

If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Setting a UUID

You can set an arbitrary ID to identify a logical volume from the host when host mode option 33 is set to on. The ID is referred to as the UUID (universally unique identifier) and is typically composed of a Prefix and an Initial Number.

Note the following when setting a UUID:

- If host mode 05 OpenVMS is used with host mode option 33 set to ON, LUs that do not have UUID settings are inaccessible.
- If host mode 05 OpenVMS is used with host mode option 33 set to OFF, LUs that have UUID settings are inaccessible.

The following rules apply to setting a UUID:

- These characters cannot be used for UUID: \ / : , ; * ? " < > |
- A space character cannot be used as the first or the last character of a UUID.
- UUID is case-sensitive. For example, Abc and abc are different UUIDs.

To keep track of device information, create a correspondence table similar to the example in Correspondence table for defining devices on page 341.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- Before editing UUID settings, review the information about UUID requirements on page 340.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Host Groups/iSCSI Targets** tab, click the link of the **Port ID** of the host group.
4. Click the link of a **Host Group Name**.
5. Click the **LUNs** tab.
6. Select one or more logical units to which volumes are assigned (if a volume is assigned to an LU, the columns on the right of the LUN column are not empty).

   When multiple LUs are selected, the same UUID is set to all selected LUs.
7. Click **More Actions**, and then select **Edit UUIDs**.
8. In the **Edit UUIDs** window, in **Prefix**, type the UUID.

If a UUID is already specified, you can change it. The UUID before changing appears in **UUID** in the **Edit UUIDs** window. However, if multiple LUs, or **N/A**s are selected, the **Prefix** box is blank.

For an OpenVMS server host, enter a UUID composed of a **Prefix** and an **Initial Number**. The **Prefix** may include up to 5 digits, from 1 to 32767, and the **Initial Number** may include up to 5 digits, from 0 to 32767.

For a server host other than OpenVMS, enter a UUID composed of a **Prefix** and an **Initial Number**. The **Prefix** may include up to 64 ASCII characters (letters, numerals and symbols) and the **Initial Number** may include up to 9 digits.

When changing the server host OS from HP-UX to OpenVMS, or from OpenVMS to HP-UX, the same UUID cannot be used continuously. Clear the UUID setting (see Clearing a UUID setting on page 346), and then set the proper UUID for a server host.

9. To sequentially number the UUIDs, type the first digit in the **Initial Number** box. The following rules apply to the Initial Number:

```
1: Up to 9 numbers are added (1, 2, 3, ... 9).
08: Up to 92 numbers are added (08, 09, 10, ... 99).
If the host mode is set to OpenVMS, the numbers are as
follows:
8, 9, 10, ... 99
23: Up to 77 numbers are added (23, 24, 25, ... 99).
```

10. Click **Finish**.
    The **Confirm** window appears.
11. In the **Task Name** text box, type a unique name for the task or accept the default.
    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
12. Click **Apply**.
    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

UUID requirements

A UUID (user-definable LUN identifier) is typically composed of a Prefix and an Initial Number.

The following rules apply to defining a UUID:

- These characters cannot be used for a UUID: `\ / : , ; * ? " < > |`
- A space character cannot be used as the first or the last character of a UUID.
- UUIDs are case-sensitive. For example, `Abc` and `abc` are different UUIDs.

Also note the following when defining a UUID:

- If host mode `05 OpenVMS` is used with host mode option 33 set to `ON`, LUs that do not have UUID settings are inaccessible.
- If host mode `05 OpenVMS` is used with host mode option 33 set to `OFF`, LUs that have UUID settings are inaccessible.
- For an OpenVMS server host, the Prefix can include up to 5 digits, from 1 to 32767, and the Initial Number can include up to 5 digits, from 0 to 32767.
- For a server host other than OpenVMS, the Prefix can include up to 64 ASCII characters (letters, numerals and symbols) and the Initial Number can include up to 9 digits.

Correspondence table for defining devices

When configuring the storage system, you will need definition information about devices set by LUN Manager, for example, LUs, LDKC:CU:LDEV, or UUID. A correspondence table similar to the example below is useful and recommended when collecting this information.

Port	LU	LDKC:CU:LDEV	UUID	OpenVMS device file name
BR	0000	00:00:30	148	1dga148
BR	0001	00:00:31	149	1dga149
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

Defining alternate LU paths

The Storage Administrator (Provisioning) role is required to perform this task.

You may want to define alternate LU paths so that if one LU path fails, you will be able to switch to its alternate path.

To create an alternate LU path, copy the original LU path from one port to another. For example, if you want to define an alternate for the LU path from the CL1-A port to logical volume 00:00:01, copy the LU path from the CL1-A port to another port.

Use one of these methods to copy LU paths:

- Copy all the LU paths defined in a host group or an iSCSI target
- Copy one or more (but not all) LU paths defined in a host group or an iSCSI target

Before taking the following steps:

- See Rules, restrictions, and guidelines for managing LUs on page 318 for important information.

- To define alternate paths when LUN security is disabled, you must redefine the LU path.

Copying all LU paths defined in a host group

Use this procedure to copy all LU paths defined in a host group.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Expand the target host group and click **Ports/Host Groups/iSCSI Targets**.
3. In the **Host Groups** pane, select the **Port ID** of a host group.
4. Click **More Actions** and select **Create Alternative LUN Paths**.
5. In the **Create Alternative LUN Paths** window, select the copy destination port from the **Available Ports** table, and then click **Add**.

   The selected ports appear in the **Selected Ports** table.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Copying all LU paths defined in an iSCSI target

Use this procedure to copy all LU paths defined in a host group.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Expand the target host group, and click **Ports/Host Groups/iSCSI Targets**.
3. In the **iSCSI Targets** pane, select the **Port ID** of a iSCSI target.
4. Click **More Actions** and select **Create Alternative LUN Paths**.

5. In the **Create Alternative LUN Paths** window, select the copy destination port from the **Selected Ports** table, and then click **Add**.

   The selected ports appear in the **Selected Ports** table.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Copying selected (but not all) LU paths defined in a host group

You can use this procedure to copy the LU paths associated with a selected host group.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Host Groups/iSCSI Targets** tab, click the link of the **Port ID** of the host group.
4. Click the link of a **Host Group Name**.
5. Click **LUNs** tab.
6. Select one or more logical units to which volumes are assigned (if a volume is assigned to a logical unit, the columns on the right of the LUN column are not empty).
7. Select **Copy LUN Paths**.
8. In the **Copy LUN Paths** window, select the host group to which you want to paste paths from the **Available Host Groups** table, and then click **Add**.

   The selected host groups appear in the **Selected Host Groups** table.
9. Click **Finish**.
   The **Confirm** window appears.
10. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
11. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Copying selected (but not all) LU paths defined in an iSCSI target

You can use this procedure to copy the LU paths associated with a selected host group.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Host Groups/iSCSI Targets** tab, click the link of the **Port ID** of the iSCSI target.
4. Click the link of a **iSCSI target**.
5. Click **LUNs** tab.
6. Select one or more logical units to which volumes are assigned (if a volume is assigned to a logical unit, the columns on the right of the LUN column are not empty).
7. Select **Copy LUN Paths**.
8. In the **Copy LUN Paths** window, select the iSCSI target to which you want to paste paths from the **Available iSCSI Targets** table, and then click **Add**.

   The selected host groups appear in the **Selected iSCSI Targets** table.
9. Click **Finish**.
   The **Confirm** window appears.
10. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
11. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Managing LU paths

You can modify the LU paths configuration with LUN Manager when the system is in operation, but not when host I/O is in progress. Managing LU paths includes the following tasks:

- Deleting LU paths on page 344
- Clearing a UUID setting on page 346
- Viewing LU path settings on page 346

Deleting LU paths

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Caution: Do not delete LU paths when host I/O is in progress.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click the link of a host group.
4. Select the **LUNs** tab.
5. Select the LU path you want to delete.

   Caution: When an LDEV is selected and **Delete LUN Paths** is performed, all LUN paths of the selected LDEV are deleted by default.

6. Click **More Actions** and select **Delete LUN Paths**.
7. In the **Delete LUN Paths** window, confirm that the LU paths that you want to delete are listed in **Selected LUN Paths**.

   If LU paths that you do not want to delete are listed, select the LU path you do not want to delete, and then click **Remove from Delete process**.

   Caution: When an LDEV is selected and **Delete LUN Paths** is performed, all LUN paths of the selected LDEV are deleted by default.

8. If necessary, check the **Delete all defined LUN paths to above LDEVs** check box. When checked, all additional LU paths on the selected LDEVs will be deleted.
9. Click **Finish** to open the **Confirm** window.

   If you want to start shredding operations to delete the data of the volume, click **Next**. For detailed information about shredding operations, see the *Hitachi Volume Shredder User Guide.*
10. Click **Finish**.
    The **Confirm** window appears.
11. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
12. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

If you delete many paths at one time, the deletion process may take time and the dialog box may seem to hang temporarily.

Clearing a UUID setting

You can clear the UUID setting that has been set to identify a logical volume from the host.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. In the **LDEVs** pane of the **Logical Devices** window, click **Create LDEVs**.
4. Select the LDEVs with the UUID setting you want to clear.
5. Select **Delete UUIDs**. The **Delete UUIDs** window opens.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, type a unique name for the task or accept the default.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Viewing LU path settings

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click the link of a host group or iSCSI target.
4. Select the **LUNs** tab.
5. Select a **LUN ID** to open the **LUN Properties** window.

Releasing LUN reservation by host

The following explains how to release forcibly a LUN reservation by a host.

Before you begin

You must have the Storage Administrator (System Resource Management) role to perform this task.

Caution: If you perform the releasing a LUN reservation by a host, the host which is connected to LDEV by LUN path is affected.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click the link of a **Host Group Name**.
4. Select the **LUNs** tab.
5. Click **More Actions**, and then click **View Host-Reserved LUNs**.
6. In the **Host-Reserved LUNs** window, select a LUN, and then click **Release Host-Reserved LUNs**.
7. Confirm the settings and enter a unique **Task Name**.

   A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
8. Click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

LUN security on ports

To protect mission-critical data in your storage system from illegal access, apply security policies to logical volumes. Use LUN Manager to enable LUN security on ports to safeguard LUs from illegal access.

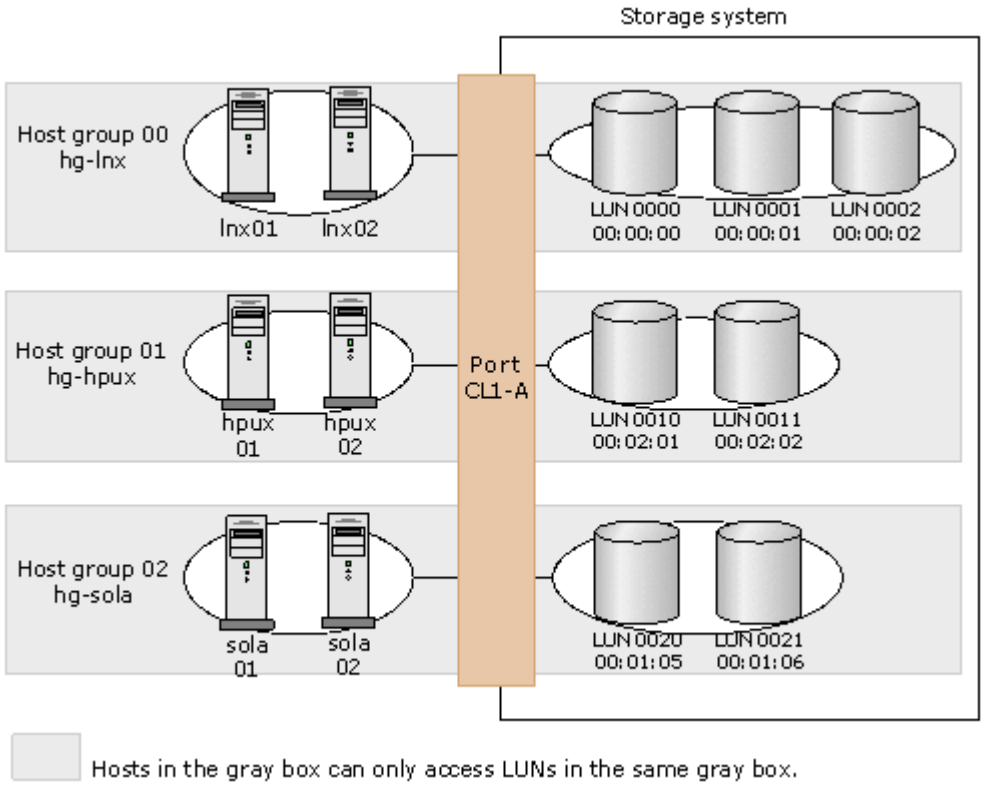
If LUN security is enabled on ports, host groups affect which host can access which LUs. Hosts can access only the LUs associated with the host group to which the hosts belong. Hosts cannot access LUs associated with other host groups. For example, hosts in the `hp-ux` host group cannot access LUs associated with the `windows` host group. Also, hosts in the `windows` host group cannot access LUs associated with the `hp-ux` host group.

Examples of enabling and disabling LUN security on ports

Enabling LUN security

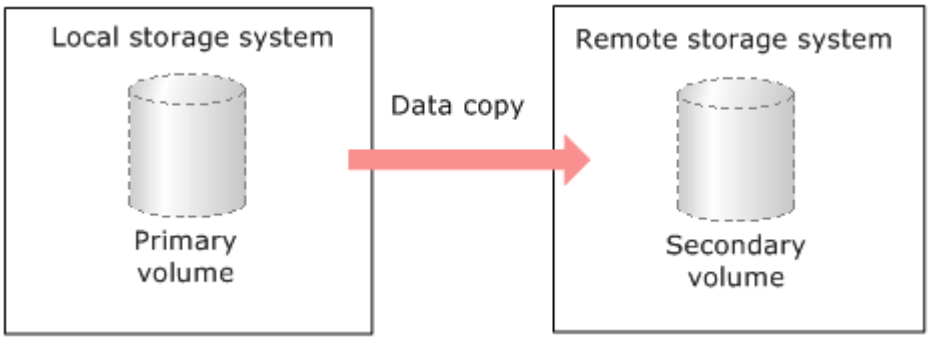
In the following example, LUN security is enabled on port CL1-A. The two hosts in the `hg-lnx` host group can access only three LUs (00:00:00, 00:00:01, and 00:00:02). The two hosts in the `hg-hpux` host group can

access only two LUs (00:02:01 and 00:02:02). The two hosts in the `hg-solar` host group can access only two LUs (00:01:05 and 00:01:06).



Disabling LUN security

Typically, you do not need to disable LUN security on ports. For example, if LUN security is disabled on a port, the connected hosts can access only the LUs associated with host group 0, and cannot access LUs associated with any other host group.



Host group 0 is the only host group reserved, by default, for each port. If you use the LUN Manager window to view a list of host groups in a port, host group 0, indicated by the number 00, usually appears at the top of the list.

The default name of host group 0 consists of the port name, a hyphen, and the number 00. For example, the default name of host group 0 for port 1A is 1A-G00. However, you can change the default name of the host group 0.

LUN security is disabled, by default, on each port. When you configure your storage system, you must enable LUN security on each port to which hosts are connected.

Enabling LUN security on a port

Before you begin

One of the following roles is required to perform this task:
- Storage Administrator (System Resource Management)
- Storage Administrator (Provisioning)

To protect mission-critical data in your storage system from illegal access, secure the logical volumes in the storage system. Use LUN Manager to secure LUs from illegal access by enabling LUN security on ports.

By default, LUN security is disabled on each port. When registering hosts in multiple host groups, you must enable LUN security (set the switch to enabled). When you change LUN security from disabled to enabled, you must specify the WWN of the host bus adapter.

Caution: It is best to enable LUN security on each port when configuring your storage system. Although you can enable LUN security on a port when host I/O is in progress, I/O is rejected with a security guard after enabling.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. Select the **Port Security** check box, and then select **Enable**.
6. Click **Finish**. A message appears, confirming whether to switch the LUN security. Clicking **OK** opens the **Confirm** window.
7. In the **Confirm** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Disabling LUN security on a port

Before you begin

One of the following roles is required to perform this task:

- Storage Administrator (System Resource Management)
- Storage Administrator (Provisioning)

Caution: Do not disable LUN security on a port when host I/O is in progress.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. In the **Ports/Host Groups/iSCSI Targets** window, click the **Ports** tab.
4. Select the desired port, and then click **Edit Ports**.
5. Select the **Port Security** check box, and then select **Disable**.
6. Click **Finish**. If disabling LUN security, a message appears, indicating that only host group 0 (the group whose number is 00) is to be enabled. Clicking **OK** opens the **Confirm** window.
7. In the **Confirm** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.

Setting Fibre Channel authentication

When configuring a Fibre Channel environment, use the **Authentication** window to set user authentication on host groups, Fibre Channel ports, and fabric switches of the storage system.

Note: Authentication operations are performed in a Device Manager - Storage Navigator secondary window. For more information about enabling and using secondary windows, see the *System Administrator Guide*.

The hosts to be connected must be configured for authentication by host groups (and for authentication of host groups by the host, if required). For details on how to configure the host for CHAP authentication, see the documentation of the operating system and Fibre Channel driver in your environment.

The following topics provide information for managing user authentication on host groups, Fibre Channel ports, and fabric switches:

- User authentication on page 351
- Fibre Channel authentication on page 359
- Fibre Channel port authentication on page 364
- Setting Fibre Channel port authentication on page 365
- Registering user information on a Fibre Channel port on page 366
- Registering user information on a fabric switch on page 366
- Clearing fabric switch user information on page 367

- Setting the fabric switch authentication mode on page 368
- Enabling or disabling fabric switch authentication on page 369

User authentication

When configuring a Fibre Channel environment, use LUN Manager to set user authentication for ports between your storage system and hosts. In a Fibre Channel environment, the ports and hosts use Null DH-CHAP or CHAP (Challenge Handshake Authentication Protocol with a Null Diffie-Hellmann algorithm) as the authentication method.

Note: User authentication is not supported for the CHB ports of the 4HF32R package.

User authentication is performed in a Fibre Channel environment in three phases:

1. A host group of the storage system authenticates a host that attempts to connect (authentication of hosts).
2. The host authenticates the connection-target host group of the storage system (authentication of host groups).

   Caution: Because the host bus adapters at present do not support this function, this authentication phase is unusable in the Fibre Channel environment.

3. A target port of the storage system authenticates a fabric switch that attempts to connect (authentication of fabric switches).

The storage system performs user authentication by host groups. Therefore, the host groups and hosts need to have their own user information for performing user authentication.

When a host attempts to connect to the storage system, the authentication of hosts phase starts. In this phase, first it is determined whether the host group requires authentication of the host. If it does not, the host connects to the storage system without authentication. If it does, authentication is performed for the host, and when the host is authenticated successfully, processing goes on to the next phase.

After successful authentication of the host, if the host requires user authentication for the host group that is the connection target, the authentication of host groups phase starts. In this way, the host groups and hosts authenticate with each other, that is, mutual authentication. In the authentication of host groups phase, if the host does not require user authentication for the host group, the host connects to the storage system without authentication of the host group.

The settings for authentication of host groups are needed only when you want to perform mutual authentication. The following topics explain the settings required for user authentication.

- Settings for authentication of hosts on page 352
- Settings for authentication of ports (required if performing mutual authentication) on page 352

Settings for authentication of hosts

On the storage system, use LUN Manager to specify whether to authenticate hosts on each host group.

On a host group that performs authentication, register user information (group name, user name, and secret) of the hosts that are allowed to connect to the host group. A secret is a password used in CHAP authentication. When registering user information, you can also specify whether to enable or disable authentication on a host basis.

On hosts, configure the operating system and Fibre Channel host bus adapter driver for authentication by host groups with CHAP. You need to specify the user name and secret of the host used for CHAP. For details, see the documentation of the operating system and Fibre Channel host bus adapter driver in your environment.

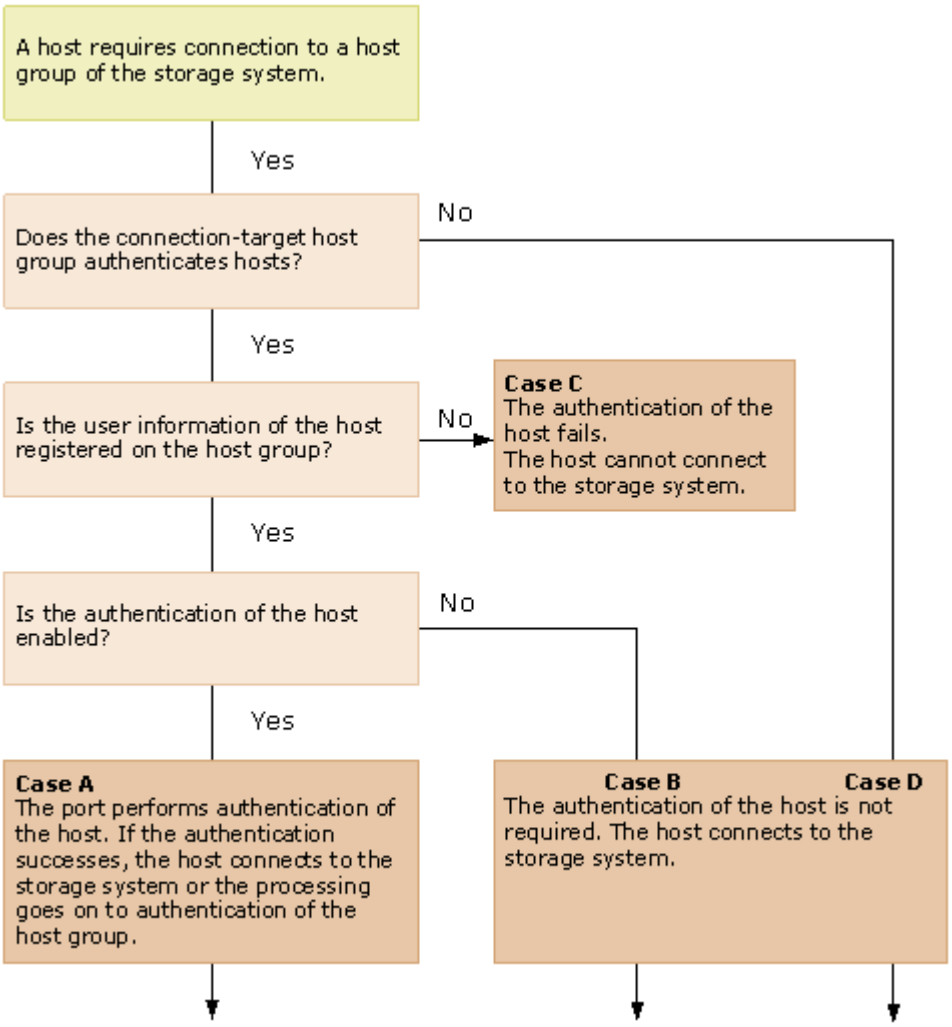
Settings for authentication of ports (required if performing mutual authentication)

On the storage system, use LUN Manager to specify user information (user name and secret) of each host group.

On hosts, configure the operating system and Fibre Channel host bus adapter driver for authenticating host groups with CHAP. You need to specify the user name and secret of the host group that is the connection target. For details, see the documentation of the operating system and Fibre Channel host bus adapter driver in your environment.

Host and host group authentication

When a host attempts to connect to the storage system, the connection of the authentication of the host differs depending on the host group settings. The following diagram illustrates the flow of authentication of hosts in a Fibre Channel environment. The connection use cases (Cases A, B, and C) are described below the diagram.



Authenticating hosts (Cases A, B, and C)

The following cases describe the examples of performing authentication of host groups.

Case A - The user information of the host is registered on the host group, and authentication of the host is enabled.

The host group authenticates the user information sent from the host. If authentication of the host is successful, either of the following occurs:

- When the host is configured for mutual authentication, authentication of the host group is performed.
- When the host is not configured for mutual authentication, the host connects to the storage system.

If the host is not configured for authentication by host groups with CHAP, the authentication fails and the host cannot connect to the storage system.

Case B - The user information of the host is registered on the host group, but authentication of the host is disabled.

The host group does not perform authentication of the host. The host will connect to the storage system without authentication regardless of whether the host is configured for authentication by host groups with CHAP.

Case C - The user information of the host is not registered on the host group.

Regardless of the setting on the host, the host group performs authentication of the host, but this results in failure. The host cannot connect to the storage system.

Not authenticating hosts (Case D)

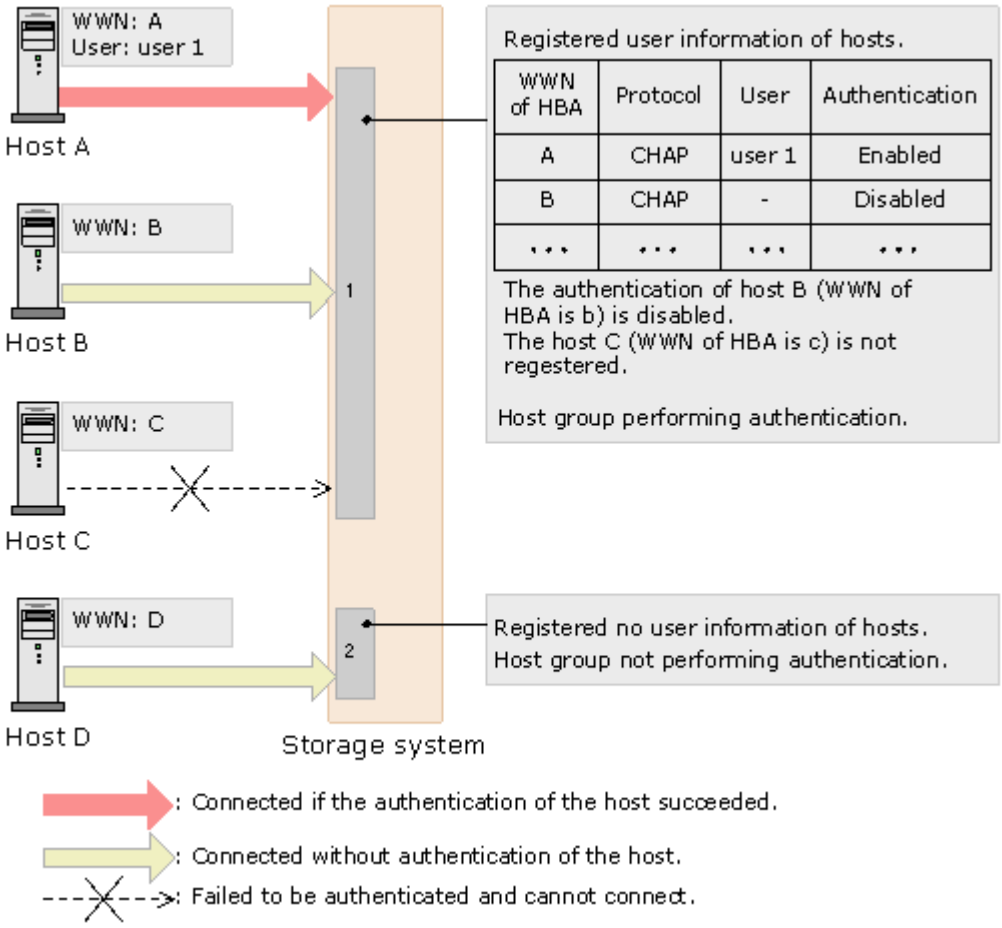
Case D is an example of connecting via a host group that does not perform authentication of hosts. The host will connect to the storage system without authentication of the host regardless of whether the host is configured for authentication by host groups with CHAP. In this case, though you do not need to register user information of the host on the host group, you can register it.

You should register user information of all hosts to be connected to a host group that performs authentication of hosts. To allow a specific host to connect to such a host group without authentication, configure the host group and the host as follows.

On the host group: Register the user information of the host you want to allow to connect without authentication, and then disable the authentication setting of the host.

Example of authenticating hosts in a Fibre Channel environment

Following is an example of authentication of hosts in a Fibre Channel environment. In this figure, WWNs of host bus adapters (HBAs) are abbreviated, such as A, B, and so on.



In the example, host group 1 performs authentication of hosts, and host group 2 does not.

The user information of host A is registered on the host group 1, and the authentication setting is enabled. Therefore, if the authentication of the host is successful, host A can connect to the storage system (or, the processing goes on to the authentication of the host group). As a precondition of successful authentication, host A should be configured for authentication by host groups with CHAP.

The user information of host B is also registered on the host group 1, but the authentication setting is disabled. Therefore, host B can connect to the storage system without authentication.

The user information of host C is not registered on the host group 1. Therefore, when host C tries to connect to the storage system, the authentication fails and the connection request is denied regardless of the setting on host C.

Host D is attached to the host group 2 that does not perform authentication of hosts. Therefore, host D can connect to the storage system without authentication.

During authentication of hosts, the connection is determined depending on the combination of the following host group settings:

- Setting of the host group in the Port tree: enable ( ) or disable ( )
- Whether the user information of the host that attempts to connect is registered on the host group

Port settings and connection results

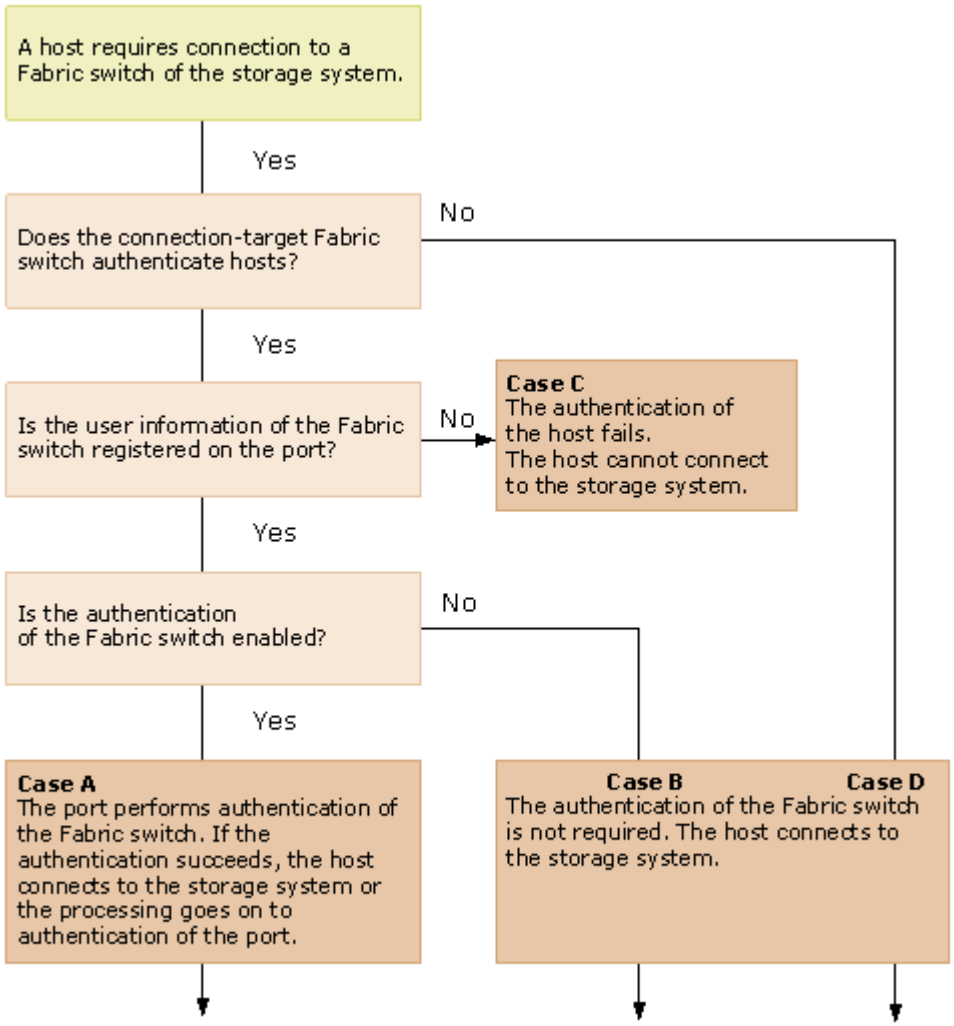
The following table shows the relationships between host group settings and the connection results in authentication of hosts. Unless otherwise noted, connection results are as described regardless of whether the host is configured for authentication by ports with CHAP.

Port settings		Host settings	Connection results
Authentication at host group	User information of host		
Enabled	Registered	Registered	Connected if the authentication of the host succeeded
Enabled	Registered	Not registered	Failed to be authenticated and cannot be connected
Enabled	Not registered	Registered	Failed to be authenticated and cannot be connected
Disabled	---	---	Connected without authentication of the host If a host is configured for authentication by ports with CHAP, authentication of the host will fail. To allow such a host to connect to the port without authentication, do not configure it for authentication by ports with CHAP.
---: This item does not affect the connection results, or cannot be specified.			

Fabric switch authentication

When a host attempts to connect to the storage system, the connection results of the authentication of the fabric switch differs depending on the fabric switch setting related to each port.

The following figure illustrates the flow of authentication between fabric switch settings and the connection results. The setting of fabric switch authentication is independent from the setting of host authentication. The connection use cases are detailed below the diagram.



Authenticating fabric switches by ports (Cases A, B, and C)

- If the user information of the fabric switch is registered on the port, and authentication of the fabric switch is enabled (Case A)

  Each port authenticates the fabric switch. If the authentication of the fabric switch ends successfully, either of the following actions occurs:
  - When the fabric switch is configured for mutual authentication, processing continues to authentication of the port.
  - When the fabric switch is not configured for mutual authentication, the fabric switch connects to the storage system.

  If the fabric switch of the port is not configured for authentication with CHAP, the authentication fails and the fabric switch cannot connect to the storage system.
- If the user information of the fabric switch is registered on the port, but authentication of the fabric switch is disabled (Case B)

Each port does not perform authentication of the fabric switch. The fabric switch connects to the storage system without authentication regardless of whether the fabric switch is configured for authentication with CHAP.

- If the user information of the fabric switch is not registered on the port (Case C)
  Regardless of the setting on the fabric switch, the port performs authentication of the fabric switch, but results in failure. The fabric switch cannot connect to the storage system.

Not authenticating fabric switches by ports (Case D)

The fabric switch connects to the storage system without authentication of the host regardless of whether the fabric switch is configured for authentication with CHAP. In this case, though you need not register the user information of the fabric switch on the port, you can register it.

During authentication of hosts, the connection result is determined depending on the combination of the following port settings:

- Setting of the port in the Port tree: enable () or disable ()
- Whether the user information of the fabric switch that attempts to connect is registered on the port

Fabric switch settings and connection results

The following table shows the relationship between the combinations of port settings and the connection results in authentication of fabric switches. Unless otherwise noted, connection results are as described regardless of whether the host is configured for authentication by fabric switches with CHAP.

Port Settings		fabric switch settings	Connection results
Authentication at fabric switch	User information of fabric switch		
Enabled	Registered	Registered	Connected if the authentication of the fabric switch succeeded
Enabled	Registered	Not registered	Failed to be authenticated and cannot be connected
Enabled	Not registered	Registered	Failed to be authenticated and cannot be connected
Disabled	---	---	Connected without authentication of the fabric switch If a fabric switch is configured for authentication by ports with CHAP, authentication of the host will fail. To allow such a fabric switch to connect to the port

Port Settings		fabric switch settings	Connection results
Authentication at fabric switch	User information of fabric switch		
			without authentication, do not configure it for authentication by ports with CHAP.
---: This item does not affect the connection results, or cannot be specified.			

Mutual authentication of ports

If mutual authentication is required, when authentication of a host is successful, the host in return authenticates the port. In authentication of ports, when user information (user name and secret) specified on the port side matches with that stored on the host, the host allows the host group to connect.

Fibre Channel authentication

Enabling or disabling host authentication on a host group

You can specify whether to authenticate hosts on each host group. Change the user authentication settings of host groups to enable or disable authentication of hosts. By default, user authentication is disabled.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to enable or disable host authentication, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.

   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.
4. Double-click the **Fibre** folder and Fibre Channel port icon under the **Fibre** folder.

   When you double-click the **Fibre** folder, the Fibre Channel ports contained in the storage system appear as icons. If you double-click the fibre channel ports, host groups appear as icons. On the right of each icon appears the host group name.

 indicates the host group authenticates hosts. This is the default.

 indicates the host group does not authenticate hosts.

5. Right-click a host group that appears with  and select **Authentication:Disable > Enable**. The host group icon  changes to  , and the port name appears in blue.
6. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
7. Click **OK** to close the message. The settings are applied to the storage system.

   To return the host group setting to  , perform the same operation, except select the **Authentication:Enable > Disable** menu in step 4.

Registering host user information

On a host group that performs authentication of hosts, register user information of all hosts that you allow to connect.

You should register user information of all the hosts to be connected to a host group that performs authentication of hosts. To allow a specific host to connect to such a host group without authentication, configure the host group and the host as follows.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to register host user information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

On the host: It does not matter if you configure the host for authentication by ports with CHAP, or not.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, select a port or host group on which you want to register user information of a host.

   The user information of hosts currently registered on the selected port or host group appears in the **Authentication Information (Host)** list below the **Authentication Information (Target)** list.

You can register user information of a host even if the port status is  . In this case, however, the registered user information of a host is ignored.

4. Right-click any point in the **Authentication Information (Host)** list and select **Add New User Information**. The **Add New User Information (Host)** dialog box opens.
5. In this dialog box, specify the following user information of the host you want to allow connection.
   - **Group Name**: Specify the group name of host bus adapter. Select one from the list. In the list, all the group names of host bus adapters connected to the selected port by the cable appear.
   - **User Name**: Specify the WWN of the host bus adapter with 16 characters. You can use hexadecimal characters in a user name.
   - **Secret**: Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters.

     You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : [ ] , ~
   - **Re-enter Secret**: Specify the secret, again, for confirmation.
   - **Protocol**: Specify the protocol used in the user authentication. This protocol is fixed to `CHAP`.
6. Click **OK** to close the **Add New User Information (Host)** dialog box. The specified user information of the host is added in blue in the **Authentication Information (Host)** list of the **Authentication** window.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
8. Click **OK** to close the message. The settings are applied to the storage system.

Changing host user information registered on a host group

You can change the registered user name or secret of a host, and enable and disable authentication settings after registration.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to change host user information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

You cannot change the WWN when you change user information.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.

2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, expand the **Fibre** folder and select a port or host group on which the user information you want to change is registered.

   All the user information of the hosts registered on the selected port or host group appears in the **Authentication Information (Host)** list below the **Authentication Information (Target)**.
4. In the **User Information (Host)** list, right-click a user information item that you want to change and select **Change User Information**. The **Change User Information (Host)** dialog box opens.
5. Change the user information of the host in the **Change User Information (Host)** dialog box. You can change the specifications of **User Name**, and **Secret**.
6. Click **OK** to close the **Change User Information (Host)** dialog box. The user information of the host is changed in blue in the **Authentication Information (Host)** list of the **Authentication** window.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
8. Click **OK** to close the message. The settings are applied to the storage system.

Deleting host user information

You can delete registered user information from a host group.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to delete host user information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, expand the **Fibre** folder and select a port or host group on which the user information you want to delete is registered.

   The user information of hosts currently registered on the selected port or host group appears in the **Authentication Information (Host)** list below the **Authentication Information (Target)**.
4. In the **Authentication Information (Host)** list, right-click a user information item that you want to delete.

5. Select **Delete User Information**. The **Delete Authentication Information** dialog box opens asking whether to delete the selected host user information.
6. Click **OK** to close the message.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the setting to the storage system.
8. Click **OK** to close the message. The setting is applied to the storage system.

Registering user information for a host group (for mutual authentication)

You can perform mutual authentication by specifying user information for host groups on the storage system ports. Specify unique user information for each host group. You can change the specified user information for host groups in the same way you initially specify it.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to register user information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, select a port or host group whose user information you want to specify.

   The currently registered user information of the selected port or host group appears in the **Authentication Information (Target)** list.
4. Right-click any point in the **Authentication Information (Target)** list and select **Specify Authentication information**.
5. In the **Specify Authentication Information** dialog box, specify the user information of the port or host group selected in the **Port** tree.
   - **Port Name**: The port name of the selected port appears. You cannot change the port name.
   - **User Name**: Specify the user name of the host group with 16 characters. You can use specified hexadecimal characters. User names are not case-sensitive.
   - **Secret**: Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters. You can use alphanumeric characters, spaces, and the following symbols in a user name: . - + @ _ = : / [ ] , ~
   - **Re-enter Secret**: Specify the secret, again, for confirmation.

6. Click **OK** to close the **Specify Authentication Information** dialog box. The specified user information of the port appears in blue in the **Authentication Information (Target)** list of the **Authentication** window.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
8. Click **OK** to close the message. The settings are applied to the storage system.

Clearing user information from a host group

You can clear user information from a host group.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to clear user information from a host group, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, expand the **Fibre** folder and select a port or host group whose user information you want to clear.

   The currently registered user information of the port or host group appears in the **Authentication Information (Target)**.
4. Right-click any point in the **Authentication Information (Target)** list and select **Clear Authentication information**. The **Clear Authentication Information** dialog box opens asking whether to clear the user information of the selected host group.
5. Click **OK** to close the **Clear Authentication Information** dialog box. The user information of the selected host group disappears from the **Authentication Information (Target)** list.
6. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the setting to the storage system.
7. Click **OK** to close the message. The setting is applied to the storage system.

Fibre Channel port authentication

Setting Fibre Channel port authentication

You can perform user authentication in a Fibre Channel environment by specifying authentication information on the Fibre Channel ports of the storage system.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to set port information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.
   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder. Information about the port appears in the **Port Information** list of the **Authentication** window.
4. Right-click any point in the **Port Information** list and select **Set Port Information**.
5. In the **Set Port Information** dialog box, specify the port information.
   - **Time out**: Specify the period of time from when authentication fails to when the next authentication session is ended. This period of time is between 15 to 60 seconds. The initial value of the **Time out** is 45 seconds.
   - **Refusal Interval**: Specify the interval from when connection to a port fails to when the next authentication session starts, with up to 60 minutes. The initial value of the **Refusal Interval** is 3 minutes.
   - **Refusal Frequency**: Specify the number of times of authentication allowable for connection to a port with up to 10 times. The initial value of the **Refusal Frequency** is 3 times.
6. Click **OK** to close the **Set Port Information** dialog box.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
8. Click **OK** to close the message. The settings are applied to the storage system.

Registering user information on a Fibre Channel port

You can perform user authentication in a Fibre Channel environment by registering user information on the Fibre Channel ports of the storage system.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to register user information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.
   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.
4. In the **Port** tree, double-click the **Fibre** folder. Information about the port appears in the tree of the **Authentication** window.
5. Right-click any icon of port in the **Port** tree and select **Default Setting (User Name/Secret)**.
6. In the **Default Setting (User Name/Secret)** dialog box, specify the user information.
   - **User Name**: Specify the user name of Fibre Channel with up to 16 characters. You can use hexadecimal characters in a user name. User names are not case-sensitive.
   - **Secret**: Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters.
     You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : / [ ] , ~
   - **Re-enter Secret**: Specify the secret, again, for confirmation.
7. Click **OK** to close the **Default Setting(User Name/Secret)** dialog box.
8. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the setting to the storage system.
9. Click **OK** to close the message. The setting is applied to the storage system.

Registering user information on a fabric switch

You can perform user authentication in a Fibre Channel environment by registering user information on the fabric switch of the storage system.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to specify authentication information, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.
   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.
4. In the **Port** tree, double-click the **Fibre** folder. Information about the fabric switch appears in the **Fabric Switch Information** list below the **Port Information** list.
5. Right-click any point in the **Fabric Switch Information** list and select **Specify User Information**.
6. In the **Specify Authentication Information** dialog box, specify the user information of the host you want to allow connection.
   - **User Name**: Specify the user name of the fabric switch with up to 16 characters.
     You can use hexadecimal characters in a user name. User names are not case-sensitive.
   - **Secret**: Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters.
     You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : / [ ] , ~
   - **Re-enter Secret**: Specify the secret, again, for confirmation.
7. Click **OK** to close the **Specify Authentication Information** dialog box.
8. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
9. Click **OK** to close the message. The settings are applied to the storage system.

Clearing fabric switch user information

You can clear the specified user information of a fabric switch from the storage system.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to clear authentication information, other users or

programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.
   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.
4. In the **Port** tree, double-click the **Fibre** folder. Information about the fabric switch appears in the **Fabric Switch Information** list below the **Port Information** list.
5. Right-click any point in the **Fabric Switch Information** list and select **Clear Authentication Information**. The **Clear Authentication Information** dialog box opens asking whether to clear the user information of the selected fabric switch.
6. Click **OK** to close the **Clear Authentication Information** dialog box.
7. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
8. Click **OK** to close the message. The settings are applied to the storage system.

Setting the fabric switch authentication mode

You can specify the authentication mode of a fabric switch.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to set the fabric switch authentication mode, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. On the menu bar, select **Actions > Port/Host Group > Fibre > Authentication**.
2. In the **Authentication** window, click  to change to **Modify** mode.
3. In the **Port** tree, double-click the **Storage System** folder.
   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.

4. In the **Port** tree, double-click the **Fibre** folder. Information about the fabric switch appears in the **Fabric Switch Information** list below the **Port Information** list.
5. Right-click any point in the **Fabric Switch Information** list and select **Authentication Mode: unidirectional > bi-directional**.
6. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
7. Click **OK** to close the message. The settings are applied to the storage system.
8. To return the Fibre Channel setting, perform the same operation, except that you must select the **Authentication Mode: bi-directional > unidirectional** menu in step 4.

Enabling or disabling fabric switch authentication

By default, the fabric switch authentication is disabled. To enable fabric switches to authenticate hosts, enable the user authentication settings of fabric switches.

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from the **Authentication** secondary window to enable or disable fabric switch authentication, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the System Administrator Guide.

Procedure

1. In the **Authentication** window, click  to change to **Modify** mode.
2. In the **Port** tree, double-click the **Storage System** folder.

   If the storage system contains any Fibre Channel boards, the **Fibre** folder appears below the **Storage System** folder.
3. In the **Port** tree, double-click the **Fibre** folder. Information about the fabric switch appears in the **Fabric Switch Information** list below the **Port Information** list.
4. Right-click any point in the **Fabric Switch Information** list and select **Authentication:Disable > Enable**.
5. Click **Apply** in the **Authentication** window. A message appears asking whether to apply the settings to the storage system.
6. Click **OK** to close the message. The settings are applied to the storage system.

   To return the fabric switch setting so that the switch cannot authenticate hosts, perform the same operation, except select the **Authentication:Enable > Disable** menu in step 4.

Overview for iSCSI

An iSCSI (Internet SCSI) is a protocol for sending and receiving a SCSI command through an IP network. iSCSI transfers data in block units. An IP-SAN that uses an existing Ethernet can be constructed by using iSCSI. In the network for iSCSI, LUN Manager manages access paths between hosts and volumes, for each port in your storage system. LUN Manager has the following features:

- Connecting multiple hosts to an port
  With LUN Manager, you can connect more than one host to a port on your storage system.
  When setting up host connections in LUN Manager, for each host you specify the settings for host mode, volume, and iSCSI target. Each host can access a volume simulating a dedicated port to the host even if that host shares the port with other hosts.

- Mapping volumes to hosts
  With LUN Manager, you can map or assign volumes to the hosts on your network. You have complete flexibility to share or restrict volume access among the hosts.

- Network security
  With LUN Manager, you can enable or disable CHAP (Challenge Handshake Authentication Protocol), a security protocol that requires users to enter a secret for access.

Network configuration for iSCSI

An iSCSI connection makes it possible to construct an IP-SAN by connecting many hosts and storage systems at a low cost. However, iSCSI greatly increases the I/O workload of the network and the storage system. When using iSCSI, it is very important that you configure the network so that the workload among the network, port, controller, and drive is properly distributed.

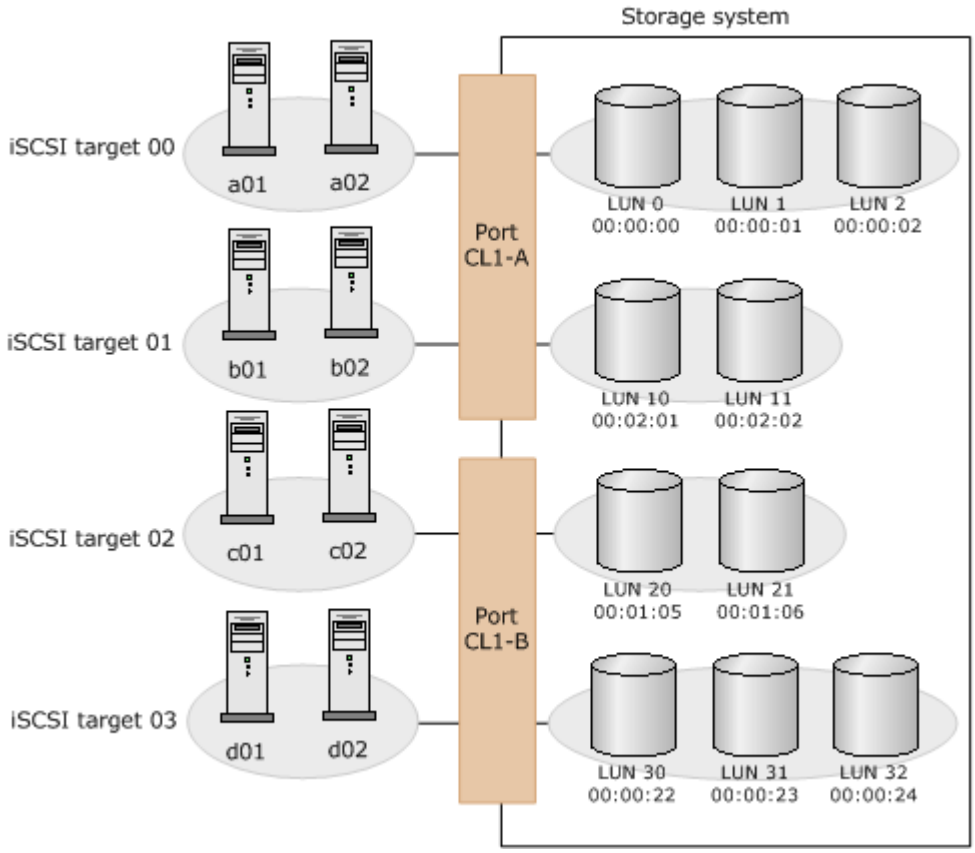
Even though the LAN switches and NICs are the same, there are some important differences when you use iSCSI, particularly regarding the LAN connection. You need to focus particular attention to the following:

- iSCSI consumes almost all of the available Ethernet bandwidth, unlike a conventional LAN connection. This can significantly degrade the performance of both the iSCSI traffic and the LAN. Therefore, it is very important that you separate the iSCSI IP-SAN and the office LAN.

- Host I/O load will affect the iSCSI response time. In general, the greater the I/O traffic is, the lower the iSCSI performance.

- You need to have a failover path between host and iSCSI, so that you can update the firmware without stopping the system.

The following figure shows LU paths configuration in a Fibre Channel environment. The figure shows the iSCSI target 00 associated with three logical volumes (00:00:00, 00:00:01, and 00:00:02). LU paths are defined between the two hosts in the iSCSI target 00 and the three logical volumes.



You can define paths between a single server host and multiple LUs. The figure shows that each of the two hosts in the iSCSI target 00 can access the three LUs.

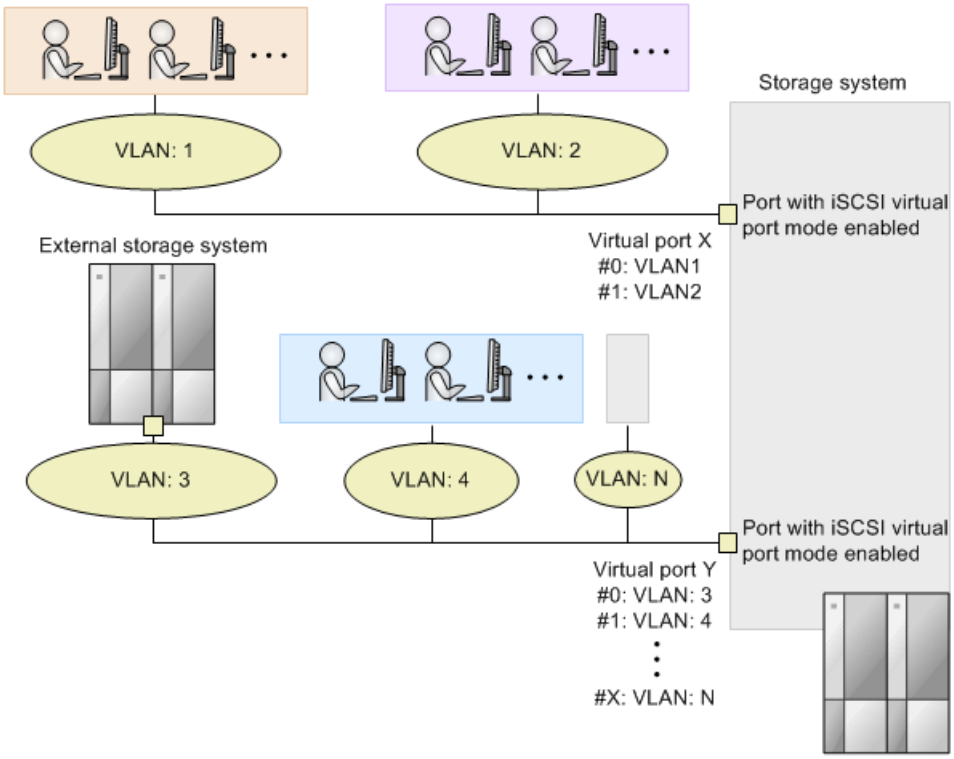
You can also define paths between multiple server hosts and a single LU. The figure shows that the LU identified by the LDKC:CU:LDEV number 00:00:00 is accessible from the two hosts that belong to the iSCSI target 00.

Multi VLAN operations with iSCSI virtual port mode

Multi VLAN operations are supported with the iSCSI virtual port mode. The iSCSI virtual port mode enables you to add up to 16 virtual ports to a single physical iSCSI port. Virtual ports are used to access the storage system using multiple segments that are divided by VLAN, enabling efficient use of ports and network resources.

You can perform the following multi VLAN operations using Command Control Interface. For details about the commands, see the CCI manuals.

- Enabling and disabling the iSCSI virtual port mode
- Adding and deleting virtual ports



Cautions for using the iSCSI virtual port mode:

- The iSNS function cannot be used when the virtual port mode is enabled.
- If the virtual port mode is enabled, the port information when the virtual port mode is disabled is taken over to the iSCSI virtual port ID (0). If iSCSI port IDs that are from 1 to 15 are added, specify IPv4 or IPv6.
- If an IPv6 address is used on a virtual port, multiple virtual ports cannot be used in the same network.
- If the setting for the virtual port mode is changed, Link Down/Link Up(temporary disconnecting) occurs on the target iSCSI ports. Therefore, when you change the setting of the system that are being connected by hosts, not to put the high workload for the system, perform the maintenance operations when the I/O loads are low.

Managing hosts

Changing WWN or nickname of a host bus adapter

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

In Fibre Channel environments, host bus adapters can be identified by WWNs or nicknames.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Hosts** tab, and then click the **Port ID** of the **HBA WWN** or **Host Name** you want to change.
4. Click **Edit Host**.
   a. To change the WWN, select the **HBA WWN** check box, and then type a new WWN.
   b. To change the nickname, select a **Host Name** check box, and then type a new nickname.

   If you check **Apply same settings to the HBA WWN in all ports**, new settings affect other ports. For example, if the same host bus adapter (the same WWN) is located below ports CL1-A and CL2-A in the tree, when you select the host bus adapter (or the WWN) from below one of the ports and change the nickname to hba1, the host bus adapter below the other port will also be renamed hba1.

   However, new settings will not affect any port if:
   - The resulting nickname is already used as the nickname of a host bus adapter connected to the port.
   - The resulting WWN exists in the port.
5. Click **Finish**.

   The **Confirm** window appears.
6. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

   If **Apply same settings to the HBA WWN in all ports** is checked, a dialog box opens listing the host bus adapter to be changed. Confirm the changes and click **OK**. Otherwise, click **Cancel**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing HBA iSCSI name or nickname of a host bus adapter

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

In iSCSI environments, host bus adapters can be identified by HBA iSCSI names or nicknames.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Hosts** tab, and then click the **Port ID** of the **HBA iSCSI Name** or **Host Name** you want to change.
4. Click **Edit Host**.
   a. To change the HBA iSCSI name, select the **HBA iSCSI Name** check box, and then type a new iSCSI name.
   b. To change the nickname, select a **Host Name** check box, and then type a new nickname.

   If you check **Apply same settings to the HBA iSCSI Name in all ports**, new settings affect other ports. For example, if the same host bus adapter (the same iSCSI Name) is located below ports CL1-A and CL2-A in the tree, when you select the host bus adapter (or the iSCSI Name) from below one of the ports and change the nickname to hba1, the host bus adapter below the other port will also be renamed hba1.

   However, new settings will not affect any port if:
   - The resulting nickname is already used as the nickname of a host bus adapter connected to the port.
   - The resulting iSCSI name exists in the port.
5. Click **Finish**.

   The **Confirm** window appears.
6. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.

   If **Apply same settings to the HBA WWN in all ports** is checked, a dialog box opens listing the host bus adapter to be changed. Confirm the changes and click **OK**. Otherwise, click **Cancel**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing the name, host mode, or host mode options of a host group

Use this procedure to change the name, host mode, or host mode options (HMOs) of a host group.

Caution:
- Before changing the host mode of a host group, you should back up data on the port to which the host group belongs. Changing the host mode should not be destructive, but data integrity cannot be guaranteed without a backup.
- When a port has a path defined for an LDEV with the GAD reserve attribute and you need to change the host mode, the operation might fail if you configure more than one port at a time. For ports that have a path defined for an LDEV with the GAD reserve attribute, perform this operation on one port at a time.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. On the **Host Groups** tab, select the **Port ID** of the host group you want to change.
4. Click **More Actions** and then click **Edit Host Groups**.
   a. To change the name of the host group, select **Host Group Name**, and then enter the new host group name.
   b. To change the host mode, select **Host Mode**, and then select the new host mode. For details about host modes, see Host modes for host groups on page 326.
   c. To change a host mode option, select the host mode option and click **Enable** or **Disable**. For details about host mode options, see Host mode options on page 327.
5. Click **Finish**.
   The **Confirm** window appears.
6. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Changing iSCSI target setting

Use LUN Manager to change the name or host mode of a iSCSI target. You can change only the host mode option of the host group for the initiator port. You cannot use this procedure on the host group for the external port.

Caution:
- Before changing the host mode of an iSCSI target, you should back up data on the port to which the iSCSI target belongs. Setting host mode should not be destructive, but data integrity cannot be guaranteed without a backup.
- When a secret is changed two times or more for the same iSCSI target successively, perform the next change after waiting for the completion of the task that has been applied. If the secret is changed without waiting for the completion of the task that has been applied, the user name which you expected to be changed can not be incorporated.

Before you begin

To perform this task, following roles are required:
- Storage Administrator (Provisioning) role
- Security Administrator (View and Modify) role

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. On the **iSCSI Targets** tab, select the **Port ID** of the iSCSI target you want to change.
4. Display the **Edit iSCSI Targets** window by performing the following:
   Click **Edit iSCSI Targets**. Or click **More Actions** and then select **Edit iSCSI Targets**. Or from the **Actions** menu, select **Ports/Host Groups**, **iSCSI**, and then **Edit iSCSI Targets**.
5. In the **Edit iSCSI Targets** window, select **ON** and specify the values. The following values can be modified:
   - **iSCSI Target Alias**: Specifies the alias of the iSCSI target.
   - **iSCSI Target Name**: Selects the format from iqn or eui, and specifies the name of the iSCSI target.
   - **Host Mode**: Selects the host mode and the host mode option. For detailed information about host mode options, see Host mode options on page 327.
   - **Authentication Method**: Selects the CHAP authentication mode from Comply with Host Setting, CHAP, or None.
   - **Mutual CHAP**: Selects **Enable** or **Disable**. If **Enable** is selected, the mutual authentication mode is performed. If **Disable** is selected, the unidirectional authentication mode is performed.

- **User Name**: Specifies the user name. You can use case-sensitive alphanumeric characters, spaces, and the following symbols:
  . - + @ _ = : [ ] , ~
- **Secret**: Specifies the password. You can use alphanumeric characters, spaces, and the following symbols in a secret:
  . - + @ _ = : [ ] , ~

6. Click **Finish**.
   If **OK** is clicked, either the **Edit iSCSI Targets** window or the **Confirm** window appears. If the **Confirm** window appears proceed to the next step. If the **Edit iSCSI Targets** window appears, go to step 3 and edit the settings again.
7. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Removing hosts from iSCSI targets

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select hosts in the **Hosts** tab.
4. Display the **Remove Hosts** window by performing one of the following:
   - Click **Remove Hosts**.
   - Click **Remove Hosts (iSCSI)**.
   - Click **More Actions**, then select **Remove Hosts(iSCSI)**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, then **Remove Hosts**.
5. Click **Finish**.
   The **Confirm** window appears.
6. In the **Task Name** text box, enter the task name.
   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
7. Click **Apply**.
   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Initializing host group 0

Use this procedure to set host group 0 (zero) to its initial state. This removes all the WWNs from host group 0 and also removes all the LU paths related to host group 0. The procedure also changes the host mode of host group 0 to Standard and initializes the host group name. For example, if you initialize host group 0 for the port CL1-A, the name of host group 0 will change to 1A-G00.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click the link of a host group.
4. Select the **Host Groups** tab.
5. Select the host group 0 which is displayed as `host group (00)`.
6. Click **More Actions** and select **Delete Host Groups**.
7. Confirm the settings and enter the task name in the **Task Name** box.

   A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
8. Click **Apply** in the **Delete Host Groups** window.

   A message appears, asking whether to delete it.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.
9. Click **OK** to close the message.

Deleting a host bus adapter from a host group

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Click the link of a host group.
4. Select a host bus adapter.
5. Click **More Actions** and **Remove Hosts**.

6. If necessary, check **Remove selected hosts from all host groups containing the hosts in the storage system** in the **Remove Hosts** window.

   If the option is checked, the selected hosts are removed from all host groups containing the hosts in the storage system.
7. Click **Finish**.

   The **Confirm** window appears.
8. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
9. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Deleting WWNs from the WWN table

If you disconnect a host that has been connected with a cable to your storage system, the WWN of the host remains listed in the Login WWNs tab. Use this procedure to delete WWNs of a host that is no longer connected to your storage system from the WWN list.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Login WWNs/iSCSI Names** tab.

   To confirm the statuses of WWNs, click **View Login WWN Statuses** window.
4. In the **Login WWNs** tab, select the WWNs you want to delete.
5. Click **Delete Login WWNs**.
6. Click **Finish**.

   The **Confirm** window appears.
7. In the **Task Name** text box, enter the task name.

   You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
8. Click **Apply**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Deleting a host group

Use this procedure to delete a host group.

If host group 0 (zero) is deleted, all WWNs that belong to host group 0 are deleted and all LU paths that correspond to host group 0 are deleted. The host mode of host group 0 becomes Standard, and the host group name is initialized. To remove all the WWNs and LU paths from host group 0, you must initialize host group 0. For details, see Initializing host group 0 on page 378.

Caution:

- If you plan to delete a host group that includes paths to LDEVs with the GAD reserve attribute, reduce the number of LDEVs in the host group to 100 or fewer before deleting the host group. Host group deletion might fail if the number of LDEVs in the host group is too large.
- When a port has a path defined for an LDEV with the GAD reserve attribute and you need to configure the port (delete a host group, set a command device, or change the host mode, topology, AL-PA, or transfer speed), the operation might fail if you configure more than one port at a time. For ports that have a path defined for an LDEV with the GAD reserve attribute, perform these operations on one port at a time.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Host Groups** tab, or select a port from the tree then select the **Host Groups** tab.
4. Select a host group that you want to delete.
5. Select **Delete Host Groups**.
6. In the **Delete Host Groups** window, confirm the settings, in **Task Name** type a unique name or accept the default, and then click **Apply**.

   If **Go to tasks window for status** is checked, the **Tasks** window opens.
7. Click **OK** to close the message.

Deleting an iSCSI target

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Caution: This task cannot be performed if corresponding with following:
- Host I/O processing is being performed.
- Hosts are not reserved (mounted) in the iSCSI target.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the iSCSI target that you want to delete.
4. Display the **Delete iSCSI Targets** window by performing one of the following:
   - Click **More Actions**, then select **Delete iSCSI Targets**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, then **Delete iSCSI Targets**.
5. In the **Delete iSCSI Targets** window, confirm the settings, in **Task Name**, type a unique name for this task or accept the default, then click **Apply**.
   If Go to tasks window for status is checked, the **Tasks** window opens.
6. Click **OK** to close a message.

Deleting login iSCSI names

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Note: If you disconnect a host that has been connected through a cable to your storage system, the iSCSI name for the host will remain in the Login WWNs/iSCSI Names tab. Use the **Delete Login WWNs** window to delete from the Login WWNs/iSCSI Names tab. A login iSCSI name for a host that is no longer connected to your storage system.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Login WWNs/iSCSI Names** tab. To confirm the statuses of iSCSI names, click **View Login iSCSI Name Statuses** window.
4. Select the iSCSI names you want to delete.
5. Display the Delete Login iSCSI Names window by performing one of the following
   - Click **Delete Login iSCSI Names**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, then **Delete Login iSCSI Names**.

6. In the **Delete Login iSCSI Names** window, confirm the settings, in **Task Name**, type a unique name for this task or accept the default, then click **Apply**.
7. Click **OK** to close a message.

Adding a selected host to a host group

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Hosts** tab, or select a port from the tree then select the **Hosts** tab.
4. Select a host that you want to add.
5. Select **Add to Host groups**.
6. Select the desired host groups from the **Available Host Groups** table, and then click **Add**.

   Selected host groups are listed in the **Selected Host Groups** table.

   If you select a row and click **Detail**, the **Host Group Properties** window appears.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Add to Host groups** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, and then click **Apply**.
   If **Go to tasks window for status** is checked, the **Tasks** window opens.
9. Click **OK** to close the message.

Adding a host to the selected host group

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Host Groups** tab.
4. Select the host group for the host you want to add.
5. Select **Add to Hosts**.

6. Select the desired host from the **Available Hosts** table, and then click **Add**.

   Selected host groups are listed in the **Selected Hosts** table.

   If the desired host has never been connected with a cable to any port in the storage system, perform the following steps:

   a. Click **Add New Host** under the **Available Hosts** list.
      The **Add New Host** dialog box opens.
   b. Enter the desired WWN in the **HBA WWN** box.
   c. If necessary, enter a nickname for the host bus adapter in the **Host Name** box.
   d. Click **OK** to close the **Add New Host** dialog box.
   e. Select the desired host bus adapter from the **Available Hosts** list.
7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Add to Host groups** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, and then click **Apply**.
   If **Go to tasks window for status** is checked, the **Tasks** window opens.
9. Click **OK** to close the message.

Adding a host to the selected iSCSI target

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Host** tab.
4. Select the iSCSI target for the host you want to add.
5. Select **Add to Hosts**.
6. Select the desired host from the **Available Hosts** table, and then click **Add**.

   Selected iSCSI targets are listed in the **Selected Hosts** table.

   If the desired host has never been connected with a cable to any port in the storage system, perform the following steps:

   a. Click **Add New Host** under the **Available Hosts** list.
      The **Add New Host** dialog box opens.
   b. Select the format from **iqn** or **eui**. Enter the desired HBA iSCSI name in the **HBA iSCSI Name** box.
   c. If necessary, enter a nickname for the host bus adapter in the **Host Name** box.

d. Click **OK** to close the **Add New Host** dialog box.
e. Select the desired host bus adapter from the **Available Hosts** list.

7. Click **Finish**.
   The **Confirm** window appears.
8. In the **Add to Host groups** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, and then click **Apply**.
   If **Go to tasks window for status** is checked, the **Tasks** window opens.
9. Click **OK** to close the message.

Confirming communication status

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. From the Storage Navigator, click **Actions**, **Ports/Host Groups/iSCSI**, and then **Authentication** to open the **Test Communication Statuses** window.
2. Select the port ID from **Local Port ID (From)**.
3. In **IP Address (To)**, select **IPv4** or **IPv6** then specify the IP address.
4. Click **Test**.
5. In the **Communication Statuses** table, confirm the result.
6. Click **Close**.

Creating LDEVs used as system drives of NAS

To apply the settings of LDEVs used for system drives of NAS, you must add LU paths between target LEVs and dedicated host groups.

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The NAS module must be installed in the storage system.
- LDEVs used as system drives of NAS must already be created.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets** and select the target host group or iSCSI target.
3. Click **Add LUN Paths**.
4. In the **Select LDEVs** window, select target LDEVs from the **Available LDEVs** table, then click **Add**.

Added LDEVs are listed in the Selected LDEVs table.

5. Click **Next**.
6. In **Selection Object**, click **NAS Platform (User LU)**.
7. Dedicated host groups are listed in the **Selected Host Groups** table.

Note: In the window, **Available Host Groups**, **Add**, and **Remove** are inactive.

If you select the check box of the row, and then click **Detail**, the **Host Group Property** window appears.

8. Click **Next**.
9. Confirm the defined LU paths.

   To change the LDEV name:

   1. Select the check boxes of LDEV IDs that you want to change.
   2. Click **Change LDEV Settings**.
   3. In the **Change LDEV Settings** window, specify values in **Prefix** and **Initial Number**.
   4. Click **OK**.

   To change the LUN ID:

   1. In the LUN ID column (Any number Sets of Paths), select the host groups (iSCSI Targets) checkboxes.
   2. Select the check box of the LDEV ID that you want to change.
   3. Click **Change LUN IDs**.
   4. In the **Change LUN IDs** window, specify the value in **Initial LUN ID**.
   5. Click **OK**.

10. Click **Finish**.
    The **Confirm** window appears.
11. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
12. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Setting the T10 PI mode on a port

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- Access to the CHB(FC) Fibre Channel board port is required.
- The port speed must be 16 Gbps or 32 Gbps.

Caution: If you change the T10 PI mode of one port, the T10 PI mode of the other port paired with changed port also needs to be changed. You must verify the mode of each port in the pair before changing the T10 PI mode. Make sure the ports in each pair are the same in the resource group. The following shows pairs of port IDs.

If you change the setting on one of the ports in the pair, the setting on the other port in the pair will also be changed:

- Port IDs 1*x* and 3*x* (where *x* is a letter from A to R). For example, 1A and 3A can be paired with each other.
- Port IDs 2*x* and 4*x* (where *x* is a letter from A to R). For example, 2B and 4B can be paired with each other.
- If the T10 PI mode of the CHB port of the 4HF32R package, port IDs 1*x*, 3*x*, 5*x*, and 7*x* (where *x* is a letter from A to R) are collectively changed.

Note: If the T10 PI mode is enabled between the path of the target port and LDEV, you cannot disable the T10 PI mode of the port.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **Ports** tab.
4. Select the desired port.

   To collectively change the T10 PI mode of ports, do not intermix ports with enabled or disabled T10 PI modes.
5. Click **Edit Ports**.
6. Click **OK** on the message window.
7. Select **Enable** or **Disable** on the **Edit T10 PI Mode** window.
8. Click **Finish**. The **Confirm** window appears.
9. In the **Confirm** window, confirm the settings. In the **Task Name**, type a unique name for this task or accept the default, then click **Apply**. If **Go to tasks window for status** is checked, the **Tasks** window opens.

Creating iSCSI targets and registering hosts in an iSCSI target

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Enter the iSCSI alias in the **iSCSI Target Alias** box. If the **Use Default Name** checkbox is selected, the iSCSI target alias is input by default.
4. Enter the iSCSI target name in the **iSCSI Target Name** box. Select the format from **iqn** or **eui**. If the **Use Default Name** check box is selected, the iSCSI target name is input by default.
5. Select the resource group in which an iSCSI target is created. If you select **Any**, ports to which you can add iSCSI targets within all ports assigned to a user are displayed in the **Available Ports** list. If you select other than **Any**, ports to which you can add iSCSI targets within the ports assigned to the selected resource group are displayed in the **Available Ports** list.
6. Select a host mode from the **Host Mode** list. When selecting a host mode, you must consider the platform and some other factors.
7. If necessary, click **Host Mode Options** and select host mode options.

   When you click **Host Mode Options**, the dialog box expands to display the list of host mode options. The **Mode No.** column indicates option numbers. Select an option you want to specify and click **Enable**.
8. Select hosts to be registered in an iSCSI target. If the desired host has ever been connected with a cable to another port in the storage system, select the desired host bus adapter from the **Available Hosts** list. If there is no host to be registered, skip this step and move to the next step. Otherwise, an iSCSI target with no host would be created. If the desired host has never been connected through a cable to any port in the storage system, perform the following steps:
   a. Click **Add New Host** under the **Available Hosts** list. The **Add New Host** dialog box opens.
   b. Select the format from **iqn** or **eui**.
   c. Enter the desired HBA iSCSI name in the **HBA iSCSI Name** box.
   d. If necessary, enter a nickname for the host bus adapter in the **Host Name** box.
   e. Click **OK** to close the **Add New Host** dialog box.

f. Select the desired host bus adapter from the **Available Hosts** list.

9. Select the port to which you want to add the iSCSI target. If you select multiple ports, you can add the same iSCSI target to multiple ports by one operation.
10. Select **CHAP**, **None**, or **Comply with Host Setting** in the **Authentication Method** list. If **CHAP** is selected, specify following:
    - **Mutual CHAP**: Select **Enable** or **Disable**. If **Enable** is selected, the mutual authentication mode is performed. If **Disable** is selected, the unidirectional authentication mode is performed.
    - **User Name**: If **Disable** is selected in **Mutual CHAP**, this item is optionally specified. If **Enable** is selected in **Mutual CHAP**, this item must be specified.
    - **Secret** and **Re-enter Secret**: If **Disable** is selected in **Mutual CHAP**, this item is optionally specified. If **Enable** is selected in **Mutual CHAP**, this item must be specified.
11. Select CHAP users to be registered in an iSCSI target. If the CHAP user has ever been connected with a cable to another port in the storage system, select the desired host bus adapter from the **Available CHAP Users** list. If there is no host to be registered, skip this step and move to the step 11. Otherwise, an iSCSI target with no CHAP user would be created. If the desired CHAP user has never been connected through a cable to any port in the storage system, perform the following steps:
    a. Click **Add New CHAP User** under the **Available CHAP Users** list. The **Add New CHAP User** dialog box opens.
    b. Specify an user name, and secret.
    c. Click **OK** to close the **Add New CHAP User** dialog box.
    d. Select the desired CHAP user from the **Available CHAP Users** list.
12. Click **Add** to add the iSCSI target. By repeating steps from 2 to 10, you can create multiple iSCSI targets. If you select a row and click **Detail**, the **iSCSI Target Properties** window appears. If you select a row and click **Remove**, a message appears asking whether you want to remove the selected row or rows. To remove the row, click **OK**.
13. Click **Finish** to display the **Confirm** window. To continue to add LUN paths, click **Next**.
14. Confirm the settings and enter the task name in the **Task Name** box. A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default. If you select a row and click **Detail**, the **iSCSI Target Properties** window appears.
15. Click **Apply** in the **Confirm** window. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Editing iSCSI port settings

Use this procedure to edit the iSCSI port settings.

When the iSCSI virtual port mode is enabled for a port, the following items cannot be set using Device Manager - Storage Navigator:

- IPv4 Settings
- IPv6 Mode
- IPv6 Settings
- TCP Port Number
- Selective ACK
- Delayed ACK
- Maximum Window Size
- Ethernet MTU Size
- Keep Alive Timer
- VLAN Tagging Mode
- iSNS Server

To edit iSCSI ports for which the virtual port mode is enabled, use Command Control Interface. For details, see the Command Control Interface documentation.

Before you begin

- The Storage Administrator (System Resource Management and Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Caution: It is best to enable LUN security on each port when configuring your storage system. Although you can enable LUN security on a port when host I/O is in progress, I/O is rejected with a security guard after enabling.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**, and select the **Ports** tab.
3. Select the desired port, and click **Edit Ports**.
4. Select the check box to change the option and specify values. Items that can be changed are as follows:
   - **IPv4 Settings**: Specifies **IP Address**, **Subnet Mask**, or **Default Gateway**.
   - **IPv6 Mode**: Specifies enable or disable of this mode.
   - **IPv6 Settings**: Specifies **Link Local Address**, **Global Address**, **Global Address 2**, or **Default Gateway** if **IPv6 Mode** is selected to **Enable**.
   - **Port Security**: Specifies enable or disable.
   - **Port Speed**: Specifies the data transfer speed.
   - **TCP Port Number**: Specifies the TCP port number.

- **Selective ACK**: Specifies enable or disable.
- **Delayed ACK**: Specifies enable or disable.
- **Maximum Window Size**: Specifies the size of the maximum window.
- **Ethernet MTU Size**: Specifies the MTU size.
- **Keep Alive Timer**: Specifies the keep alive timer.
- **VLAN Tagging Mode**: Specifies enable or disable.
- **iSNS Server**: Specifies enable or disable. If this option is selected to **Enable**, specify **IP Address** or **TCP Port Number**.
- **CHAP User Name**: Specifies the CHAP user name.
- **Secret and Re-enter Secret**: Specifies the secret which is used for host authentication.

5. Click **Finish**. A message appears, confirming whether to switch the LUN security. Clicking **OK** opens the **Confirm** window.
6. In the **Confirm** window, confirm the settings, in **Task Name** type a unique name for this task or accept the default, then click **Apply**. If **Go to tasks window for status** is checked, the **Tasks** window opens.

Adding CHAP users

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the iSCSI target to register CHAP users.
4. Display the **Add CHAP Users** window by performing one of the following:
   - Click **More Actions**, select **Add CHAP Users**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, **Authentication**, then **Add CHAP Users**.
5. In the **Available CHAP Users** table, select the CHAP user row. Click **Add**. The selected CHAP user is registered in the **Selected CHAP Users** table. If the CHAP user does not exist, perform the following steps to register a new CHAP user:
   a. Click **Add New CHAP User** under the **Available CHAP Users** table. The **Add New CHAP User** dialog box opens.
   b. Specify **User Name** and **Secret**.
   c. Click **OK** to close the **Add New CHAP User** dialog box.
6. Click **Finish** to display the **Confirm** window.

7. Confirm the settings and enter the task name in the **Task Name** box. A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
8. Click **Apply** in the **Confirm** window. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Editing CHAP users

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **CHAP** users.
4. Display the **Edit CHAP Users** window by performing one of the following:
   - Click **Edit CHAP Users**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, **Authentication**, then **Edit CHAP Users**.
5. Specify **User Name** and **Secret**.
6. Click **Finish** to display the **Confirm** window.
7. Confirm the settings and enter the task name in the **Task Name** box. A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
8. Click **Apply** in the **Confirm** window. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Removing CHAP users

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **CHAP** users.
4. Display the **Remove CHAP Users** window by performing one of the following:
   - Click **Remove CHAP Users**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, **Authentication**, then **Remove CHAP Users**.
5. Specify **User Name** and **Secret**.
6. Click **Finish** to display the **Remove CHAP Users** window.
7. Confirm the settings and enter the task name in the **Task Name** box. A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
8. Click **Apply** in the **Confirm** window. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Removing target CHAP users

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the **iSCSI** target.
4. Display the **Remove Target CHAP Users** window by performing one of the following:
   - Click **More Actions > Remove Target CHAP Users**.
   - From the **Actions** menu, select **Ports/Host Groups/iSCSI**, **Authentication**, then **Remove Target CHAP Users**.
5. Confirm the settings and enter the task name in the **Task Name** box. A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
6. Click **Apply** in the **Confirm** window. If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Removing port CHAP users

Before you begin

- The Storage Administrator (Provisioning) role is required to perform this task.
- The Security Administrator (View and Modify) role is required to perform this task.

Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Ports/Host Groups/iSCSI Targets**.
3. Select the port CHAP user port name to be removed.
4. Display the **Remove Port CHAP Users** window by performing one of the following:
   - Click **Remove Port CHAP Users**.
   - From the **Actions** menu, select **Ports/Host Groups, iSCSI, Authentication,** then **Remove Port CHAP Users**.
5. Confirm the settings and enter the task name in the **Task Name** box.

   A task name can consist of up to 32 ASCII characters (letters, numerals, and symbols). Task names are case-sensitive. (date) - (task name) is input by default.
6. Click **Apply** in the **Confirm** window.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

8

Working with ALUs and SLUs for vSphere VVOL

The storage systems can be integrated with a VMware® ESXi host or VMware® vCenter Server by Storage Provider for VMware vCenter, which provides support for vSphere APIs for Storage Awareness (VASA). Snapshot and replication functions are used in storage systems that are configured with Administrative Logical Units (ALUs) and Subsidiary Logical Units (SLUs).

You can use Device Manager - Storage Navigator to create ALUs, view the ALUs and SLUs on the storage system, and unbind SLUs from ALUs.

Do not perform operations on LDEVs with the SLU or ALU attribute from Device Manager - Storage Navigator or Command Control Interface (CCI). If you must perform operations on LDEVs with the SLU or ALU attribute, contact customer support.

Caution: If you must change the configuration of LDEVs with the SLU or ALU attribute using Device Manager - Storage Navigator or CCI, you must first shut down the associated virtual machines. When the virtual machine is shut down, LDEVs with the SLU or ALU attribute related to the virtual machine are unbound automatically.

If virtual machines cannot be shut down, unbind the LDEVs with the SLU attribute from LDEVs with the ALU attribute related to the virtual machines using Device Manager - Storage Navigator, and then perform the configuration change operation. For instructions, see Unbinding LDEVs of SLUs attribution on page 398. If you accidentally change the configuration while the virtual machine is running without first unbinding the LDEVs with the SLU attribute, contact your storage administrator.

For information about setting up and operating VMware virtualization servers, see the *Hitachi Command Suite Administrator Guide*.

For information about installing, deploying, and configuring Storage Provider for VMware vCenter, see the *Hitachi Storage Provider for VMware vCenter Deployment Guide*.

- Creating LDEVs with the ALU attribute
- Viewing LDEVs of ALUs or SLU attribution
- Unbinding LDEVs of SLUs attribution

Creating LDEVs with the ALU attribute

Use this procedure to create LDEVs with the ALU attribute.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. In the Device Manager - Storage Navigator **Explorer** pane, click **Storage Systems**, expand the target storage system, and then click **Logical Devices**.
2. In the **LDEVs** tab, click **Create LDEVs**.
3. In the **Create LDEVs** window, from the **Provisioning Type** list, select **ALU**.
4. In **Number of LDEVs**, type the number of LDEVs to be created.
5. In **LDEV Name**, specify a name for this LDEV.
   a. In **Prefix**, type the characters that will become the fixed characters for the beginning of the LDEV name. The characters are case sensitive.
   b. In **Initial Number**, type the initial number that will follow the prefix name.
6. Click **Options** to show more options.
7. In **Initial LDEV ID**, make sure that an LDEV ID is set. To confirm the used number and unavailable number, click **View LDEV IDs** to open the **View LDEV IDs** window.
   a. In **Initial LDEV ID** in the **Create LDEVs** window, click **View LDEV IDs**.

      In the **View LDEV IDs** window, the matrix vertical scale represents the second-to-last digit of the LDEV number, and the horizontal scale represents the last digit of the LDEV number. The **LDEV IDs** table shows the available, used, and disabled LDEV IDs.

      In the table, used LDEV numbers appear in blue, unavailable numbers appear in gray, and unused numbers appear in white. LDEV numbers that are unavailable may be already in use, or already assigned to another emulation group (group by 32 LDEV numbers).
   b. Click **Close**
8. In the CLPR list, select the CLPR ID.
9. From the **MP Unit** list, select an MP unit to be used by the LDEVs.
   - If you assign a specific MP unit, select the ID of the MP unit.
   - If you can assign any MP unit, click **Auto**.
10. Click **Add**.

The created LDEVs are added to the **Selected LDEVs** table.

The **Provisioning Type** and **Number of LDEVs** must be set. If these required items are not registered, you cannot click **Add**.

11. If necessary, change the following LDEV settings:
    - Click **Change LDEV Settings** to open the **Change LDEV Settings** window.
12. If necessary, delete an LDEV from the **Selected LDEVs** table.

    Select an LDEV to delete, and then click **Remove**.
13. Click **Finish**.

    The **Confirm** window opens.

    To continue setting the LU path and defining a logical unit, click **Next**.
14. In the **Task Name** text box, type a unique name for the task or accept the default.

    You can enter up to 32 ASCII characters and symbols, with the exception of: \ / : , ; * ? " < > |. The value "date-window name" is entered by default.
15. Click **Apply**.

    If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

Related tasks

- Removing an LDEV to be registered on page 127
- Changing LDEV settings on page 126

Viewing LDEVs of ALUs or SLU attribution

Use this procedure to the view the ALUs or SLUs of the storage system. The procedure can be performed on an ESXi host or vCenter Server as well.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. In the **LDEVs** pane, click **More Actions > View ALUs/SLUs**.

Unbinding LDEVs of SLUs attribution

Use this procedure to unbind SLUs from ALUs. The procedure can be performed on an ESXi host or vCenter Server.

Before you begin

The Storage Administrator (Provisioning) role is required to perform this task.

Procedure

1. In the **LDEVs** pane, select **LDEV IDs** of the **ALU** provisioning type.
2. Click **More Actions** > **Unbind SLUs**.

   If the **Go to tasks window for status** check box is selected, the **Tasks** window appears.

9

Troubleshooting for provisioning

Troubleshooting for provisioning operations involves identifying the cause of the error and resolving the problem. For information about the error messages displayed by Device Manager - Storage Navigator, see *Hitachi Device Manager - Storage Navigator Messages*. If you are unable to solve a problem, please contact customer support.

- ☐ Troubleshooting Dynamic Provisioning
- ☐ Troubleshooting Data Retention Utility
- ☐ Troubleshooting provisioning while using Command Control Interface
- ☐ Contacting customer support

Troubleshooting Dynamic Provisioning

The following table provides troubleshooting information for Dynamic Provisioning.

If you are unable to solve a problem, or if you encounter a problem not listed, please contact customer support.

When an error occurs during operations, the error code and error message are displayed in the error message dialog box. For details about error messages, see *Hitachi Device Manager - Storage Navigator Messages*.

Problems	Causes and solutions
Cannot create a DP-VOL.	Causes: • Usage of the pool has reached to 100%. • Something in the storage system is blocked. • The available capacity of DP-VOL is restricted due to the value of Subscription-Limit set for the pool. Solutions: • Add some pool-VOLs to the pool. See Increasing pool capacity on page 270. • Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See About releasing pages in a DP-VOL on page 283. • Adjust the value of Subscription Limit for the pool. See Changing the pool subscription limit on page 261. • Ask customer support to solve the problem.
Cannot add a pool-VOL.	Causes: • 1,024 pool-VOLs are already defined in the pool. • The pool-VOL does not fill the requirements for a pool-VOL. • Something in the storage system is blocked. Solution: • Change the setting of the LDEV to satisfy the requirement of the Pool-VOL. See Pool-VOL requirements on page 144.

A pool-VOL is blocked. SIM code 627xxx is reported.	Causes:
	• A failure occurred in data drives greater than the parity group redundancy. The redundancy of the parity group depends on the number of the blocked PDEVs (data drives). For example:
	  ○ When the parity group configuration is 3D +1P and failures occur in two or more drives, the failures are considered to have occurred in data drives beyond the parity group redundancy.
	  ○ When the parity group configuration is 6D+2P and failures occur in three or more drives, the failures are considered to have occurred in data drives beyond the parity group redundancy.
	
	Solutions:
	• Ask customer support to solve the problem.

A pool is blocked.	Solutions: • Ask customer support to solve the problem.

Problems	Causes and solutions
A pool cannot be restored.	Causes: • Processing takes time, because something in the storage system is blocked. • Usage of the pool has reached to 100%. Solutions: • Add some pool-VOLs to the pool to increase the capacity of the pool. See Increasing pool capacity on page 270. • Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See About releasing pages in a DP-VOL on page 283. • Ask customer support to solve the problem.
A pool cannot be deleted.	Causes: • The pool usage is not 0. • External volumes are removed from the pool before you delete the pool. • DP-VOLs have not been deleted. Solutions: • Confirm that the pool usage is 0 after the DP-VOLs are deleted, and that you can delete the pool. • Ask customer support to solve the problem.
A failure occurs to the application for monitoring the volumes installed in a host.	Causes: • Free space of the pool is insufficient. • Some areas in the storage system are blocked. Solutions: • Check the free space of the pool and increase the capacity of the pool. See Increasing pool capacity on page 270. • Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See About releasing pages in a DP-VOL on page 283. • Ask customer support to solve the problem.
When the host computer tries to access the port, error occurs and the host cannot access the port.	Causes: • Free space of the pool is insufficient. • Some areas in the storage system are blocked. Solutions: • Check the free space of the pool and increase the capacity of the pool. See Increasing pool capacity on page 270. • Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See About releasing pages in a DP-VOL on page 283. • Ask customer support to solve the problem.
When you are operating Hitachi Device Manager - Storage Navigator, a timeout occurs frequently.	Causes: • The load on the management client is too heavy, so that it cannot respond to the SVP. • The period of time until when time-out occurs is set too short. Solutions: • Wait for a while, then try the operation again.
DP-VOL capacity cannot be increased.	See Troubleshooting provisioning while using Command Control Interface on page 408 and identify the cause. Solutions:

Problems	Causes and solutions
	• After refreshing the display, confirm whether the processing for increasing DP-VOL capacity meets the conditions described in Requirements for increasing DP-VOL capacity on page 149. • Retry the operation after 10 minutes or so. • Ask customer support to solve the problem.
Cannot reclaim zero pages in a DP-VOL.	Causes: • Zero pages in the DP-VOL cannot be reclaimed from Device Manager - Storage Navigator because the DP-VOL does not meet conditions for releasing pages in a DP-VOL. Solutions: • Make sure that the DP-VOL meets the conditions described in Releasing pages in a DP-VOL on page 284.
The DP-VOL cannot be released if the process to reclaim zero pages in the DP-VOL is interrupted.	Causes: • Pages of the DP-VOL are not released because the process of reclaiming zero pages was interrupted. Solutions: • Make sure that the DP-VOL meets the conditions described in Releasing pages in a DP-VOL on page 284.
Cannot release the Protect attribute of the DP-VOLs.	Causes: • The pool is full. • The pool-VOL is blocked. • The pool-VOL that is an external volume is blocked. Solutions: • Add pool-VOLs to the pool to increase the free space in the pool. See Increasing pool capacity on page 270. • Perform the reclaiming zero pages operation to release pages in which zero data are stored. See Releasing pages in a DP-VOL on page 284. • Contact customer support to restore the pool-VOL. • If the blocked pool-VOL is an external volume, verify the status of the path blockade and the external storage system. • After performing above solutions, release the Protect attribute (Data Retention Utility) of the DP-VOL. For information about Data Retention Utility, see the *Provisioning Guide*.
SIM code 622*xxx* was issued.	Causes: • Usage of the pool has reached 100%. Solutions: • Add pool-VOLs to the pool to increase the free space in the pool. See Increasing pool capacity on page 270. • Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See Releasing pages in a DP-VOL on page 284. The Protect attribute of Data Retention Utility can have been set to DP-VOLs. After performing above solutions, release the Protect attribute of the DP-VOLs.
SIM code 624000 was issued.	Causes: • The pools and DP-VOLs configuration, of which the size is more than the supported capacity, is created. Solutions:

Problems	Causes and solutions
	• Remove pools that are not used. • Remove DP-VOLs that are not used. • Remove Thin Image pairs that are not used. • Shrink pools capacities.

Formatted pool capacity displayed in the **View Pool Management Status** window does not increase.	Causes:
	• Another pool is being formatted.
	• The pool usage level reaches up to the threshold.
	• The pool is blocked.
	• I/O loads to the storage system are high.
	• The cache memory is blocked.
	• Pool-VOLs are blocked.
	• Pool-VOLs that are external volumes are blocked.
	
	Solutions:
	• Confirm the display again after waiting for a while.
	• Add pool-VOLs to the pool to increase the free space in the pool. See Increasing pool capacity on page 270.
	• Perform the operation to reclaim zero pages in order to release pages in which zero data are stored. See About releasing pages in a DP-VOL on page 283.
	• Confirm the display again after decreasing I/O loads of the storage system.
	• Contact customer support to restore the cache memory.
	• Contact customer support to restore the pool-VOL.
	• If the blocked pool-VOL is an external volume, confirm following:
	  ○ Path blockage
	  ○ Status of the storage system

The Assign Deduplication System Data Volume option is set to Yes when creating a pool, but the deduplication system data volume is not created.	Cause: • After creating a pool, errors occur when the deduplication system data volume is created, and then the processing aborts. Solution: • Resolve the causes of the errors, and then assign a deduplication system data volume to the pool by using the Edit Pools window.
A Deduplication-Available pool cannot be deleted, and after the failed pool deletion, the Deduplication setting is changed to Not Available.	Cause: • After deleting a deduplication system data volume, errors occur when a pool is deleted, and then the processing aborts. Solution: • Resolve the causes of the errors, and then delete the pool by using the Delete Pools window.
DP-VOLs whose capacity saving setting is Compression or Deduplication and Compression are created, but the capacity saving setting of the DP-VOLs is set to Disabled.	Cause: • After creating DP-VOLs, errors occur when the capacity saving setting changes to Compression or Deduplication and Compression, and then the processing aborts. Solution: • Resolve the causes of the errors, and then change the capacity saving setting to Compression or Deduplication and Compression by using the Edit LDEVs window.

Problems	Causes and solutions
The processing stops when Capacity Saving Status is Enabling or Rehydrating.	Cause: • Errors occur while the capacity saving status is changing, and then the processing aborts. After recovering from the errors, the resumed status change process fails. Solution: • For DP-VOLs, change Capacity Saving to Disabled, and then retry the operation by using the Edit LDEVs window.
A capacity saving status with DP-VOLs changes to the Failed status.	Causes: • The shared memory is volatilized and then the storage system is started again. • The pool is initialized. • The pool volumes are formatted. • The processing for deleting the DP-VOL failed. Solution: **1.** In the pool, back up all of the DP-VOLs whose Deduplication Data status is Enabled. **2.** Block the deduplication system data volume and all of the DP-VOLs whose Deduplication Data status is Enabled. **3.** If a deduplication system data volume exists in the pool, the volume must be formatted. If you are using Device Manager - Storage Navigator, perform the Format LDEVs operation on the deduplication system data volume. If you are using CCI, specify the deduplication system data volume, and execute the raidcom initialize pool command. **4.** Perform the Format LDEVs operation for all blocked DP-VOLs whose Deduplication Data status is Enabled. **5.** Restore the back-up data, or retry the delete LDEV operation. **Note:** If you format DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs might become Compression. If you format the deduplication system data volume for a pool that has DP-VOLs for which the capacity saving setting is disabled and Deduplication Data is Enabled, the capacity saving setting for the DP-VOLs might become Deduplication and compression. Therefore, verify the capacity saving setting of DP-VOLs after the format operation completes.
When the storage system is restarted, one of following problems occur: **1.** For the DP-VOLs, Capacity Saving Status indicates Deleting Volume, and the progress indicates a hyphen. **2.** For the DP-VOLs, Capacity Saving Status indicates Disabled.	Delete the DP-VOLs corresponding to 1 or 2 again.
For a DP-VOL, the Capacity Saving Status indicates Rehydrating, but the processing progress does not increase.	Causes: • The pool used capacity exceeded the depletion threshold. • The target DP-VOL is being blocked. • The pool with which the target DP-VOL is associated is being blocked, or the pool volumes are being blocked.

Problems	Causes and solutions
	• The deduplication system data volume of the pool with which the target DP-VOL is associated is being blocked. • The SVP or a Device Manager - Storage Navigator secondary window is in Modify mode. Solutions: If the pool used capacity exceeded the depletion threshold, take the following action: **1.** Verify the free capacity of the pool, and then expand the pool capacity for the capacity shortage. **2.** Perform the operation to release pages in DP-VOLs to reclaim zero pages. If the target DP-VOL is being blocked, take the following action: **1.** Restore the blocked DP-VOL. If the pool with which the target DP-VOL is associated is being blocked, or if the pool volumes are being blocked, take the following action: **1.** Restore the pool or pool volumes. If the deduplication system data volume of the pool with which the target DP-VOL is associated is being blocked, take the following action: **1.** Restore the deduplication system data volume that is being blocked. If the SVP or a Device Manager - Storage Navigator secondary window is in Modify mode, change to View mode.
For a DP-VOL, the Capacity Saving Status indicates Deleting Volume, however the processing progress does not increase.	Causes: • The pool used capacity exceeded the depletion threshold. • The pool with which the target DP-VOL is associated is being blocked, or the pool volumes are being blocked. • The deduplication system data volume of the pool with which the target DP-VOL is associated is being blocked. • The SVP or a Device Manager - Storage Navigator secondary window is in Modify mode. Solutions: If the pool used capacity exceeded the depletion threshold, take the following action: **1.** Verify the free capacity of the pool, and then expand the pool capacity for the capacity shortage. **2.** Perform the operation to release pages in DP-VOLs to reclaim zero pages. If the pool with which the target DP-VOL is associated is being blocked, or if the pool volumes are being blocked, take the following action: **1.** Restore the pool or pool volumes. If the deduplication system data volume of the pool with which the target DP-VOL is associated is being blocked, take the following action: **1.** Restore the deduplication system data volume that is being blocked.

Problems	Causes and solutions
	If the SVP or a Device Manager - Storage Navigator secondary window is in Modify mode, change to View mode.

Troubleshooting Data Retention Utility

If an error occurs with Data Retention Utility, the **Error Detail** dialog box appears. The **Error Detail** dialog box displays error locations and error messages.

The **Error Detail** dialog box does not display Hitachi Device Manager - Storage Navigator error messages. To find information about Hitachi Device Manager - Storage Navigator errors and solutions, see the Hitachi Device Manager - Storage Navigator Messages.

Troubleshooting for Data Retention Utility

The following table provides troubleshooting information for Data Retention Utility.

Problems	Probable cause and solution
The Disable/ Enable or the Enable/Disable button on the **Data Retention** window is unavailable. Nothing happens when you click the button.	You have been making changes in the **Data Retention** window, but the changes have not been applied to the storage system. Apply the changes first, and then perform the extension lock operation. You can find the changes by: • Scrolling the current list up and down. • Selecting another CU from the tree and then scrolling the list up and down.
Open-systems hosts cannot read from or write to a volume.	• The volume is protected by the read-only attribute. Write failure is reported as an error message. • The volume is protected by the Protect attribute. Read (or write) failure is reported as an error message.
The number of days in Retention Term does not decrease	The number of days in Retention Term is calculated based on the operating time of the storage system. Therefore, the number of days in Retention Term might not decrease.

Troubleshooting provisioning while using Command Control Interface

If an error occurs while operating Data Retention Utility or Dynamic Provisioning while using CCI, you might identify the cause of the error by referring to the log appearing on the CCI window or the CCI operation log file.

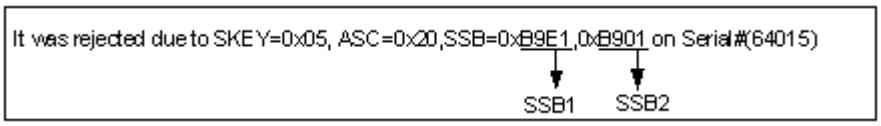
The CCI operation log file is stored in the following directory.

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

where

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

The following is an example of a log entry in the CCI window.



Errors when operating CCI (Dynamic Provisioning, SSB1: 0x2e31/0xb96d/0xb980)

Error Code (SSB2)	Error Contents	Solutions
0x0b27	The command cannot be executed because the virtual LDEV is not defined.	Define the virtual LDEV and then execute the command.
0x2c3a	Because the specified volume was being enabled for the attribute of the data direct mapping, the operation was rejected.	Specify the volume of which the attribute of the data direct mapping is disabled.
0x2c77	Because the specified DP-VOL was a deduplication system data volume, the operation was rejected.	Specify a DP-VOL that is not a deduplication system data volume.
0x2c78	Because the specified DP-VOL is being deleted, the operation failed.	Specify a DP-VOL that is not being deleted.
0x9100	The command cannot be executed because user authentication is not performed.	Perform user authentication.
0xb900/ 0xb901/ 0xaf28	Error occurred when increasing DP-VOL capacity operation.	Ask customer support to solve the problem.
0xb902	The operation was rejected because the configuration was being changed by SVP or Hitachi Device Manager - Storage Navigator, or because the DP-VOL capacity was going to be increased by another instance of the CCI.	Increase the DP-VOL capacity after finishing operations on your storage system, such as the Virtual LUN operation or a maintenance operation. See Caution in Requirements for increasing DP-VOL capacity on page 149.
0xb903	The operation cannot be performed because the specified resource is contained in NAS_Platform_System_RSG.	Move the specified resource to a resource group other than NAS_Platform_System_RSG.
0xaf22	The operation was rejected because the specified volume is placed online	Increase the DP-VOL capacity after the specified volume is placed online with the OS which supports EAV.

Error Code (SSB2)	Error Contents	Solutions
	with the OS which does not support EAV (Extended Address Volume).	
0xaf24	The operation was rejected because the total DP-VOL capacity exceeded the pool reservation rate after the capacity was increased.	Specify a capacity so that the pool reservation rate will not be exceeded.
0xaf25	The operation to increase capacity cannot be performed on the specified DP-VOL.	Check the emulation type of the specified DP-VOL.
0xaf26	The operation was rejected because of lack of cache management devices due to increased capacity.	Specify a capacity so that the maximum number of cache management devices will not be exceeded.
0xaf29	Because the specified volume was not a DP-VOL, the operation was rejected.	Makes sure that the volume is a DP-VOL.
0xaf2a	Because the specified capacities are invalid or exceeded the value immediately below LDEV Capacity in the **Expand Virtual Volumes** window, the operation was rejected.	To increase capacity, specify the correct capacity that does not exceed the value immediately below LDEV Capacity in the **Expand Virtual Volumes** window. See the conditions for increasing DP-VOL capacity in Requirements for increasing DP-VOL capacity on page 149.
0xaf2b	Because the specified volume operation was not finished, the operation was rejected.	Re-execute the operation after a brief interval.
0xaf2c	Because the shared memory capacity is not enough to increase the specified capacity, the operation was rejected.	Confirm the value immediately below LDEV Capacity in the **Expand Virtual Volumes** window.
0xaf2e	Because the specified DP-VOL was used by other software or was being formatted, the operation was rejected.	Wait until formatting of the specified volume is finished, or see Using Dynamic Provisioning or Dynamic Tiering or active flash with other software products on page 152 and confirm whether the DP-VOL is used with software in which that the DP-VOL capacity cannot be increased.
0xaf2f	Because the configuration of journal volumes is being changed, the specified DP-VOL capacity cannot be expanded.	Re-execute the operation after the journal volume configuration is changed.
0x0b2b	Because the `raidcom extend ldev` command was executed with specifying the `-cylinder` option to the DP-VOL for the open system, the operation was rejected.	Re-execute the `raidcom extend ldev` command without specifying the `-cylinder` option.

Errors when operating CCI (Data Retention Utility, SSB1:2E31/ B9BF/B9BD)

Error Code (SSB2)	Description
9100	The command cannot be executed because user authentication is not performed.
B9BD	The setting failed because the specified volume does not exist.
B9C2	The specified volume is a command device.
B9C4	The command was rejected due to one of the following reasons: • The specified volume is a virtual volume. • The specified volume is a pool volume. • The specified volume is an secondary volume of Universal Replicator. • The specified volume is a journal volume. • The specified volume is a primary volume or secondary volume of ShadowImage. • The consumed capacity exceeded the licensed capacity. • The access attribute cannot be changed because the data retention term is set. • The specified volume is a command device. • The specified volume is in the PAIR or COPY status. • The specified volume does not exist. • The S-VOL Disable attribute is set to the specified volume. • The reserve function cannot be canceled using CCI. • The specified volume is a quorum disk for global-active device, so that the requested setting of Data Retention Utility cannot be performed. • The specified volume is in an accelerated compression-enabled parity group. • The specified volume is a deduplication system data volume.
B9C7	Data Retention Utility is not installed.
B9C9	The consumed capacity exceeded the licensed capacity.
B9CA	The command was rejected due to one of the following reasons: • Fewer days are set as the data retention term. • More than 60 years are set as the data retention term. • An interface other than Java® updated the settings while Data Retention Utility was in the process of changing them. A conflict occurred between Java and the other interface.
B9CB	The retention term cannot be set because the access attribute is read/write.

Contacting customer support

If you are unable to resolve an error condition in Device Manager - Storage Navigator, contact Hitachi Data Systems customer support for assistance.

Before you contact customer support, please gather as much information about the problem as possible, including the following:

- The circumstances surrounding the error or failure.
- The exact content of any error messages displayed on the host systems.

- The exact content of any error messages displayed by Device Manager - Storage Navigator.
- The Device Manager - Storage Navigator configuration information. Use the Device Manager - Storage Navigator Dump Tool to download the dump files and configuration information from the SVP.
- The service information messages (SIMs), including reference codes and severity levels, displayed by Device Manager - Storage Navigator.

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

A

CCI command reference for provisioning

Provisioning tasks can be performed using Hitachi Device Manager - Storage Navigator and Command Control Interface (CCI).

Provisioning tasks and CCI commands

The following table lists the provisioning tasks that can be performed using Hitachi Device Manager - Storage Navigator (HDvM - SN) and provides the corresponding CCI command for each task.

Item	Task name in HDvM - SN	CCI command
Logical Device	Create LDEVs	raidcom add ldev
	Delete LDEVs	raidcom delete ldev
	Edit LDEVs	raidcom modify ldev
	Format LDEVs	raidcom initialize ldev
	Block LDEVs	raidcom modify ldev
	Restore LDEVs	raidcom modify ldev
	Assign MP Unit	raidcom modify ldev
	Add LUN Paths	raidcom add lun
	Delete LUN Paths	raidcom delete lun
	Expand V-VOLs	raidcom extend ldev
	Reclaim Zero Pages	raidcom modify ldev
	Shredding	raidcom initialize ldev
Port/Host Group/iSCSI Target (Fibre Channel)	Create Host Groups	raidcom add host_grp
	Delete Host Groups	raidcom delete host_grp
	Edit Host Groups	raidcom modify host_grp
	Add Hosts	raidcom add hba_wwn
	Add to Host Groups	raidcom add hba_wwn
	Remove Hosts	raidcom delete hba_wwn
	Edit Host	raidcom add hba_wwn
	Create Alternate LUN Paths	raidcom add lun
	Edit Ports	raidcom modify port
Pool	Create Pools	raidcom add dp_pool
	Expand Pool	raidcom add dp_pool
	Shrink pools	raidcom delete pool
	Delete Pools	raidcom delete pool
	Edit Pools	raidcom modify pool
	Monitor Pools	raidcom monitor pool
	Stop Monitoring Pools	raidcom monitor pool
	Start Tier Relocation	raidcom reallocate pool
	Stop Tier Relocation	raidcom reallocate pool
	Restore Pools	raidcom modify pool
	View Tier Properties	raidcom get dp_pool
External Storage	Disconnect External Volumes	raidcom disconnect external_grp

Item	Task name in HDvM - SN	CCI command
	Reconnect External Volumes	raidcom check_ext_storage
Port/Host Group/iSCSI (iSCSI)	Create iSCSI Targets	raidcom add host_grp
	Delete iSCSI Targets	raidcom delete host_grp
	Edit iSCSI Targets	raidcom modify host_grp
	Add Hosts	raidcom add hba_iscsi
	Remove Hosts	raidcom delete hba_iscsi
	Edit Host	raidcom set hba_iscsi
	Add CHAP Users	raidcom add chap_user
	Remove CHAP Users	raidcom delete chap_user
	Edit CHAP User	raidcom set chap_user
	Create Alternate LUN Paths	raidcom add lun
	Edit Ports	raidcom modify port

B

Guidelines for pools when accelerated compression is enabled

You must follow specific guidelines for sizing, creating, and maintaining a pool that uses LDEVs carved from parity groups with accelerated compression enabled.

- ☐ Checking whether accelerated compression can be enabled
- ☐ Estimating required FMC capacity
- ☐ Creating parity groups, LDEVs, and pools with accelerated compression
- ☐ Monitoring the pool capacity
- ☐ Estimating FMC capacity when pool capacity is insufficient
- ☐ Disabling accelerated compression on a parity group

Checking whether accelerated compression can be enabled

Before enabling accelerated compression on a parity group, check whether it can be used with the parity group. Accelerated compression cannot be used on an FMC parity group if the parity group meets any of the following conditions:

- Encryption is enabled on the parity group.
- The LDEV carved from the parity group is not used as a pool volume.
- The LDEVs carved from the parity group are used as pool volumes in multiple pools.
- The full allocation function is enabled for all or any single DP-VOL associated with the pool containing the LDEV that is carved from the parity group.

If the DP-VOL that is associated with the pool containing the LDEV created from the FMC parity group is used as a journal volume of a Universal Replicator pair, we do not recommend using accelerated compression on this parity group.

Estimating required FMC capacity

To create or expand a pool that uses LDEVs carved from accelerated compression-enabled parity groups, you must first estimate the required FMC capacity. The Hitachi Data Reduction Estimation Tool enables you to estimate the amount of FMC capacity to install for a new pool or when expanding an existing pool.

Hitachi Data Reduction Estimation Tool

The Hitachi Data Reduction Estimation Tool (hidr_estimator.exe) samples existing data and estimates a data saving ratio.

By using the Data Reduction Estimation Tool before storing data to an FMC, you can estimate the saving percent, and the compressibility of your data. The tool samples data that is in a file or volume that you specify and calculates a compression ratio using the same compression algorithm as the storage system and FMC. By calculating a saving percent for the actual data, you can confirm the effect of accelerated compression with high precision. The Data Reduction Estimation Tool must be installed on the server host that has access to the data you want to sample. For details about how to get or use the Data Reduction Estimation Tool, contact customer support.

The following is an example of executing the Data Reduction Estimation Tool. Best practice is to use the value of **Saving % (Except Zero data)** in **[HAFDC2 Compression]**.

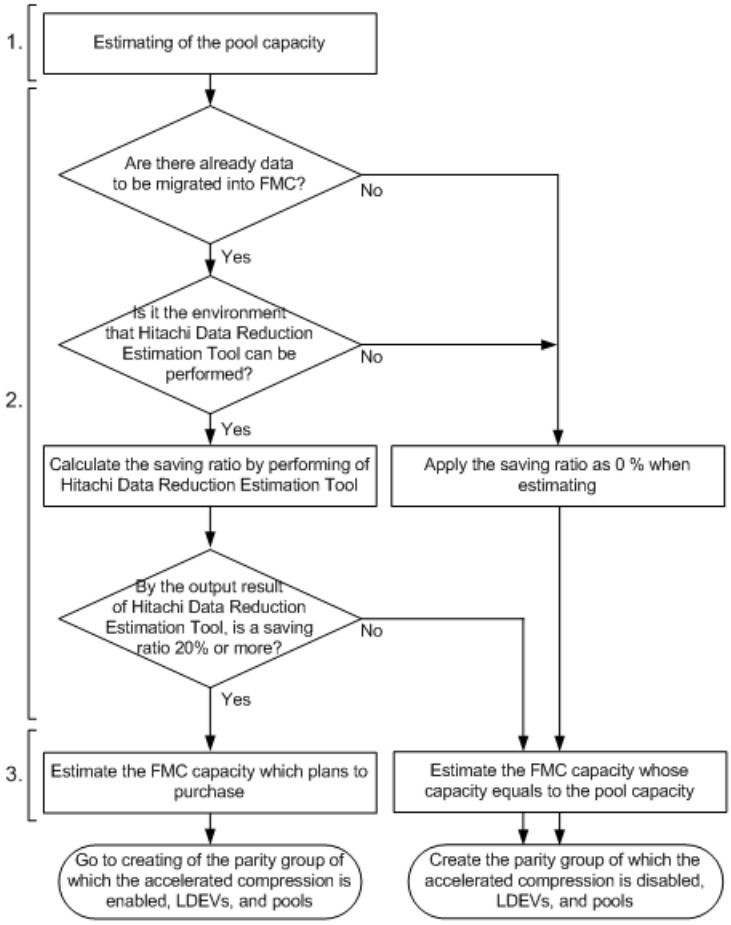
[HAFDC2 Compression]

Origin Bytes	Compressed Bytes	Saving %	Saving % (Except Zero data)	Compression Ratio
23.4 MiB	12.3 MiB	47.20 %	47.20 %	1.9 to 1

- Origin Bytes: The data size before compression. The value is approximately 23.4 MiB in the example.
- Compressed Bytes: The data size after compression. The value is approximately 12.3 MiB in the example.
- Saving %: The data-size saving rate after compression. The value is 47.20% in the example.
- Saving % (Except Zero data): The data-size saving rate with all zero pages excluded from the data before compression. The value is 47.20% in the example.
- Compression Ratio: The ratio of data size compression. In the example, the data size after compression is assumed to be 1, and the ratio of data size compression is 1.9.

Estimating FMC capacity for a new pool

When you need to install FMC drives to create a new pool, use the following workflow to estimate the required capacity.



Note: To estimate the FMC capacity to be used for an accelerated compression-enabled parity group, estimate a buffer capacity in addition to the main capacity for storing data. Add approximately 20% of the required FMC capacity as buffer capacity. Buffer capacity refers to the total expected increase in FMC capacity, which includes the following:

- Expected increase in capacity used to store management information of the storage system
- Expected increase in capacity to offset degradation of the Saving % compared with estimated values

1. Estimate the required pool capacity.
   Estimate the pool capacity required for user data in the same way you estimate capacity when creating a pool.

2. Estimate the Saving % using one of the following methods:
   - If data will be migrated to the FMC, use the Data Reduction Estimation Tool to estimate the Saving %. The tool reports a Saving % that can be used to determine the capacity needed. If the estimate is less than 20%, best practice is to use a parity group with accelerated compression disabled, and to estimate the pool capacity by the conventional method.
   - If new data will be stored on the FMC, or if the Data Reduction Estimation Tool cannot be executed in the environment, consider setting the Saving % to 0% and using the conventional method to size capacity. With accelerated compression disabled for the parity group, you can monitor the Saving % through the management software and then decide to enable accelerated compression at a later time.

   Note: If the 14-TB FMC is used and the Saving % that is estimated in this step exceeds 75%, apply 75% for "Saving %" in the formula of the next step.

3. Estimate the required FMC capacity to be purchased.
   If there is data to migrate to the FMC, use the following formula to calculate the required FMC capacity.

   ```
   Required FMC capacity to be purchased = Required pool
   capacity × (100% − (Saving % − 10%)) × 110%
   ```

   The buffers in the above formula are as follows:
   - − 10%: Buffer representing expected increase in capacity because of degradation in Saving %
   - × 110%: Buffer representing expected increase in capacity because of additional space required to store management information of the storage system

Then, enable accelerated compression and create parity groups, LDEVs, and pools.

Note: When using Dynamic Tiering or active flash, if the Tier 1 is configured of FMC drives, use 1.2 times the calculated required pool capacity. Use the following formula to calculate the value:

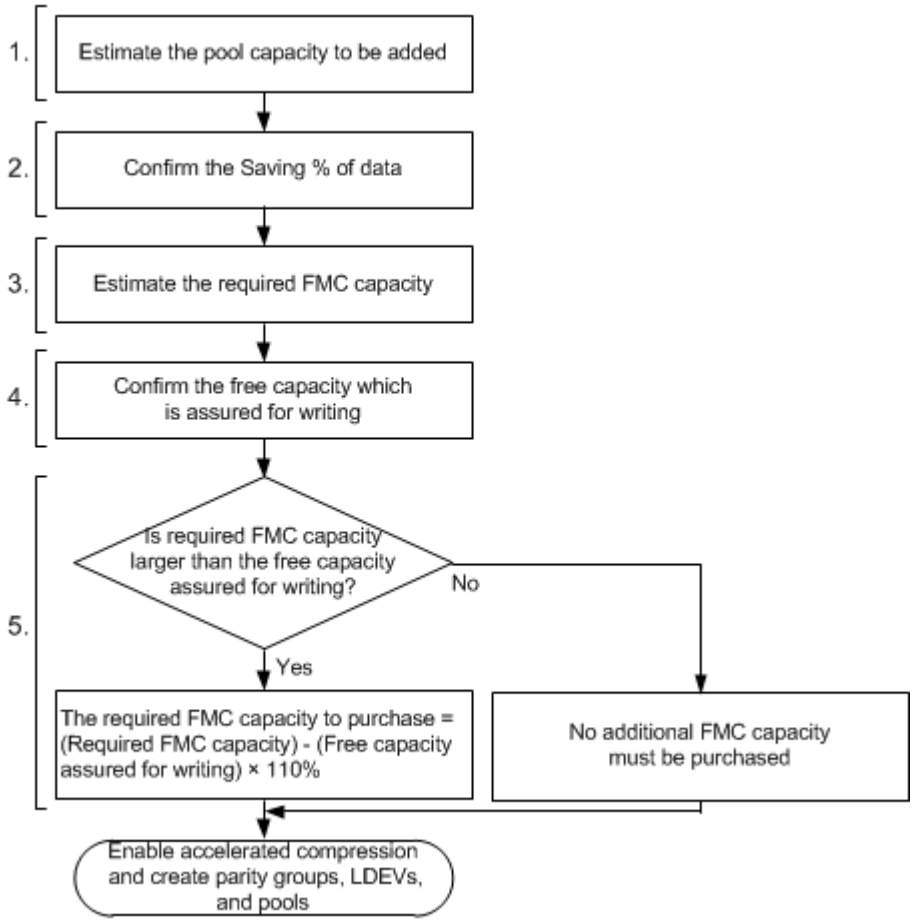
```
Required pool capacity = Required pool capacity
estimated in Step 1 × 120 %
```

To prevent the depletion of assured capacity for writing due to the tier relocation, Dynamic Tiering or active flash uses a 20% buffer when calculating the number of pages that can fit in the FMC tier. If accelerated compression is disabled, Dynamic Tiering or active flash do not use the 20% buffer.

Therefore, if the same FMC (Tier 1) capacity is applied, the amount of data that can be stored with accelerated compression enabled is smaller than the amount of data that can be stored with accelerated compression disabled.

Estimating FMC capacity to expand an existing pool

When you need to install additional FMC drives to expand an existing pool, use the following workflow to estimate the required capacity.



1. Estimate the pool capacity to be added.
   Estimate the pool capacity required for user data in the same way you estimated capacity when creating a pool. If you are expanding a pool, also estimate the additional capacity.

2. Check the Saving %.
   The Saving % is displayed in the Pools window. View the Saving % by clicking Pools > FMC Pool Volumes Capacity > Saving (%).

   Note: If the 14-TB FMC is used and the Saving % confirmed in this step exceeds 75%, apply 75% for "Saving %" in the formula of the next step.

3. Estimate the required FMC capacity.
   Use the following formula to calculate the required FMC capacity:

```
Required FMC capacity = Required pool capacity × [100% -
(Saving % - 10%)]
```

The buffer in the above formula is as follows:

- - 10%: Buffer representing expected increase in capacity because of degradation in Saving %

Estimate the additional FMC capacity to be purchased according to the required FMC capacity calculated using the above formula, and the free capacity assured for writing.

4. Check the free capacity assured for writing.
   In the Pools tab of the Pools window, check the value of FMC Pool Volumes Capacity. The free capacity reserved for writing is the difference between the Total and Used values.

5. Estimate the additional FMC capacity to be purchased.
   If the space calculated in step 4 is sufficient, this step is unnecessary. If the space is insufficient, use the following formula to calculate the required FMC capacity:

```
Required FMC capacity to be purchased = (Required FMC
capacity - free capacity assured for writing in step 4) ×
110%
```

Creating parity groups, LDEVs, and pools with accelerated compression

After you have confirmed that the Saving % on used pool capacity is sufficient, you can create accelerated compression-enabled parity groups, LDEVs, and pools.

Use the following workflow to create accelerated compression-enabled parity groups, LDEVs, and pools

Caution: When you create LDEVs in an accelerated compression-enabled FMC parity group, you must add all LDEVs you create to the same pool. If you do not add an LDEV to the pool, data recovery for a drive failure might fail. Make sure that you register all LDEVs to the pool.

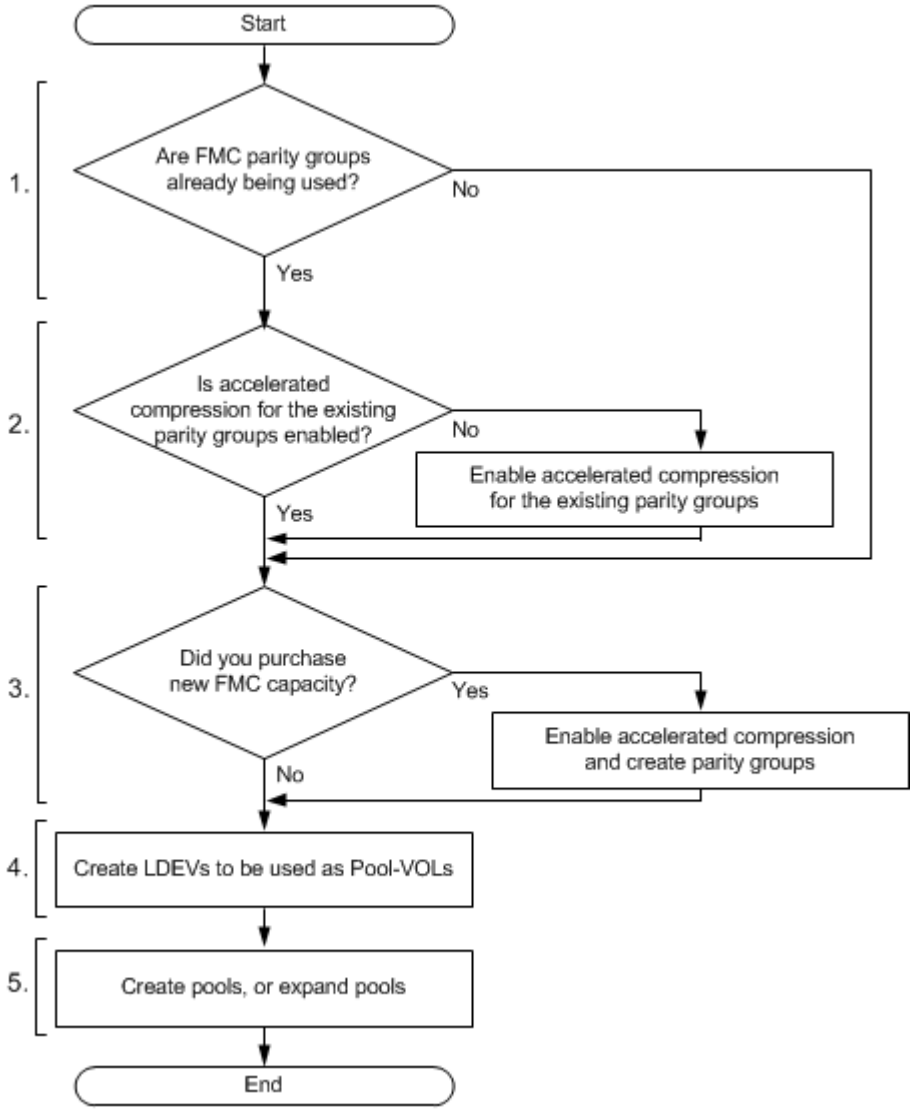
During data recovery, LDEVs that were not added to the pool will be recovered to the FMC drive that was replaced when a failure occurred. In this case, the size of data to be recovered becomes greater than the original size, and the following might occur:

- The pool reduction ratio might become very low.
- The capacity of the FMC drive to which data is copied runs out, and data recovery might fail.
- The FMC drive capacity runs out, the write pending rate of cache remains high, and access to the storage system might be lost.

After data recovery, if you continue operation without formatting the following LDEVs, the FMC drive capacity remains consumed. As a result, the FMC capacity runs out, the write pending ratio of cache remains high, and access to the storage system might be lost:

- LDEVs used as normal volumes before the accelerated compression function is enabled
- LDEVs deleted from the pool because of the reduction of the pool capacity

To use LDEVs that are not registered to a pool, you must format them before the deletion. Quick format cannot be performed.



1. Check whether FMC parity groups are already used.
   If yes, go to step 2.
   If no, go to step 3.
2. Enable the accelerated compression function for an existing parity group. Use the Edit Parity Groups window to enable accelerated compression.

3. Use the new FMC capacity to create accelerated compression-enabled parity groups. Use the Create Parity Groups window to create parity groups.
4. Create LDEVs to be used as pool-VOLs. Use the Create LDEVs window to create LDEVs.
   Best practice is to create 2.99-TB LDEVs because this is the maximum capacity of a pool-VOL. Use the following formula to calculate the recommended value of the total LDEV capacity to be defined for one parity group:

   ```
   Total LDEV capacity = FMC capacity of the parity group ÷
   [100% - (Saving % - 10%)] ÷ 110%
   ```

   The buffers in the formula are as follows:
   - - 10%: Buffer representing the expected increase in capacity used because of degradation in the Saving %
   - ÷ 110%: Buffer representing the expected increase in capacity used to store management information of the storage system

   Note:
   - If the 14-TB FMC drive is used and the Saving % exceeds 75%, apply 75% for "Saving %" in the formula for total LDEV capacity.
   - The total capacity of LDEVs that can be created from a parity group of 14-TB FMC drives is equal to the total capacity of LDEVs that can be created from a parity group of 7-TB FMC drives (for example, up to 8x expansion for the 7-TB parity group but only 4x expansion for the 14-TB parity group). This is because the virtualized total capacity of LDEVs that can be created from a 14-TB FMC parity group exceeds the capacity of the Parity Group table.

   For example, when the 3.2-TB FMC is used in a 3D+1P configuration and the estimated Saving % is 40%, the number of required LDEVs is calculated as follows:
   - Calculate the total capacity of the LDEVs to be created as follows:

     ```
     Total LDEV capacity = 9.6 TB ÷ (100% - (40% - 10%)) ÷ 110%
     = 12.5 TB
     ```

   - Calculate the number of LDEVs as follows. The value enclosed in ceil( ) must be rounded up to the nearest whole number.

     ```
     ceil(12.5 TB ÷ 2.99 TB ) = 5
     ```

     If the capacity of each LDEV is 2.99 TB, 5 LDEVs are required.

Note: If you use multiple parity groups, best practice is to configure the same basic usable capacity expansion rate for each parity group. Use the following formula to calculate the basic usable capacity expansion rate of the parity groups:

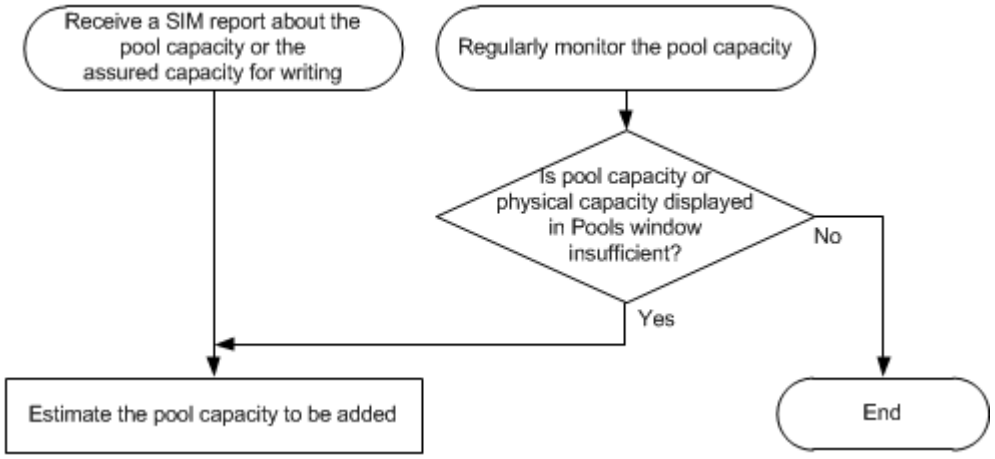
```
Basic usable capacity expansion rate of the parity
groups = Total capacity of the LDEVs created from the
parity groups ÷ FMC capacity of the parity groups
```

5. Create or expand the pool, and then add all of the created LDEVs to the same pool.

Note: Add all of the LDEVs that were created from a single parity group to the same pool.

Monitoring the pool capacity

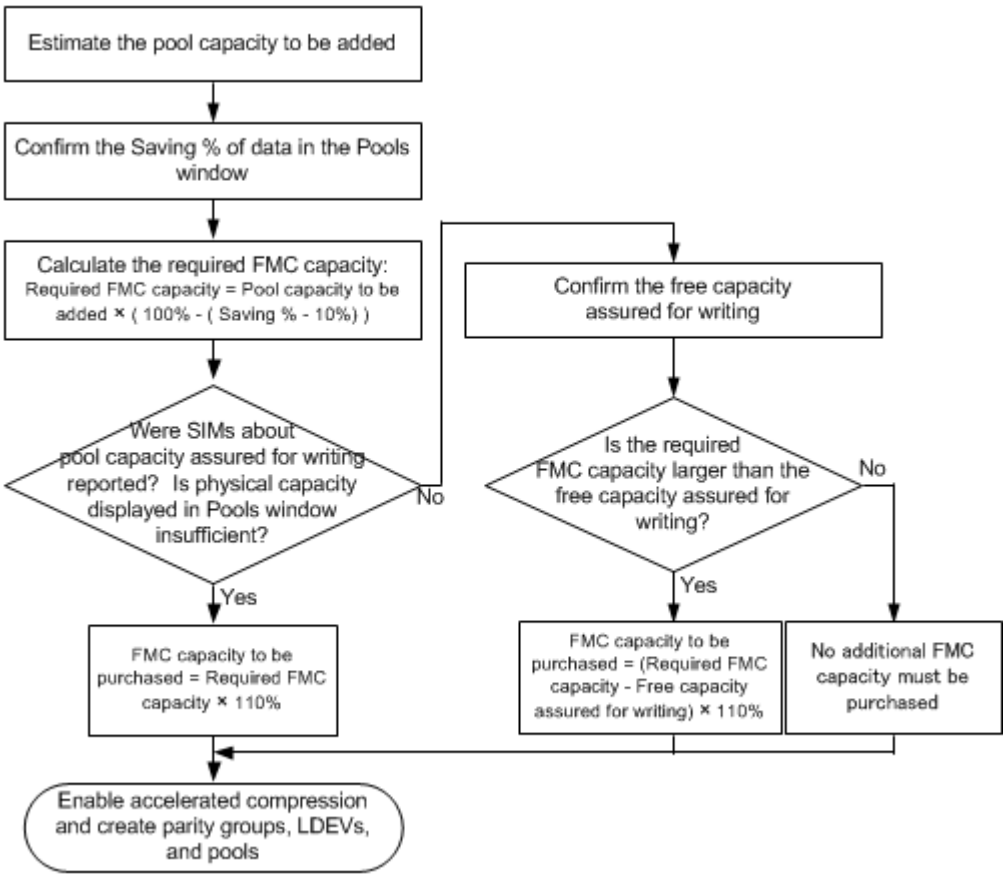
If you are regularly monitoring pool capacity and notice that a pool has insufficient space, or if insufficient space is reported in a related SIM report, you need to estimate the capacity to be added.



Estimating FMC capacity when pool capacity is insufficient

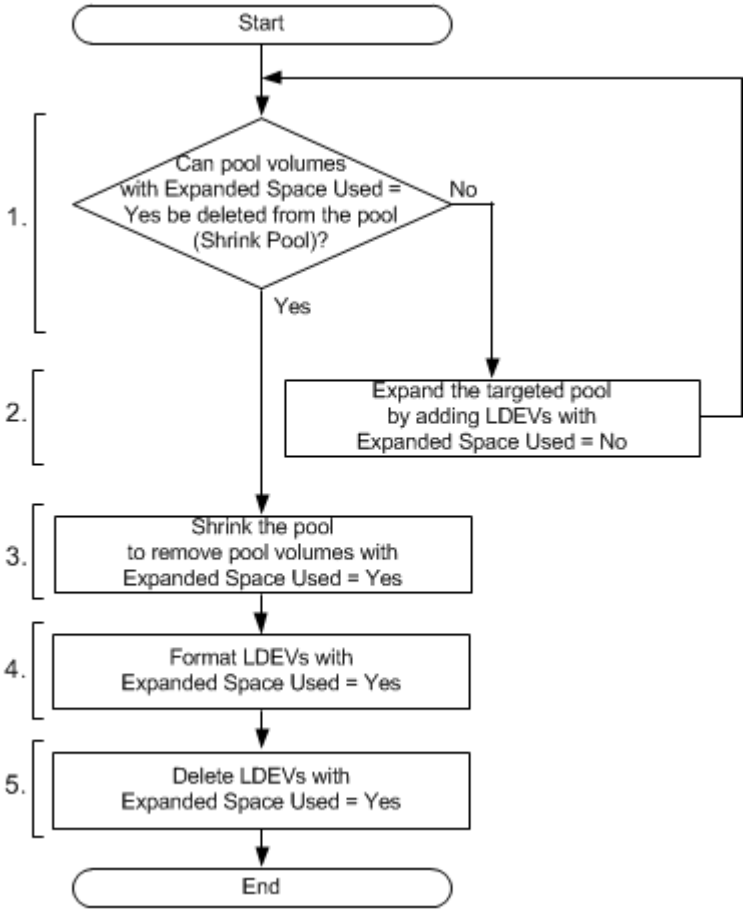
If the pool capacity or physical pool capacity is insufficient, use the following workflow to estimate the capacity to be added.

Note: If the 14-TB FMC is used and the Saving % exceeds 75%, apply 75% for "Saving %" when calculating the required FMC capacity (third task in the workflow).



Disabling accelerated compression on a parity group

Use the following workflow to disable accelerated compression on a parity group.



1. For the targeted pool, use the following formulas to determine whether the shrink pool operation can be performed:
   - Pool capacity after shrinking =

     ```
     (pool-capacity-before-shrinking) - (total-capacity-of-pool-VOLs-with-Expanded-Space-Used=Yes)
     ```

   - Decision formula:

     ```
     (used-pool-capacity) < (pool-capacity-after-shrinking) × (depletion-threshold)
     ```

   If the condition of the decision formula is met, you can delete pool-VOLs with Expanded Space Used = Yes. Go to step 3.
   If the condition of the decision formula is not met, you cannot delete pool-VOLs with Expanded Space Used = Yes. Go to step 2.
2. Expand the pool.
   For the LDEVs to be added as pool-VOLs, use LDEVs with Expanded Space Used = No. Add capacity that is larger than the total of pool-VOLs with Expanded Space Used = Yes.

3. Shrink the pool so that all pool-VOLs in the pool are deleted.
4. Format the LDEVs with Expanded Space Used = Yes.
5. Delete the LDEVs with Expanded Space Used = Yes.

C

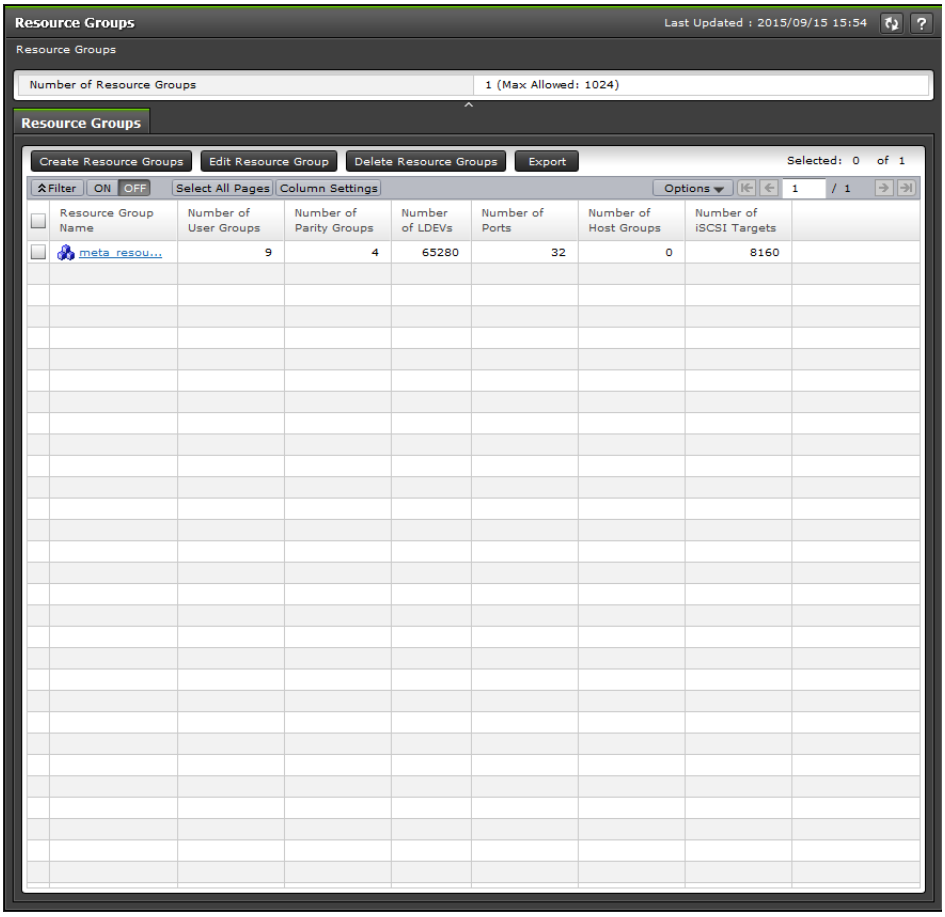
Resource Partition Manager GUI reference

The Resource Partition Manager windows in Hitachi Device Manager - Storage Navigator display the resource group information for the storage system and allow you to create, configure, and delete resource groups.

For general information about the Device Manager - Storage Navigator GUI, see the *System Administrator Guide*.

Resource Groups window

Use this window to create or delete resource groups, and to view, edit, or export information about resource groups. You must have correct user permissions to perform tasks on resource groups.



Summary and buttons

Item	Description
Number of Resource Groups	The number of resource groups configured in your storage system. The maximum allowed is 1024.
Create Resource Groups	Opens the **Create Resource Group** window, where you can create one or more new resource groups. The results will appear in this window.
Edit Resource Group	Opens the **Edit Resource Group** window, where you can edit the name of a selected resource group.
Delete Resource Groups	Opens the **Delete Resource Groups** window, where you can delete one or more resource groups selected in this window.

Item	Description
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as for backup or reporting.

Resource Groups tab

Item	Description
Resource Group Name	Name of a resource group.
Resource Group ID[1]	Identifier of a resource group.
Number of User Groups	Number of user groups where the resource group is assigned.
Number of Parity Groups	Number of parity groups that are assigned to the resource group.
Number of LDEVs	Number of LDEVs that are assigned to the resource group.
Number of Ports	Number of ports that are assigned to the resource group.
Number of Host Groups	Number of host groups that are assigned to the resource group.
Number of iSCSI Targets	Number of iSCSI targets that are assigned to the resource group.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine assigned to the resource group.

Note:

1. This item does not appear in the window by default. To display this item, change the **Column Settings** of the table option.

Selected resource group window

This window opens when you select a resource group in the **Resource Groups** window. It provides information about parity groups, LDEVs, ports, and host groups in the selected resource group.

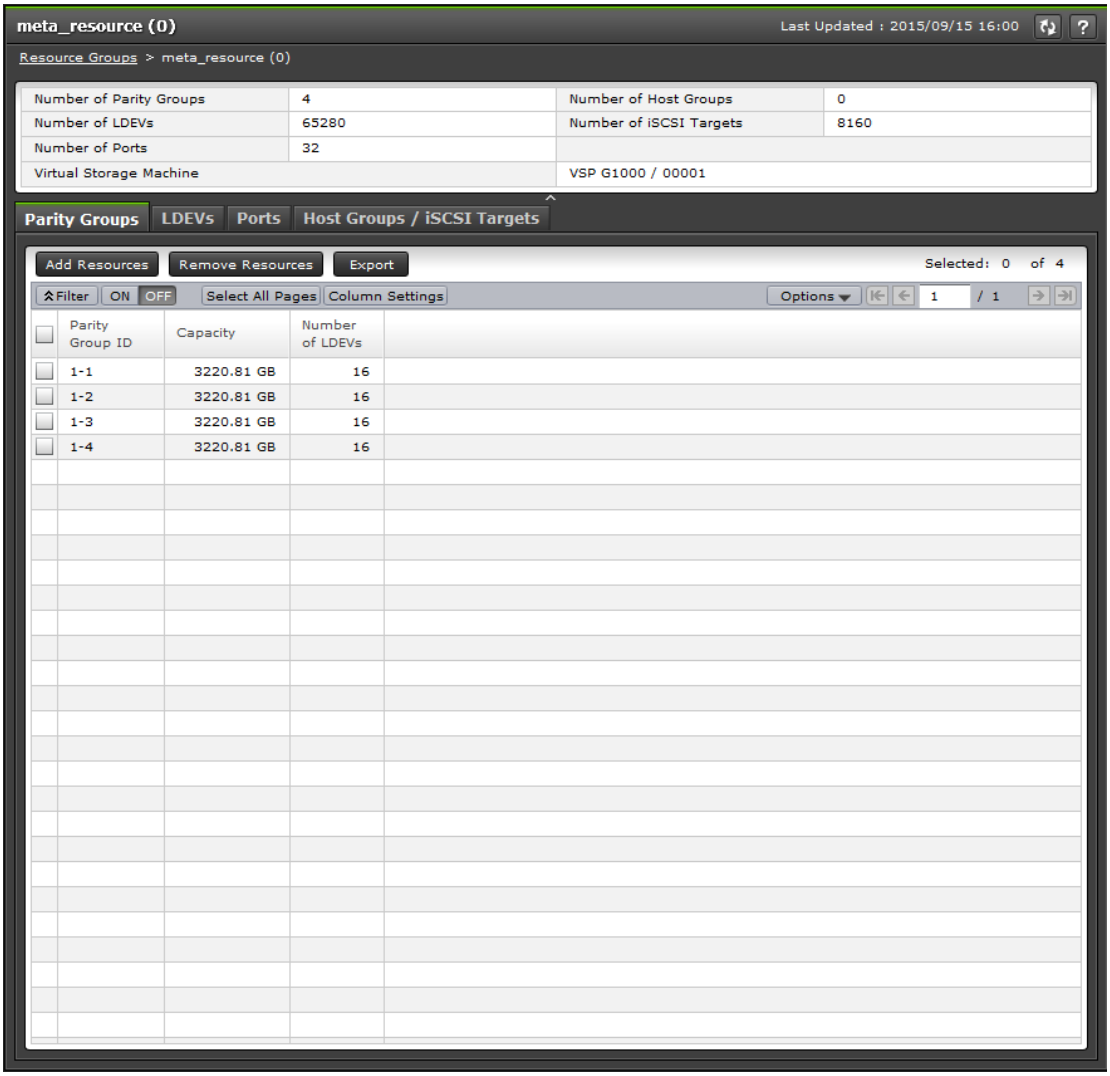
- Summary on page 433
- Parity Groups tab on page 434
- LDEVs tab on page 435
- Ports tab on page 438
- Host Groups / iSCSI Targets tab on page 439

Summary

Item	Description
Number of Parity Groups	Number of parity groups that are assigned to the resource group.

Item	Description
Number of LDEVs	Number of LDEVs that are assigned to the resource group.
Number of Ports	Number of ports that are assigned to the resource group.
Number of Host Groups	Number of host groups that are assigned to the resource group.
Number of iSCSI Targets	Number of iSCSI targets that are assigned to the resource group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine assigned to the resource group.

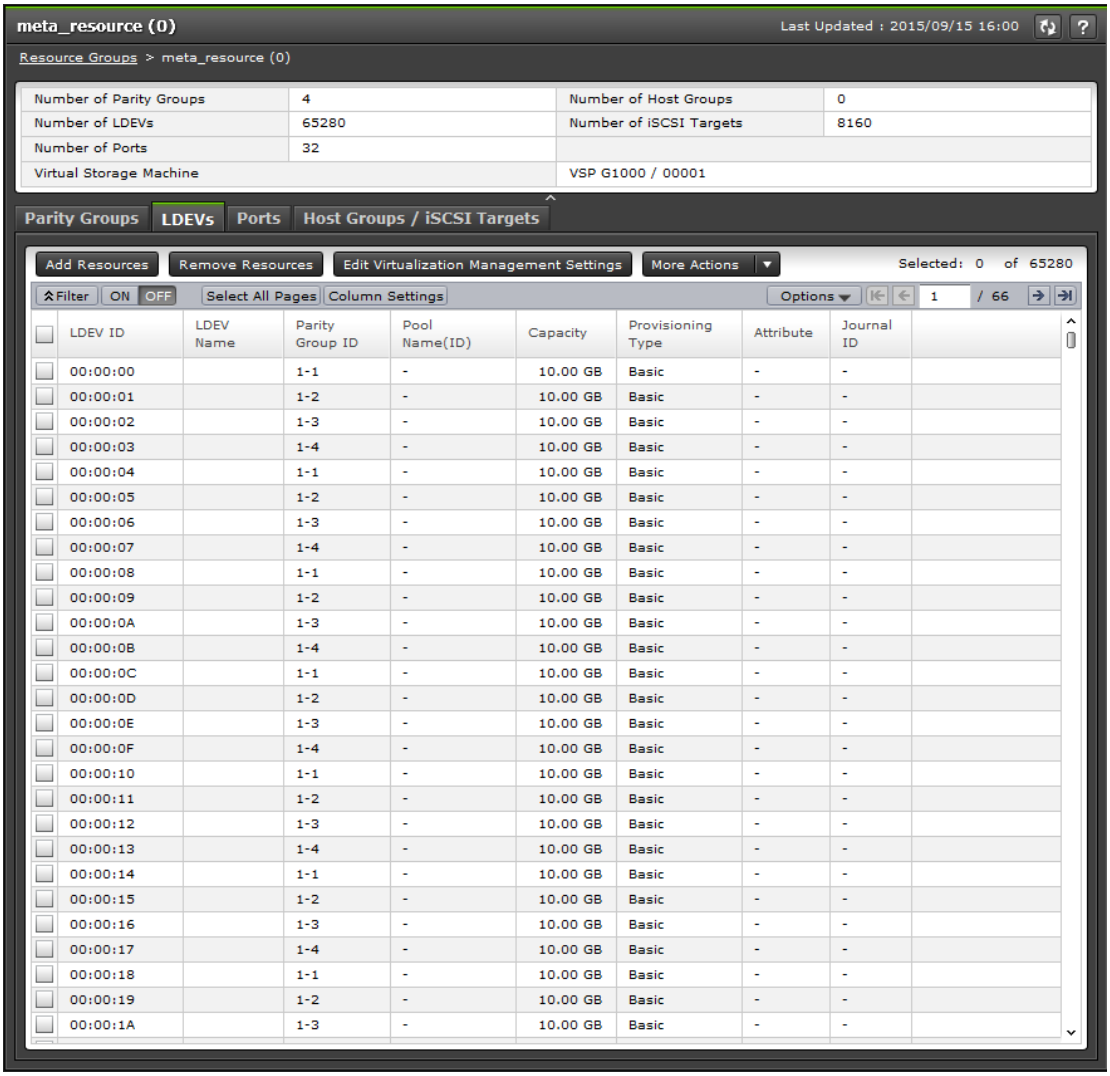
Parity Groups tab



Item	Description
Parity Group ID	Identifiers of parity groups that are already defined.

Item	Description
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in each parity group.
Add Resources	Opens the **Add Resources** window, which allows you to add one or more resources to the resource group.
Remove Resources	Opens the **Remove Resources** window, which allows you to remove one or more resources from the resource group.
Export	Opens a window that allows you to export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

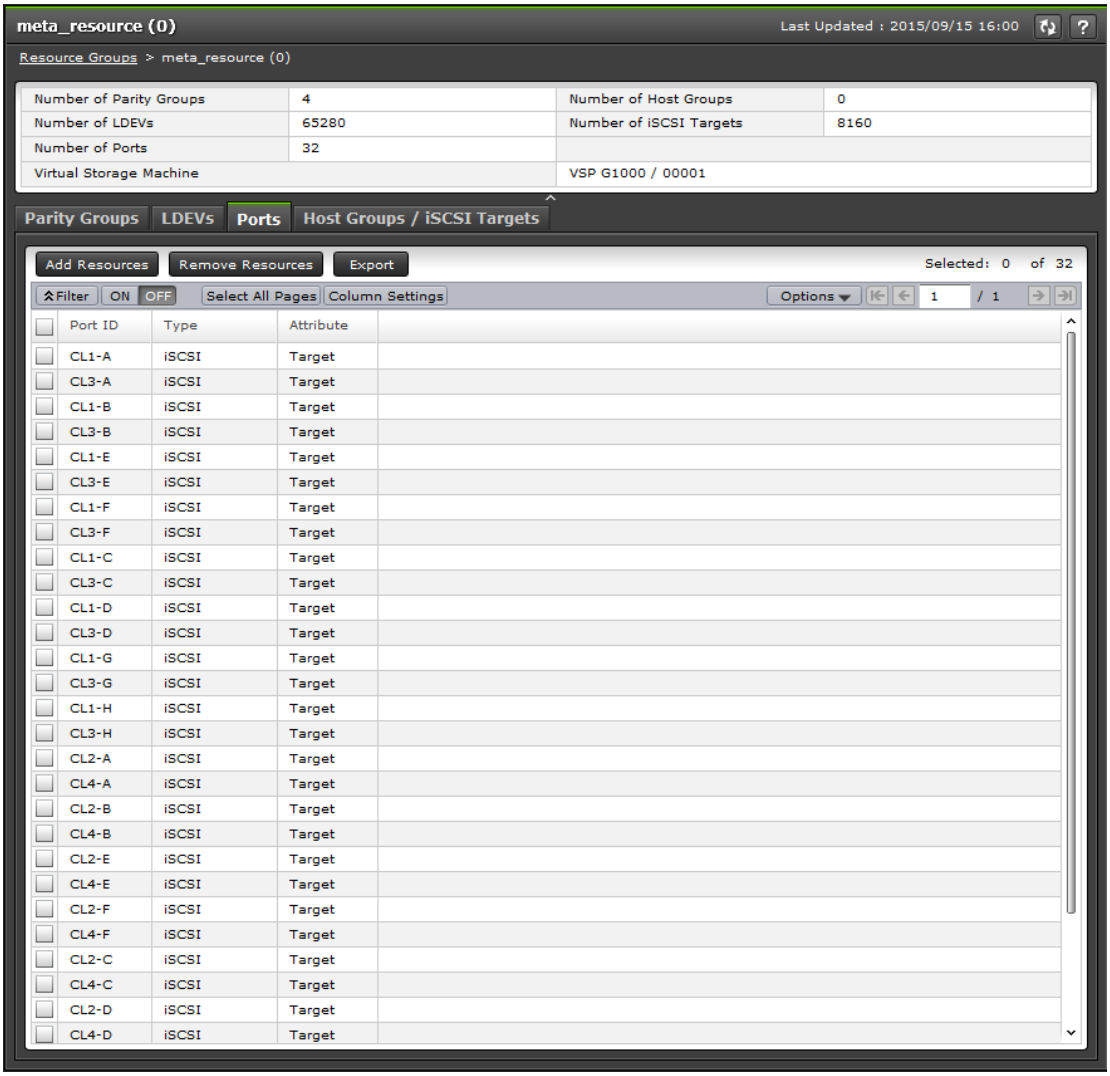
LDEVs tab



Item	Description
LDEV ID	LDEV identifiers. Some undefined LDEV IDs might appear. A hyphen (-) in the LDEV name indicates the LDEV is undefined.
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier to which the LDEV belongs.
Pool Name (ID)	Pool name and identifier to which the LDEV belongs.
Capacity	Capacity of each LDEV.
Provisioning Type	Provisioning type of each volume. • Basic: Internal volume • DP: DP-VOL • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV of the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Command device for CCI. • Remote Command Device: Remote command device for CCI • JNL VOL: Journal volume. • Pool VOL: Pool volume. The number in parentheses is the pool identifier. • Quorum Disk: Quorum disk for global-active device. • Data Direct Mapping: LDEV with the data direct mapping attribute. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: LDEV used to manage data deduplication. • - (hyphen): LDEV in which the attribute is not defined.
Journal ID	Journal identifier when the attribute is JNL VOL. A hyphen (-) indicates the attribute is other than JNL VOL.
Virtual Storage Machine[1]	Information about the virtual storage machine. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. If the setting of the LDEV virtualization management is canceled, Transient is displayed. Failed is displayed on the Status column in the **Task** window. To resolve the transient status, perform one of following operation to LDEVs: ○ Resolve the cause of the failure by confirming the solution of the error message in the **Task** window. Then retry the same operation by using the **Edit Virtualization Management Settings** window. ○ In the **Edit Virtualization Management Settings** window, set Virtual Management Settings to Disable and apply the setting to the storage system. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE

Item	Description
	volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.
Add Resources	Opens the **Add Resources** window, which allows you to add one or more resources to the resource group.
Remove Resources	Opens the **Remove Resources** window, which allows you to remove one or more resources from the resource group.
Edit Virtualization Management Settings	Opens the **Edit Virtualization Management Settings** window, which allows you to set the global storage virtualization function, and edit the virtual LDEV ID or the virtual LDEV information.
Assign GAD Reserves[1]	Opens the **Assign GAD Reserves** window, which allows you to set the attribute of the global-active device secondary volume for the selected LDEV. For details, see *Global-Active Device User Guide*.
Release GAD Reserves[1]	Opens the **Release GAD Reserves** window, which allows you to remove the attribute of the global-active device secondary volume from the selected LDEV. For details, see *Global-Active Device User Guide*.
Export[1]	Opens a window that allows you to export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
Notes: **1.** This item does not appear by default. To display this item, change the Column Settings.	

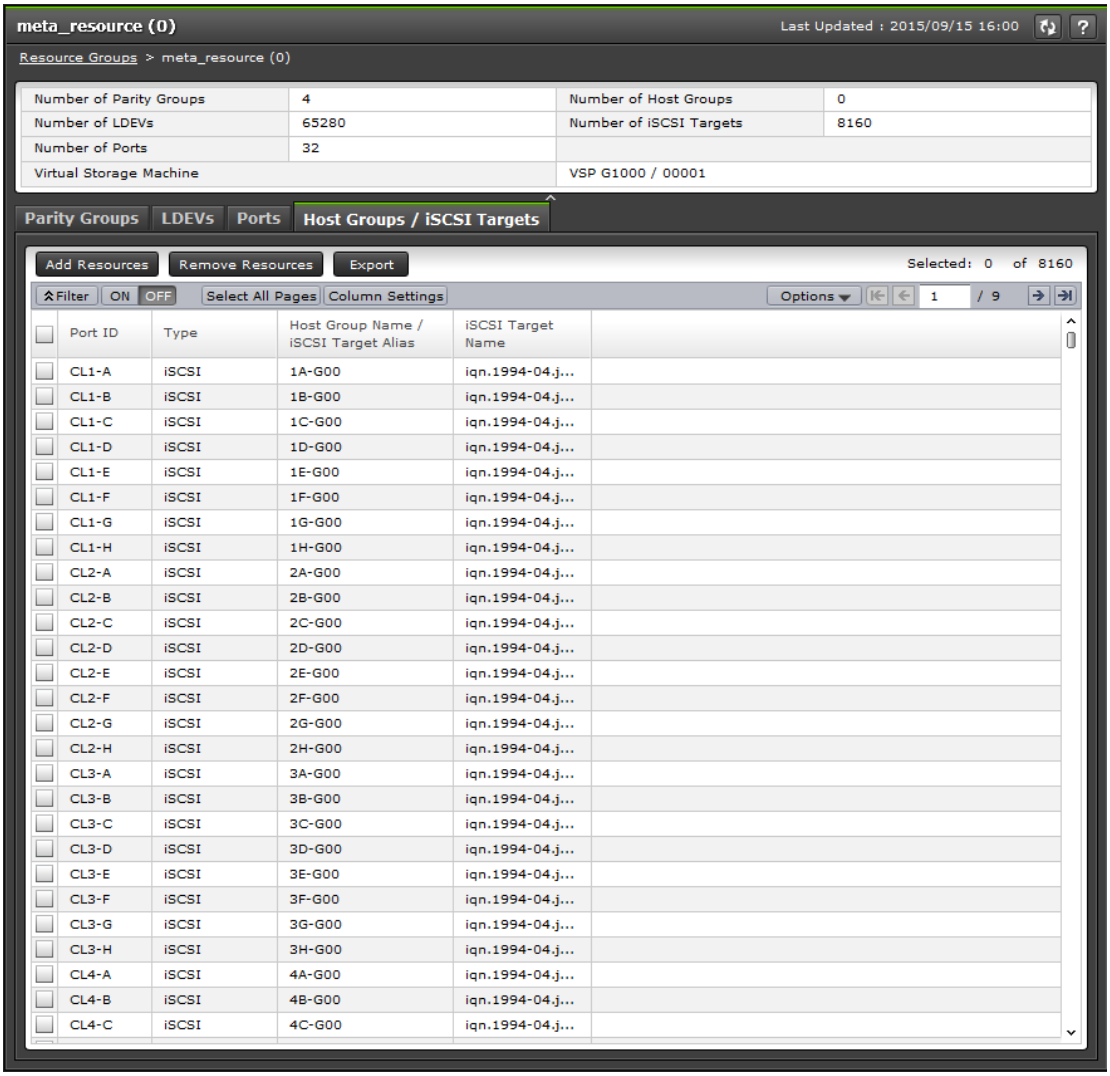
Ports tab



Item	Description
Port ID	Identifiers of the ports that are already mounted.
Type	Types of ports. • Fibre: Fibre Channel ports • iSCSI: iSCSI ports • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Add Resources	Opens the **Add Resources** window, which allows you to add one or more resources to the resource group.
Remove Resources	Opens the **Remove Resources** window, which allows you to remove one or more resources from the resource group.

Item	Description
Export	Opens a window that allows you to export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Host Groups / iSCSI Targets tab



Item	Description
Port ID	Port identifiers.
Type	Type of ports. • Fibre: Fibre Channel ports • iSCSI: iSCSI ports • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed.

Item	Description
	• NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Host Group Name/ iSCSI Target Alias	Name and identifier of each host group or iSCSI target alias that uses a port. Some undefined host groups or iSCSI targets can appear. If a host group or an iSCSI target is not defined, a blank space appears.
Host Group ID/ iSCSI Target ID[1]	Host Group ID or iSCSI Target ID.
iSCSI Target Name	iSCSI target name. A hyphen (-) appears if the row of the host group.
Add Resources	Opens the **Add Resources** window, which allows you to add one or more resources to a resource group.
Remove Resources	Opens the **Remove Resources** window, which allows you to remove one or more resources from a resource group.
Export	Opens a window that allows you to export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

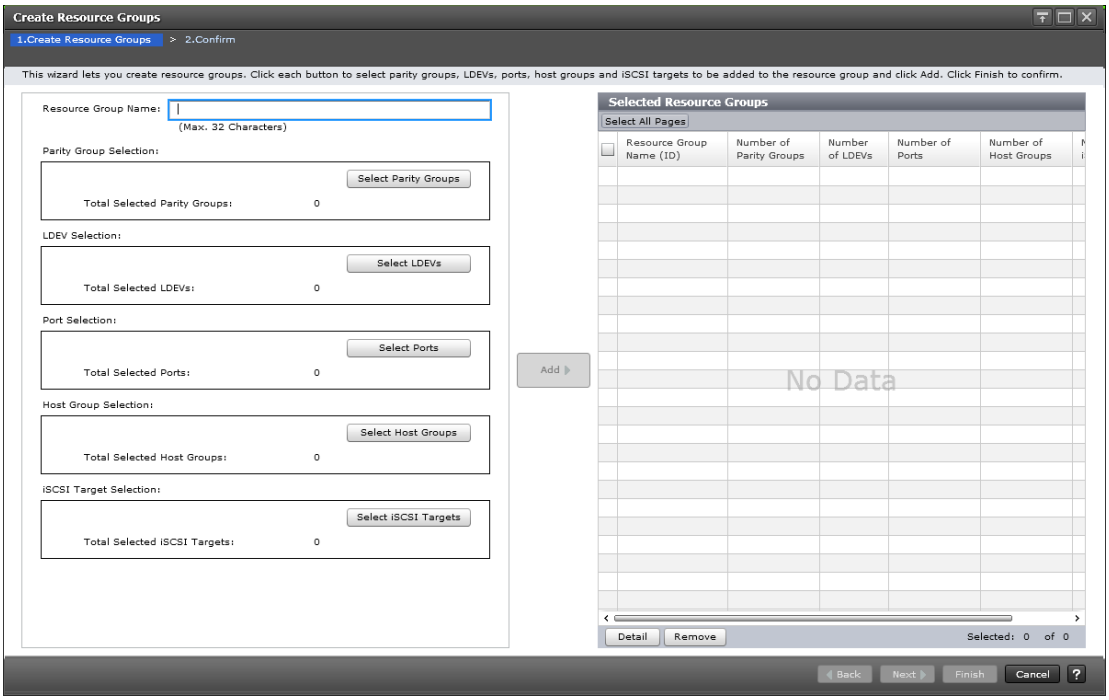
Note:

1. This item does not appear in the window by default. To display this item, change the **Column Settings** of the table option.

Create Resource Groups wizard

Create Resource Groups window

Use this window to select the parity groups, LDEVs, ports, host groups, and iSCSI targets that will make up a resource group.



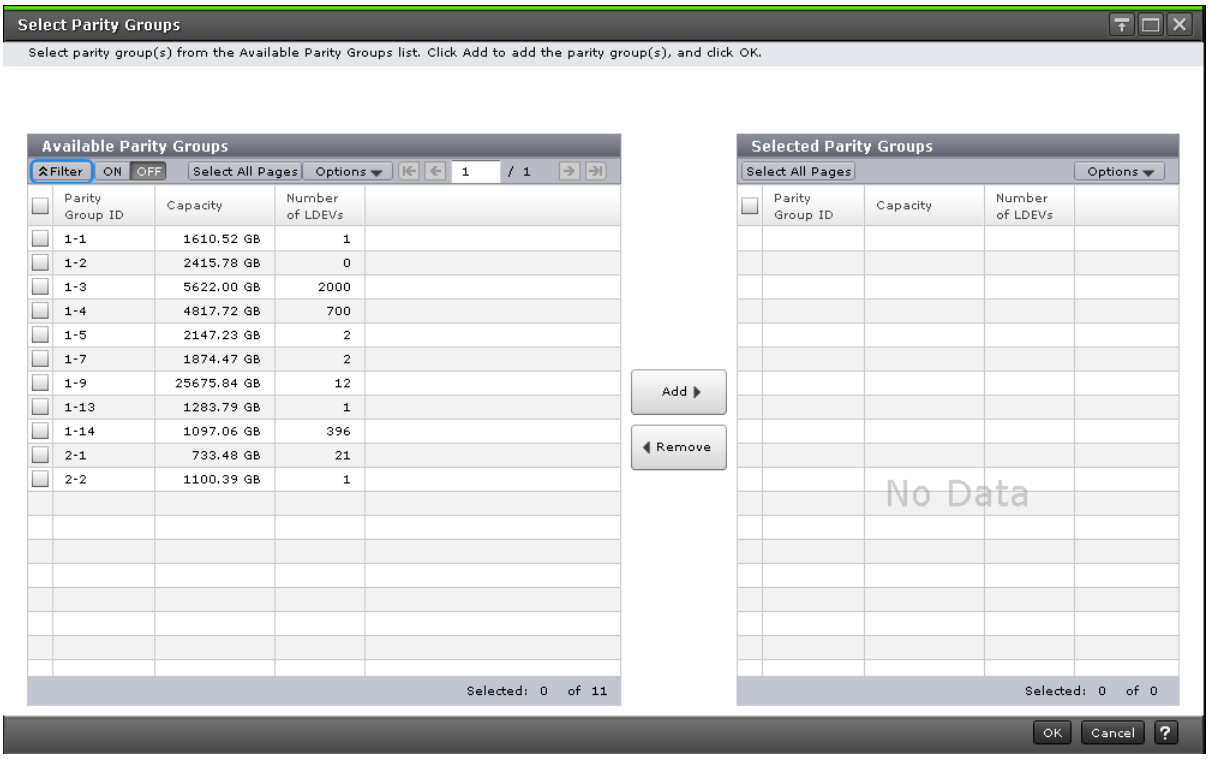
Setting fields

Item	Description
Resource Group Name*	Type a unique name for this resource group. the following rules apply: • meta_resource and NAS_Platform_System_RSG cannot be set as a resource group name. • Names must be unique, and multiple occurrences of the same resource group name are not allowed in one storage system. • Resource names are case-sensitive. • Usable characters are alphanumeric, spaces, and symbols (! # $ % & ' ( ) + - . = @ [ ] ^ _ ` { } ~)
Select Parity Groups	Opens the **Select Parity Groups** window, where you select one or more parity groups to be assigned to the resource group.
Select iSCSI Targets	Opens the Select iSCSI Targets window where you select one or more iSCSI Targets to be assigned to the resource group.
Select LDEVs	Opens the **Select LDEVs** window, where you select one or more LDEVs to be assigned to the resource group.
Select Ports	Opens the **Select Ports** window, where you select one or more ports to be assigned to the resource group.
Select Host Groups	Opens the **Select Host Groups** window, where you select one or more host groups to be assigned to the resource group.
Add	Adds your settings to the Selected Resource Groups table.
* Item requires configuration.	

Selected Resource Groups table

Item	Description
Resource Group Name (ID)	Name and identifier of each resource group. A hyphen indicates the ID number is not assigned before setting a resource group.
Number of Parity Groups	Number of parity groups to be assigned to the resource group.
Number of LDEVs	Number of LDEVs to be assigned to the resource group.
Number of Ports	Number of ports to be assigned to the resource group.
Number of Host Groups	Number of host groups to be assigned to the resource group.
Number of iSCSI Targets	Number of iSCSI targets to be assigned to the resource group.
Detail	Opens the **Resource Group Property** window, where you can view details of the selected resource group.
Remove	Removes a selected resource group.

Select Parity Groups window



Available Parity Groups table

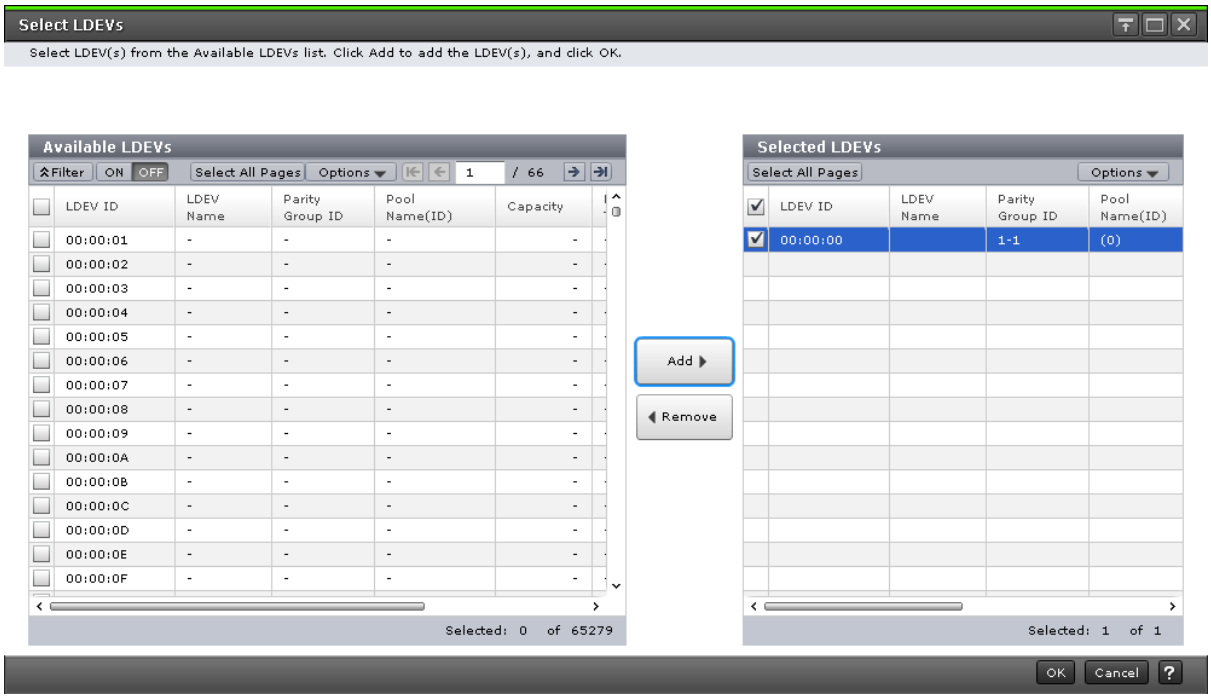
Item	Description
Parity Group ID	Parity group identifiers.

Item	Description
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in each parity group.
Add	Adds one or more parity groups selected in the Available Parity Groups table to the Selected Parity Groups table.
Remove	Removes one or more selected parity groups from the Selected Parity Groups table and relocates the parity groups to the Available Parity Groups table.

Selected Parity Groups table

Item	Description
Parity Group ID	Parity group identifiers.
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in each parity group.

Select LDEVs window



Available LDEVs table

Item	Description
LDEV ID	LDEV identifiers.

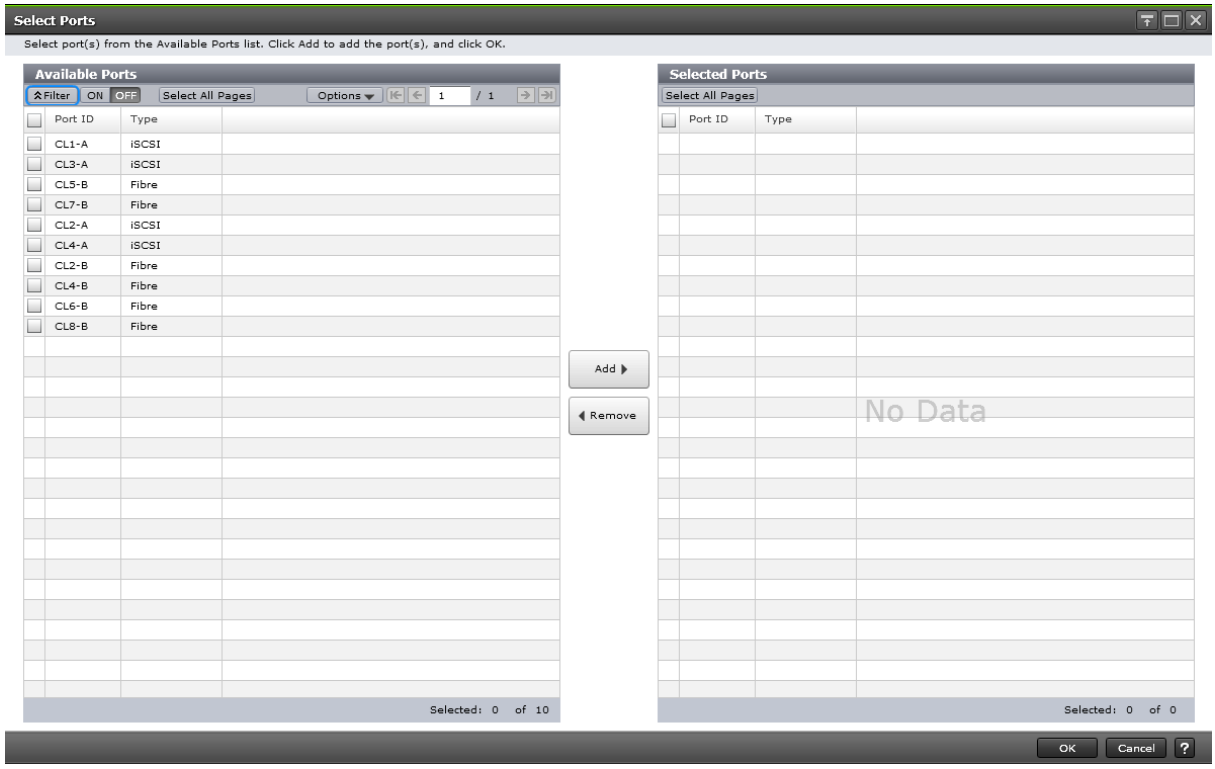
Item	Description
	LDEV IDs may appear for undefined LDEVs. A hyphen appearing in columns to the right of the LDEV ID and LDEV name (for example, Parity Group ID, Pool Name ID, Capacity, and so on) indicates the LDEV is undefined.
LDEV Name	LDEV names.
Parity Group ID	Parity group identifier where the LDEV belongs.
Pool Name (ID)	Pool name and identifier where the LDEV belongs.
Capacity	Capacity of each LDEV.
Provisioning Type	Provisioning type of each volume. • Basic: Internal volume • DP: V-VOL of Dynamic Provisioning • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV with the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is used. • Command Device: Command device • Remote Command Device: Remote command device • JNL VOL: Journal volume • Pool VOL: Pool volume. The number in parentheses shows the pool ID. • Quorum Disk: Quorum disk for global-active device. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: LDEV used to manage data deduplication. • - (hyphen): LDEV for which the attribute is not defined
Journal ID	Journal identifier when the attribute is JNL VOL. A hyphen indicates the attribute is other than JNL VOL.
Add	Adds the LDEVs selected in the Available LDEVs table to the Selected LDEVs table.
Remove	Removes the selected LDEVs from the Selected LDEVs table and relocates the LDEVs to the Available LDEVs table.

Selected LDEVs table

Item	Description
LDEV ID	LDEV identifiers. Some undefined LDEV IDs might appear. A hyphen in the LDEV name indicates the LDEV is undefined.
LDEV Name	LDEV names.

Item	Description
Parity Group ID	Parity group identifier where the LDEV belongs.
Pool Name (ID)	Pool name and identifier where the LDEV belongs.
Capacity	Capacity of each LDEV.
Provisioning Type	Displays the type of each volume. • Basic: Internal volume • DP: DP-VOL • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV with the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Command device. • Remote Command Device. • JNL VOL: Journal volume. • Pool VOL: Pool volume. The number in parentheses is the pool identifier. • Quorum Disk: Quorum disk for global-active device. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: LDEV used to manage data deduplication. • - (hyphen): LDEV for which the attribute is not defined.
Journal ID	Journal identifier when the attribute is JNL VOL. A hyphen (-) indicates the attribute is other than JNL VOL.

Select Ports window



Available Ports table

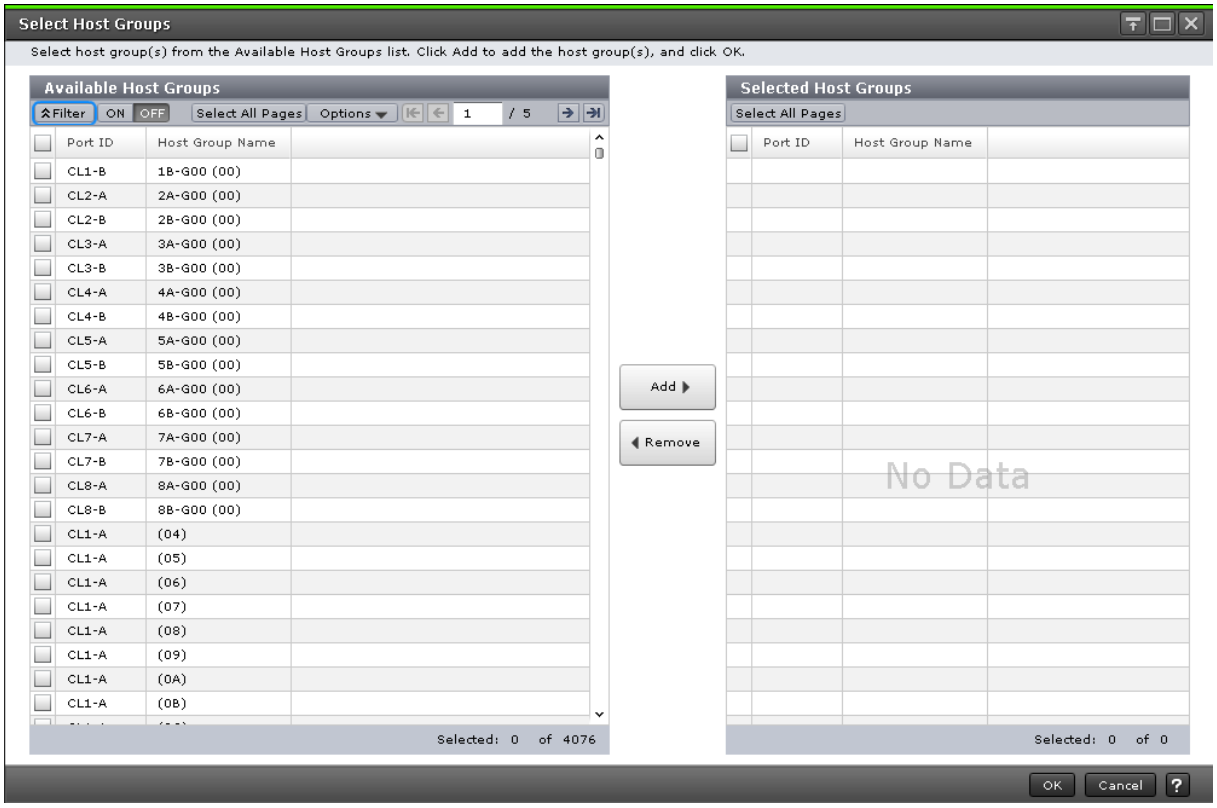
Item	Description
Port ID	Port identifier.
Type	Types of ports. • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Add	Adds one or more ports selected in the Available Ports table to the Selected Ports table.
Remove	Removes one or more selected ports from the Selected Ports table and relocates the ports to the Available Ports table.

Selected Ports table

Item	Description
Port ID	Port identifier.

Item	Description
Type	Types of ports. • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.

Select Host Groups window



Available Host Groups table

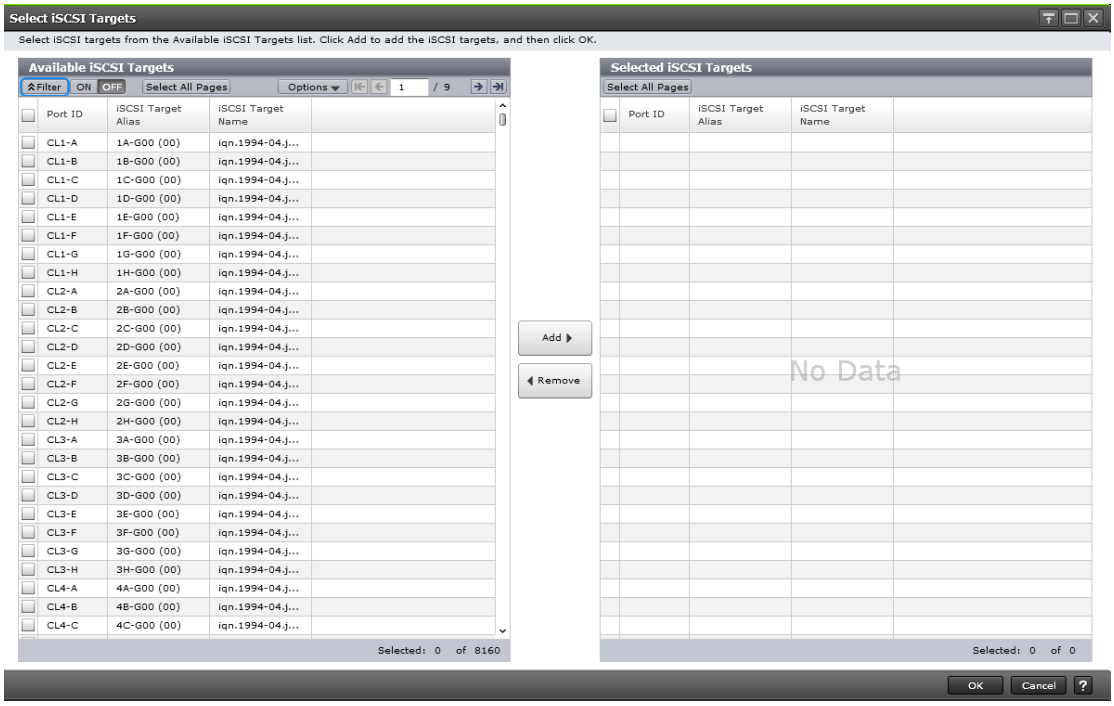
Item	Description
Port ID	Port identifiers.
Host Group Name	Name and identifier of each host group that uses a port. Some undefined host groups might appear. If a host group is not defined, the host name is blank.
Add	Adds one or more host groups selected in the Available Host Groups table to the Selected Host Groups table.

Item	Description
Remove	Removes one or more selected host groups from the Selected Host Groups table and relocates the host groups to the Available Host Groups table.

Selected Host Groups table

Item	Description
Port ID	Port identifiers.
Host Group Name	Name and identifier of each host group that uses a port. Some undefined host groups may appear. If a host group is not defined, the host name is blank.

Select iSCSI Targets window



Available iSCSI Targets table

This table lists iSCSI targets that are assigned to each user.

Item	Description
Port ID	Port identifiers.

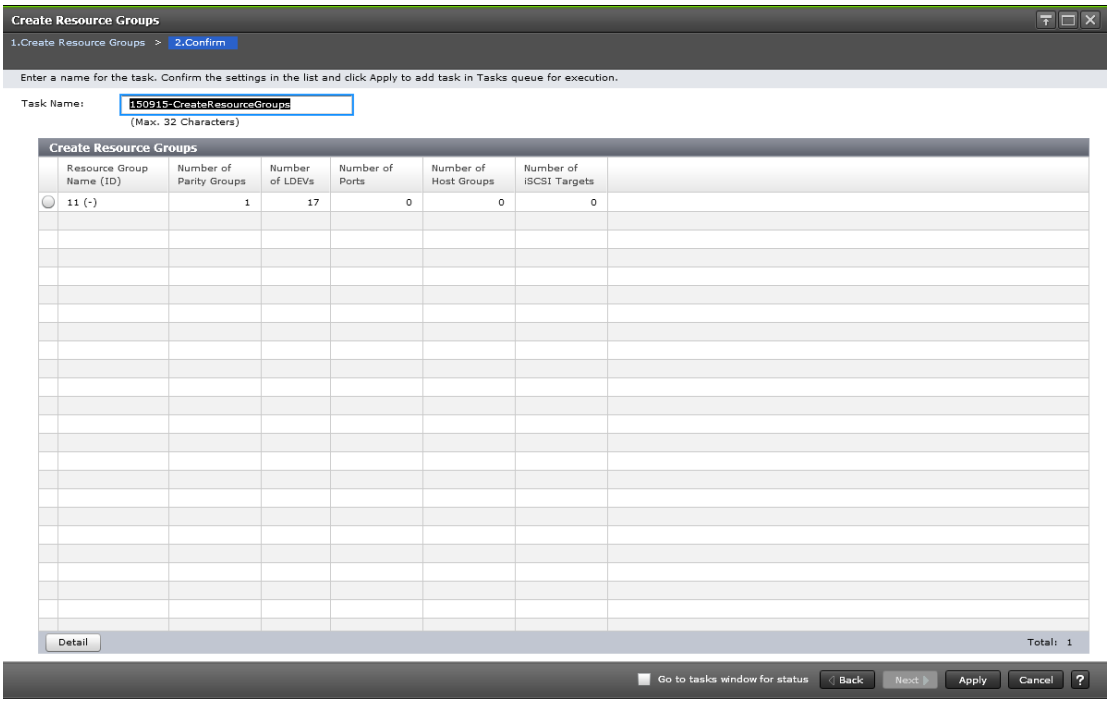
Item	Description
iSCSI Target Alias	Name and identifier of each iSCSI target alias that uses a port. Some undefined iSCSI targets may appear. If an iSCSI target is not defined, the blank appears.
iSCSI Target Name	iSCSI target name. If an iSCSI target is not defined, the blank appears.
Add	Adds one or more iSCSI targets selected in the Available iSCSI Targets table to the Selected iSCSI Targets table.
Remove	Removes one or more selected host groups from the **Selected iSCSI Targets** table and relocates the iSCSI targets to the **Available iSCSI Targets** table.

Selected iSCSI Targets table

Item	Description
Port ID	Port identifiers.
iSCSI Target Alias	Name and identifier of each iSCSI target alias that uses a port. Some undefined iSCSI targets may appear. If an iSCSI target is not defined, the blank appears.
iSCSI Target Name	iSCSI target name. If an iSCSI target is not defined, the blank appears.

Create Resource Groups Confirmation window

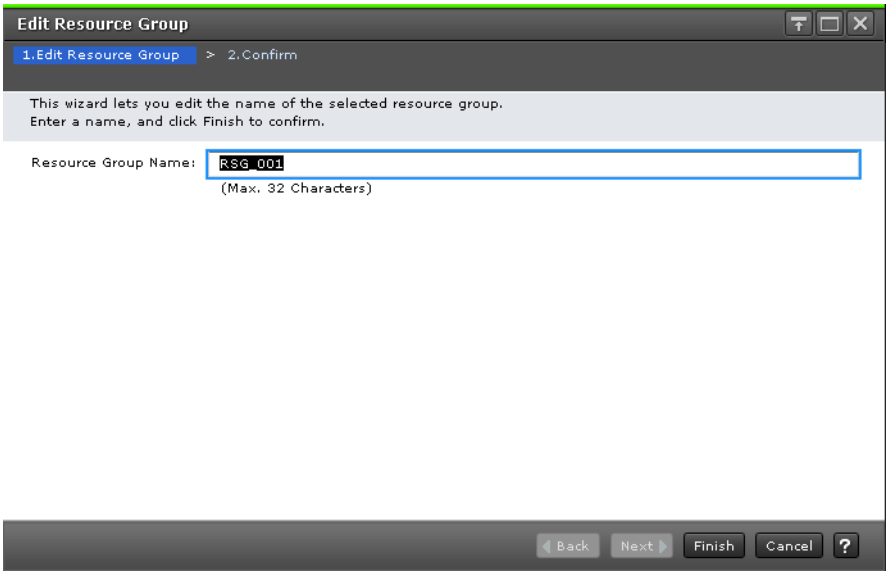
Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Item	Description
Resource Group Name (ID)	Name and identifier of each resource group.
Number of Parity Groups	Number of parity groups to be assigned to the resource group.
Number of LDEVs	Number of LDEVs to be assigned to the resource group.
Number of Ports	Number of ports to be assigned to the resource group.
Number of Host Groups	Number of host groups to be assigned to the resource group.
Number of iSCSI Targets	Number of iSCSI targets to be assigned to the resource group.
Detail	Opens the **Resource Group Property** window, where you can view the details of the selected resource group.

Edit Resource Group wizard

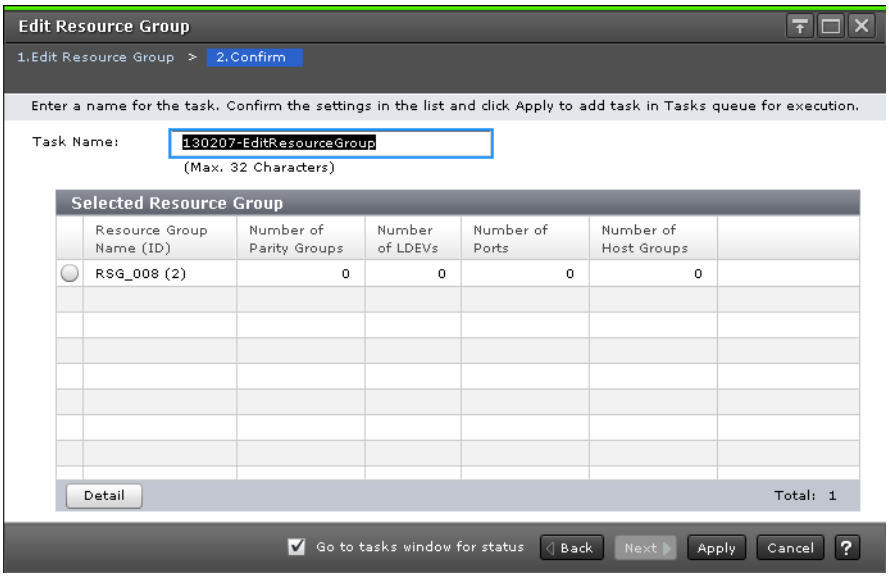
Edit Resource Group window



Item	Description
Resource Group Name	Type the name of the resource group after editing. • meta_resource and NAS_Platform_System_RSG cannot be set as a name. • Duplicate occurrences of the same resource group name are not allowed in one storage system. • Names are case-sensitive. • Usable characters are alphanumeric, spaces, and symbols (! # $ % & ' ( ) + - . = @ [ ] ^ _ ` { } ~)

Edit Resource Group Confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

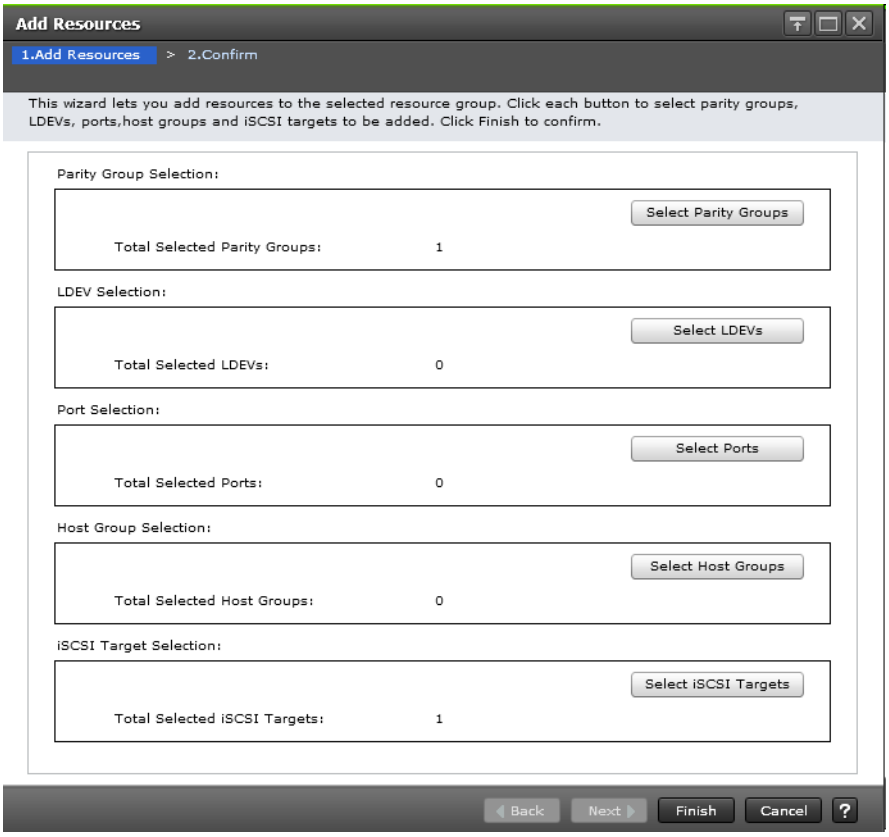


Selected Resource Group tab

Item	Description
Resource Group Name (ID)	Name and identifier of the edited resource group.
Number of Parity Groups	Number of parity groups that are assigned to the resource group.
Number of LDEVs	Number of LDEVs that are assigned to the resource group.
Number of Ports	Number of ports that are assigned to the resource group.
Number of Host Groups	Number of host groups that are assigned to the resource group.
Detail	Opens the **Resource Group Property** window, where you can view the details of the selected resource group.

Add Resources wizard

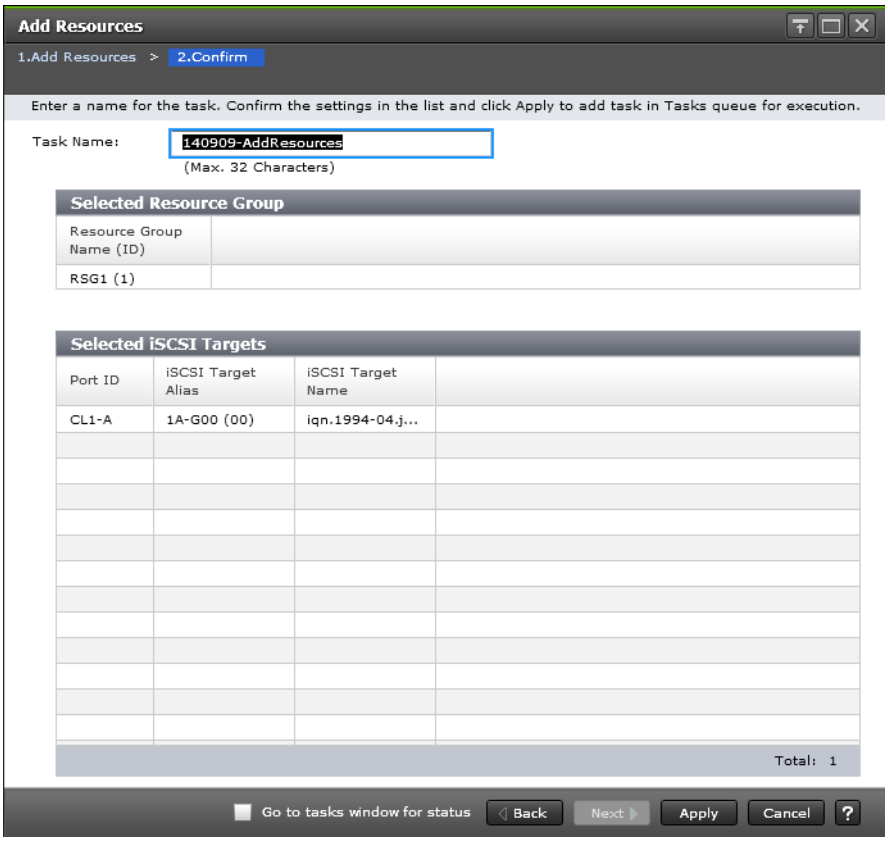
Add Resources window



Item	Description
Select Parity Groups	Opens the **Select Parity Group** window, where you can select one or more parity groups to be added to the resource group.
Select LDEVs	Opens the **Select LDEVs** window, where you can select one or more LDEVs to be added to the resource group.
Select Ports	Opens the **Select Ports** window, where you can select one or more ports to be added to the resource group.
Select Host Groups	Opens the **Select Host group** window, where you can select one or more host groups to be added to the resource group.
Select iSCSI Targets	Opens the Select iSCSI Targets window, where you can select one or more host groups to be added to the resource group.

Add Resources confirmation window

Confirm the proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Resource Group table

Item	Description
Resource Group Name (ID)	Name and identifier of the resource group to be added to the storage system.

Selected Parity Groups table

Item	Description
Parity Group ID	One or more parity group identifiers to be added to the resource group.
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in each parity group.

Selected LDEVs table

Item	Description
LDEV ID	The identifiers of the LDEVs to be added to a resource group. Some undefined LDEV IDs might appear. A hyphen (-) in the LDEV name indicates the LDEV is undefined.
LDEV Name	LDEV names.

Item	Description
Parity Group ID	Parity group identifier to which the LDEV belongs.
Pool Name (ID)	Pool name and identifier to which the LDEV belongs.
Capacity	Capacity of the LDEV.
Provisioning Type	Provisioning type of the volume. • Basic: Internal volume • DP: DP-VOL • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV with the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Command device for CCI • Remote Command Device: Remote command device for CCI • JNL VOL: Journal volume for Universal Replicator • Pool VOL: Pool volume. The number in parentheses is the pool identifier. • Quorum Disk: Quorum disk for global-active device • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: LDEV used to manage data deduplication. • - (hyphen): LDEV in which the attribute is not defined
Journal ID	Journal identifier appears when the attribute is JNL VOL. A hyphen indicates the attribute is other than JNL VOL.

Selected Ports table

Item	Description
Port ID	Port identifiers to be added to a resource group.
Type	Type of ports. • Fibre: Fibre Channel port. • iSCSI: iSCSI port. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.

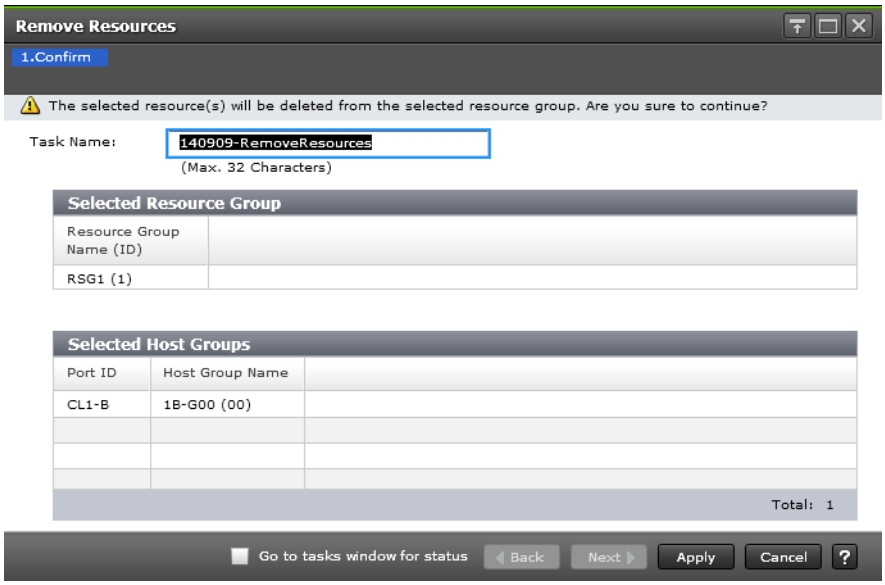
Selected Host Groups table

Item	Description
Port ID	Port identifiers that are used by the host group.
Host Group Name	Name and identifier of each host group to be added to a resource group. Some undefined host groups might appear. If a group is not defined, the host name is blank.

Selected iSCSI Targets table

Item	Description
Port ID	Port identifiers that are used by the host group.
iSCSI Target Alias	iSCSI Target Alias. Name and identifier of each iSCSI target alias to be added to a resource group. Some undefined iSCSI targets can appear. If an iSCSI target is not defined, the target name is blank.
iSCSI Target Name	iSCSI target name. If an iSCSI target is not defined, the target name is blank.

Remove Resources window



Selected Resource Group table

Item	Description
Resource Group Name (ID)	Name and identifier of each resource group whose resources are deleted.

Selected Parity Groups table (when deleting parity groups)

Item	Description
Parity Group ID	Identifier of each parity group to be deleted from the resource group.
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in the parity group.

Selected LDEVs table (when deleting LDEVs)

Item	Description
LDEV ID	LDEV identifiers to be deleted from a resource group. Some undefined LDEV IDs may appear. A hyphen in the LDEV name indicates the LDEV is undefined.
LDEV Name	LDEV names to be deleted from the resource group.
Parity Group ID	Parity group ID where the LDEV belongs.
Pool Name (ID)	Pool name where the LDEV belongs.
Capacity	Capacity of each LDEV.
Provisioning Type	Provisioning type of each volume. • Basic: Internal volume • Dynamic Provisioning: DP-VOL • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV of the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Command device. • Remote Command Device. • JNL VOL: Journal volume. • Pool VOL: Pool volume. The number in parentheses is the pool identifier. • Quorum Disk: Quorum disk for global-active device. • ALU: LDEV of the ALU attribution. • SLU: LDEV of the SLU attribution. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication system data volume. • Hyphen (-): Volume in which the attribute is not defined.

Item	Description
Journal ID	Journal ID when the attribute is JNL VOL. A hyphen indicates the attribute is other than JNL VOL.

Selected Ports table (when deleting ports)

Item	Description
Port ID	Port IDs that are to be deleted from the resource group.
Type	Type of ports. • Fibre: Fibre Channel port. • iSCSI: iSCSI port. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.

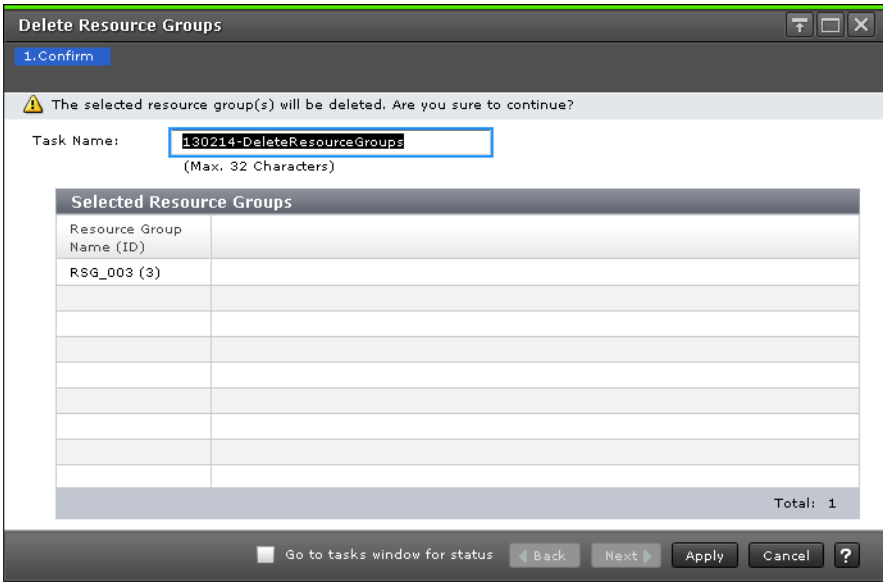
Selected Host Groups table (when deleting Host Groups)

Item	Description
Port ID	Port IDs that are used by the host group.
Host Group Name	Name and ID of each host group name to be deleted from the resource group. Some undefined host group names may appear. If a host group is not defined, the host name is blank.

Selected iSCSI Targets table (when deleting iSCSI Targets)

Item	Description
Port ID	Port IDs that are used by the host group.
iSCSI Target Alias	Name and ID of each iSCSI target alias to be deleted from the resource group. Some undefined iSCSI targets may appear. If an iSCSI target is not defined, the target alias is blank.
iSCSI Target Name	iSCSI target name. If an iSCSI target is not defined, the target name is blank.

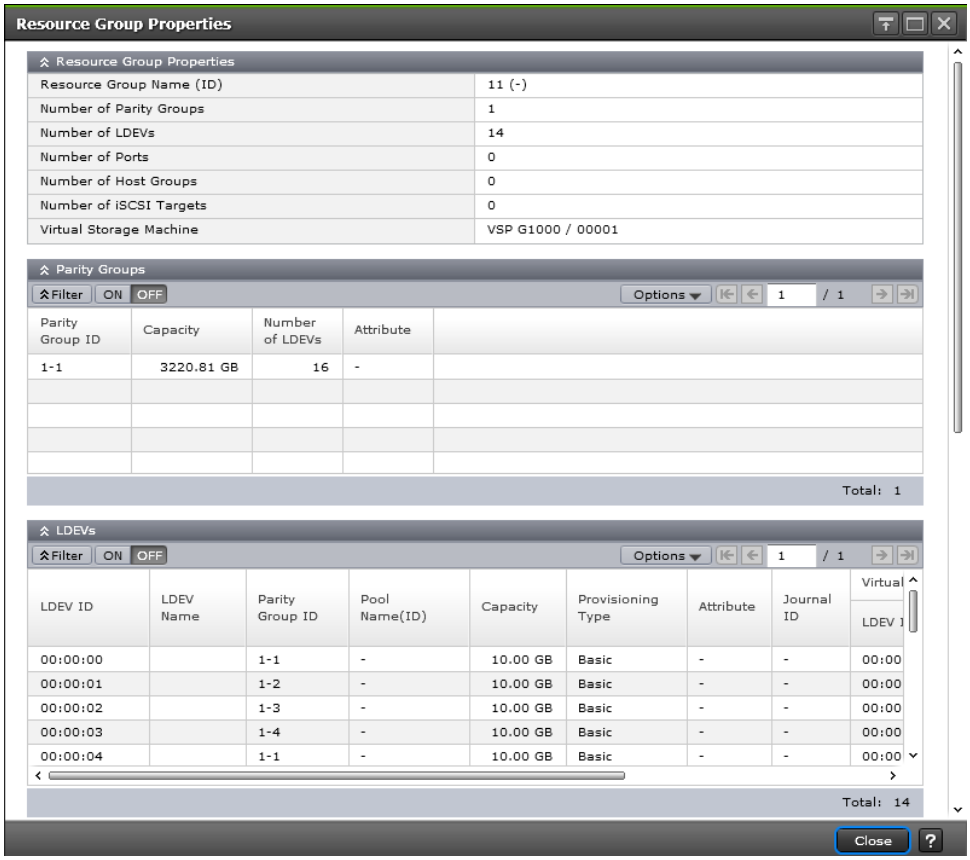
Delete Resource Groups window



Selected Resource Groups table

Item	Description
Resource Group Name (ID)	Name and ID of each resource group name to be deleted.

Resource Group Properties window



Resource Group Properties table

Item	Description
Resource Group Name (ID)	Name and ID of a resource group name.
Number of Parity Groups	Number of parity groups that are assigned to the resource group.
Number of LDEVs	Number of LDEVs that are assigned to the resource group.
Number of Ports	Number of ports that are assigned to the resource group.
Number of Host Groups	Number of host groups that are assigned to the resource group.
Number of iSCSI Targets	Number of iSCSI targets that are assigned to the resource group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine assigned to the resource group.

Parity Groups table

Item	Description
Parity Group ID	Parity group IDs.
Capacity	Capacity of each parity group.
Number of LDEVs	Number of LDEVs in each parity group.
Attribute	Displays the attribute of the parity group. -: Parity group in which the attribute is not defined.

LDEVs table

Item	Description
LDEV ID	LDEV IDs. Some undefined LDEV IDs may appear. A hyphen in the LDEV name indicates the LDEV is undefined.
LDEV Name	LDEV names.
Parity Group ID	Parity group ID where the LDEV belongs.
Pool Name (ID)	Pool name and ID where the LDEV belongs.
Capacity	Capacity of the LDEV.
Provisioning Type	Provisioning type of the volume. • Basic: Internal volume • DP: DP-VOL • External: External volume • External MF: Migration volume • Snapshot: Thin Image volume • ALU: LDEV of the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Command device. • Remote Command Device. • JNL VOL: Journal volume. • Pool VOL: Pool volume. The number in parentheses is the pool identifier. • Quorum Disk: Quorum disk for global-active device. • ALU: LDEV of the ALU attribution. • SLU: LDEV of the SLU attribution. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication System Data volume. • Hyphen (-): Volume in which the attribute is not defined.
Journal ID	Journal ID when the attribute is JNL VOL. A hyphen indicates the attribute is other than JNL VOL.
Virtual Storage Machine	Information about the virtual storage machine. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank.

Item	Description
	• Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank. • Attribute: Virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.

Ports table

Item	Description
Port Name	Port IDs.
Type	Type of port. • Fibre: Fibre Channel port. • iSCSI: iSCSI port. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.

Host Groups table

Item	Description
Port ID	Port IDs that are used by the host group.
Host Group Name	Name and ID of each host group. Some undefined host group names may appear. If a host group is not defined, the host group is blank.

iSCSI Targets table

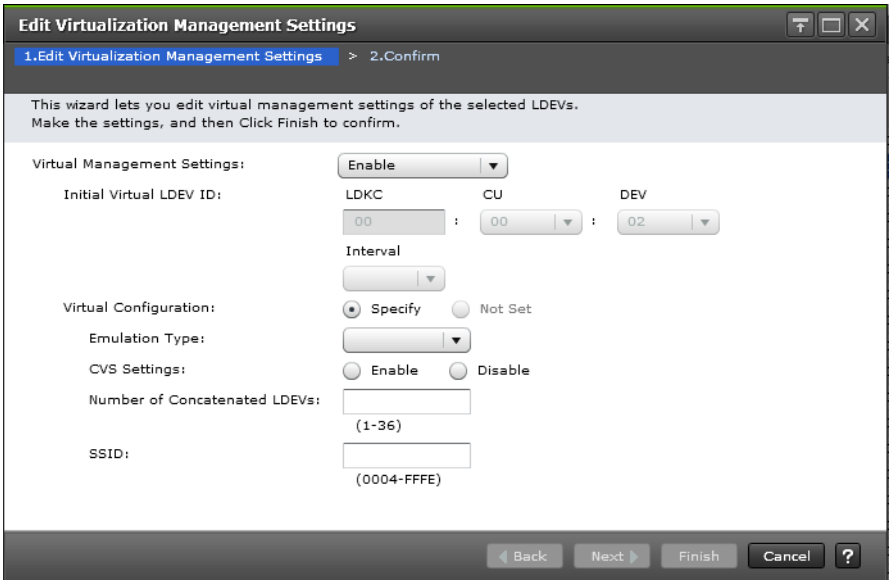
Item	Description
Port ID	Port IDs that are used by the host group.
iSCSI Target Alias	iSCSI target alias. iSCSI target alias and identifier of each iSCSI target. Some undefined iSCSI targets may appear. If an iSCSI target is not defined, the target alias is blank.

Item	Description
iSCSI Target Name	iSCSI target name. If an iSCSI target is not defined, the target name is blank.

Edit Virtualization Management Settings wizard

Edit Virtualization Management Settings window

Setting fields

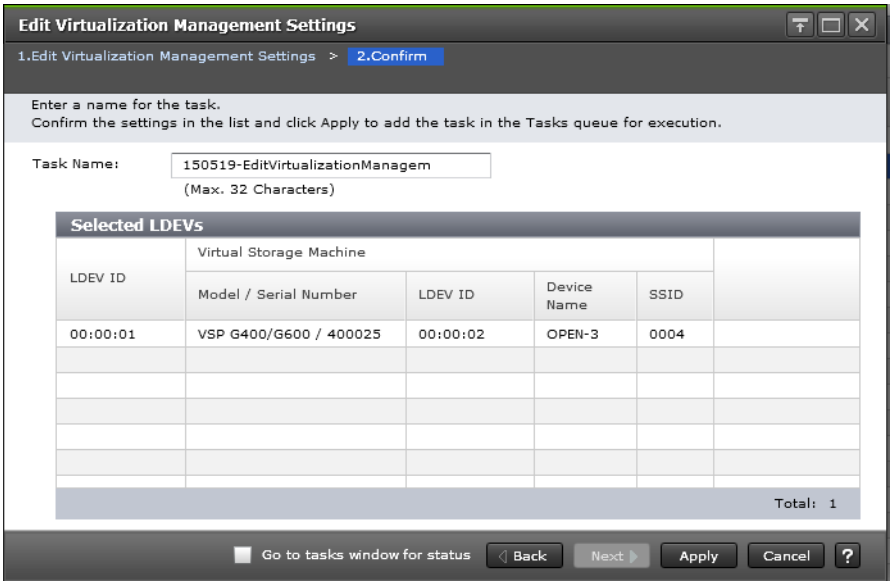


Item	Description
Virtual Management Settings	Select one from the following options. • Enable: Virtualization management can be used. You can set a initial virtual LDEV ID or the virtual configuration, or the both. • Enable (Not Set): Virtualization management can be used. However, you cannot set the initial virtual LDEV ID and the virtual configuration. • Disable: Virtual management cannot be used.
Initial Virtual LDEV ID	Specify the virtual LDEV identifier of the volume. • LDKC: LDKC number is displayed. • CU: Select the CU number between 00 and FE. • DEV: Select the device number between 00 and FF. • Interval: Specify the interval between 0 and 255. If the virtual storage machine is the same as the storage system, assign the virtual LDEV ID which is different from the LDEV ID of the selected LDEV. If the virtual storage machine is the same as the storage system, and if the virtual LDEV ID which is the same as LDEV ID of the selected LDEV must be assigned, select Disable in Virtualization Management Settings.

Item	Description
	Caution: To specify multiple virtual LDEV IDs, specify the interval for setting virtual LDEV IDs in Interval. If virtual storage machines that span multiple storage systems are configured, do not allocate any virtual LDEV ID that is already used in other storage system. This item is selectable only when the Enable is selected in the Virtual Management.
Virtual Configuration	Select either one from the following alternatives. • Specify: Virtual configuration can be specified and set. • Not Set: Virtual configuration cannot be set (the configuration is same as LDEV). For virtual configuration, the specified value is set to all the selected LDEVs. This item is selectable only when the Enable is selected in the Virtual Management.
Emulation Type	Select the virtual emulation type. For the virtual emulation type, like the emulation type, set one of the emulation types that exist in the same group of 32 volumes with LDEV IDs. This item is selectable only when the Specify is selected in the Virtual Configuration.
CVS Settings	Select either one from the following alternatives. • Enable: CVS settings can be used. • Disable: CVS Settings cannot be used. This item is selectable only when the Specify is selected in the Virtual Configuration.
Number of Concatenated LDEVs	Specify the decimal number of concatenated LDEVs between 1 and 36. If you do not concatenate virtual LDEVs, specify 1. This item is selectable only when the Specify is selected in the Virtual Configuration.
SSID	Specify the hexadecimal SSID between 0004 and FFFE. Specify a virtual SSID for each virtual LDEV address (64, 128, 256) in the virtual storage machine. This item is selectable only when the Specify is selected in the Virtual Configuration.

Edit Virtualization Management Settings confirmation window

Selected LDEVs table



Item	Description
LDEV ID	Displays LDEV identifier of the volume.
Virtual Storage Machine	Displays the following information about the virtual storage machine to which the LDEV belongs: • Model / Serial Number: Displays the model and serial number of the virtual storage machine to which the volume belongs. • LDEV ID: Displays the virtual LDEV identifier. • Device Name: Displays the virtual device name of the volume. • SSID: Displays the virtual SSID.

D

LDEV GUI reference

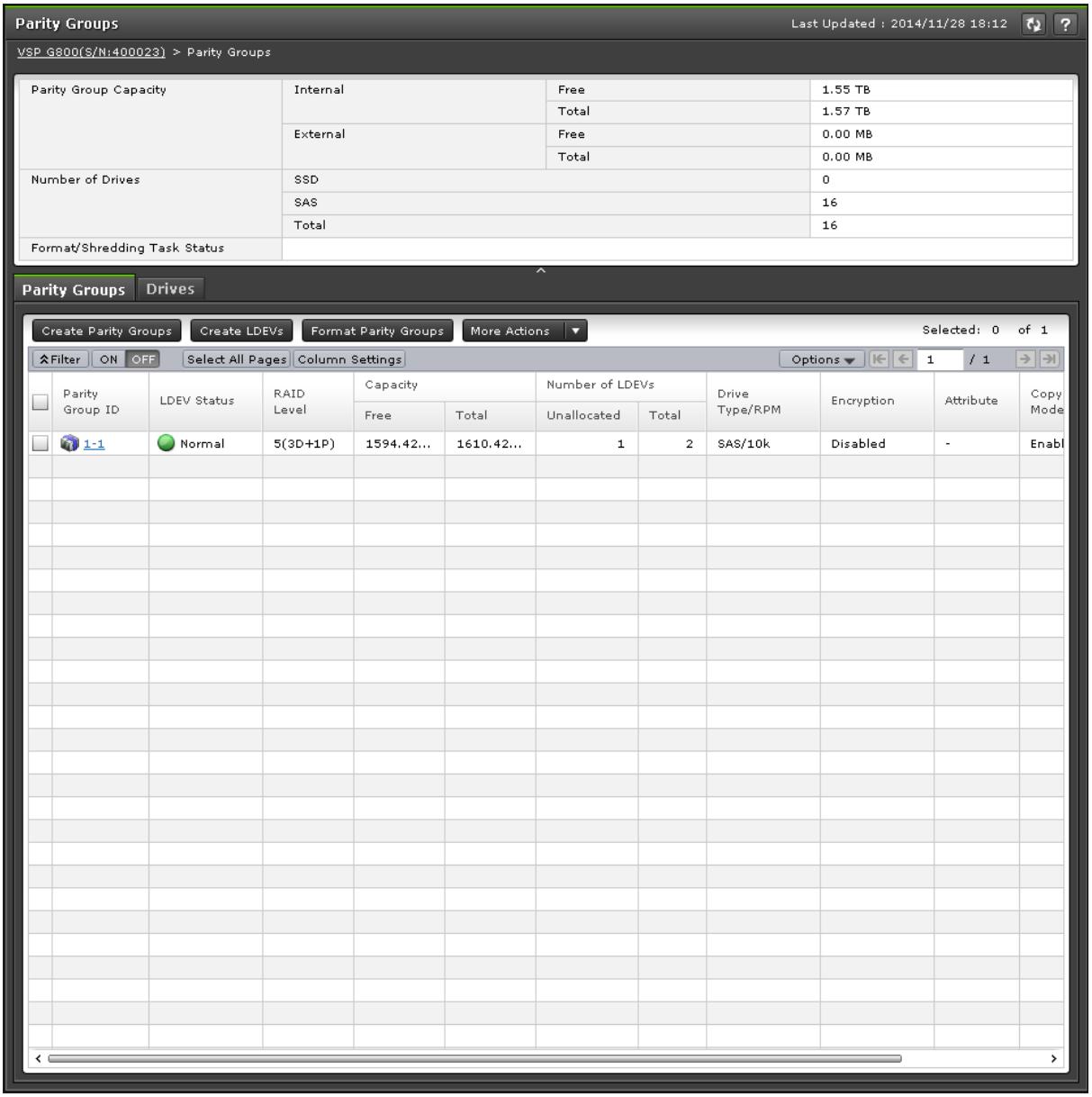
The Hitachi Device Manager - Storage Navigator windows display the logical device (LDEV) information for the storage system and allow you to configure and manage LDEVs.

For general information about the Device Manager - Storage Navigator GUI, see the *System Administrator Guide*.

- Block LDEVs window
- Delete LDEVs window
- LDEV Properties window
- ALUs / SLUs window
- Unbind SLUs window
- Components window
- DKC: Controller Boards & MP Units tab
- Edit MP Units wizard
- Assign MP Unit wizard
- View Management Resource Usage window
- Create Parity Groups wizard
- Change Settings (Parity Group) window
- Assign Spare Drives wizard
- Edit Parity Groups wizard
- Format Parity Groups window
- Delete Parity Groups window
- Parity Group Properties window

Parity Groups window

Use this window to view information about parity groups. Only the parity groups assigned to the logged-on user are available.



Summary

Item	Description
Parity Group Capacity	• Internal: Capacity of all of the parity groups in the internal volume.

Item	Description
	○ Free[1]: Free space capacity of the internal volume. The expanded capacity appears when accelerated compression is enabled for an existing parity group. ○ Total[2]: Total capacity of the internal volume. The expanded capacity appears when existing parity groups with accelerated compression is enabled. • External: Capacity of all of the parity groups in the external volume. ○ Free[1]: Free space capacity of the external volume. ○ Total[2]: Total capacity of the external volume.
Number of Drives	• SSD: Displays the number of SSDs. • SAS: Displays the number of SAS drives. • Total: Displays the total number of drives.
Format/Shredding Task Status	• Formatting *n* %: Displays the progress of the format task. • Preparing Quick Format *n* %: Displays the progress of the quick format preparing. • Verifying *n* % (*x* / *y* parity groups): Displays the progress of the verifying. *n* represents the progress of the verifying. *x* represents the number of parity groups that are completed of verifying. *y* represents the number of all parity groups that are to be verified. • Blank: States that the format, shredding, or verifying is not being performed. If the configuration of the storage system is being changed, this field is also blank because the information cannot be collected.
Notes: **1.** The control information used by the storage system, such as control cylinders, is not included in the Free capacity. **2.** The total capacity of the LDEVs and the Free capacity is displayed in the Total.	

Parity Groups tab

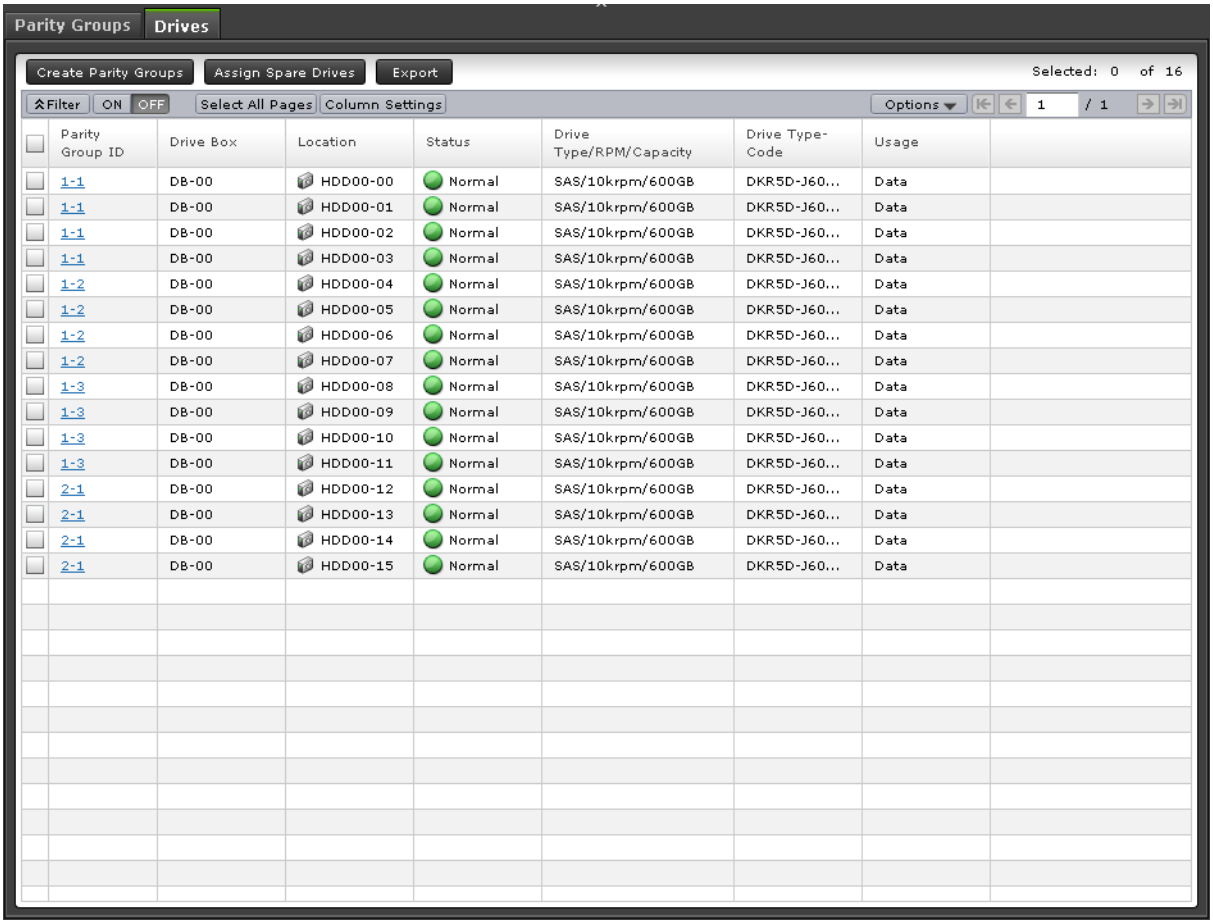
Item	Description
Parity Group ID	Parity group identifier of the parity group in the storage system.
LDEV Status	Status of each LDEV in the parity group. Normal: Normal status. Blocked: Host cannot access a blocked volume. Warning: Problem occurs in the volume. Formatting: Volume is being formatted. Preparing Quick Format: Volume is being prepared for quick formatting. Quick Formatting: Volume is being quick-formatted.

Item	Description
	 Correction Access: Access attribute is being corrected.  Copying: Data in the volume is being copied.  Read Only: Data cannot be written on a read-only volume.  Shredding: Volume is being shredded.  Hyphen (-): Any status other than the above.
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated). Either RAID level of the parity group appears.
Base Emulation Type[1]	Emulation type of each parity group.
Capacity	• Free: Capacity of the free space of each parity group. The expanded capacity appears when existing parity groups with accelerated compression is enabled. The control information used by the storage system, such as control cylinders, is not included in the Free capacity. • Total: The total capacity of the LDEVs and Free capacity is displayed in the Total. The expanded capacity appears when existing parity groups with accelerated compression is enabled.
Physical Capacity[1]	Capacity assured for writing data in the parity group.
Number of LDEVs	• Unallocated: Number of unallocated LDEVs in each parity group. • Total: Total number of LDEVs in each parity group.
Drive Type/RPM	Drive type and rpm in use on this LDEV.
Encryption	Encryption information: • Enable: encrypted parity group • Disable: non-encrypted parity group If the parity group in which the encryption setting is not defined, a hyphen (-) is displayed. This item is not available with Virtual Storage Platform G200.
Accelerated Compression[1]	Displays information about accelerated compression for the parity group. Enabled: Accelerated compression for the parity group is enabled. Disabled: Accelerated compression for the parity group is disabled. Hyphen (-): The parity group does not support accelerated compression.
Expanded Space Used[1]	Displays information about LDEV allocation in the expanded area or the physical area. If accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.

Item	Description
Attribute	Displays the attribute of the parity group. Hyphen (-): The parity group in which the attribute is not defined.
Copy-Back Mode	Displays the setting of the copy-back mode. • Enable: Copy-back mode is set to parity groups. • Disable: Copy-back mode is not set to parity groups.
Resource Group Name (ID)	Resource group name and ID of which this parity group is a member.
Virtual Storage Machine [1]	Model name and serial number of the virtual storage machine that has the parity group.
Create Parity Groups	Opens the **Create Parity Groups** window.
Create LDEVs	Opens the **Create LDEVs** window.
Format Parity Groups	Opens the **Format Parity Groups** window.
Format LDEVs[2]	Opens the **Format LDEVs** window.
Edit Encryption[2]	Opens the **Edit Encryption** window. This item is not available with Virtual Storage Platform G200.
Shred LDEVs[2]	Opens the **Shred LDEVs** window.
Edit Parity Groups[2]	Opens the **Edit Parity Groups** window.
Delete Parity Groups[2]	Opens the **Delete Parity Groups** window.
Block LDEVs[2]	Opens the **Block LDEVs** window.
Restore LDEVs[2]	Opens the **Restore LDEVs** window.
Interrupt Shredding Task[2]	Opens the **Interrupt Shredding Task** window.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
[1] Does not appear by default. To display this item, change the **Column Settings** window. [2] Available when you click More Actions.	

Drives tab

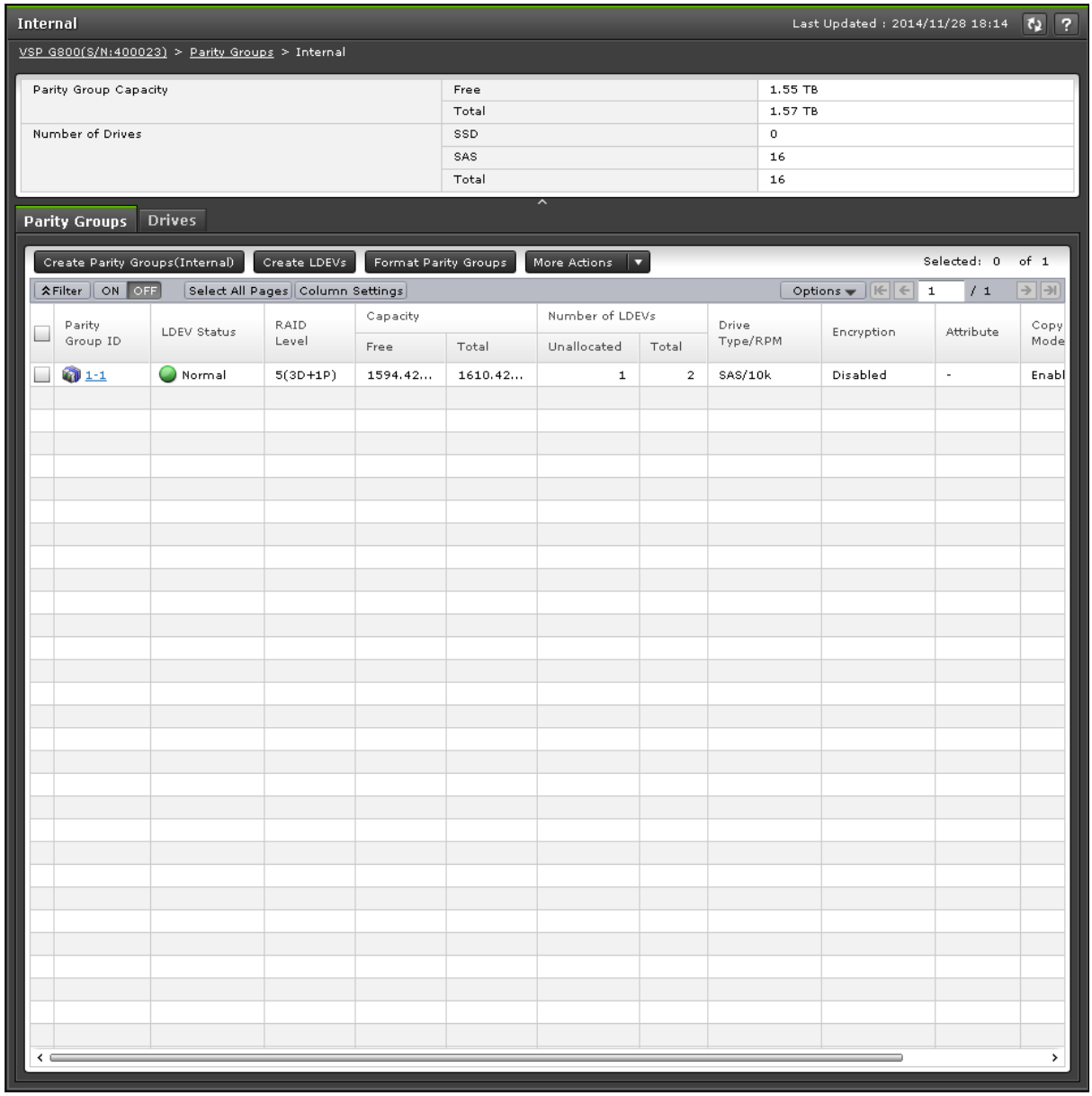
Only drives assigned to the logged-on user are displayed.



Item	Description
Parity Group ID	Displays the identifier of the parity group.
Drive Box	Displays the identifier of the drive box.
Location	Displays the location of the drive box.
Status	Displays the status of the drive box
Drive Type/RPM/Capacity	Displays the drive type, RPM, and capacity. As for SSD, a hyphen (-) appears on the RPM field.
Drive Type-Code	Displays the drive type-code.
Usage	Displays the usage status of the drive. • Data: Data drive. • Spare: Spare drive • Free: Drive which is not used.
Create Parity Groups	Displays the **Create Parity Groups** window.
Assign Spare Drives	Displays the **Assign Spare Drives** window.
Export	Displays the window for outputting table information.

Parity Groups tab: Internal or external volume

Use this window to view information about the parity groups in the internal (or external) volume. Only the parity groups assigned to the logged-on user are available.



Summary

Item	Description
Parity Group Capacity	• Free: The free space capacity of the internal or external volume. The expanded capacity appears when existing parity groups with accelerated compression is enabled. The control information used by the storage system, such as control cylinders, is not included in the Free capacity. • Total: The total capacity of the LDEVs and Free capacity is displayed in the Total. The expanded capacity appears when existing parity groups with accelerated compression is enabled.
Number of Drives	• SSD: Displays the number of SSDs. • SAS: Displays the number of SAS drives. • Total: Displays the total number of drives.

Parity Groups tab

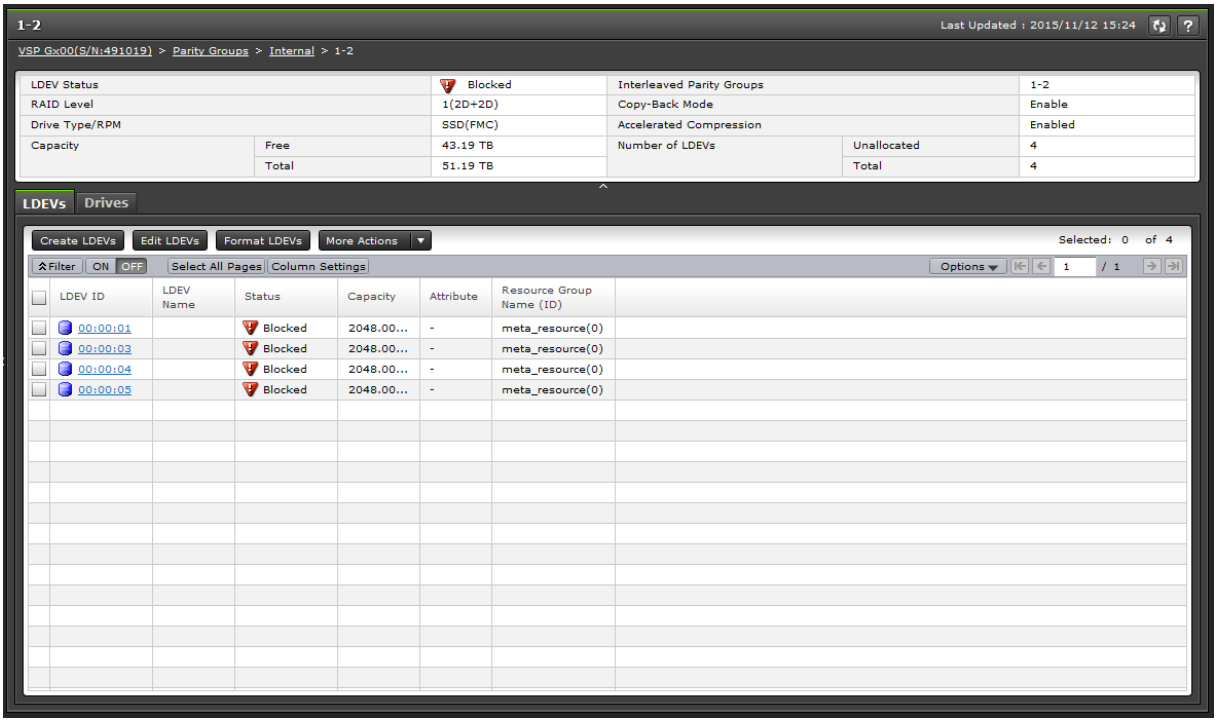
Item	Description
Parity Group ID	The parity group identifiers of the parity groups in the storage system.
LDEV Status	The icons indicate the LDEV status. Normal: Normal status. Blocked: Host cannot access a blocked volume. Warning: Problem occurs in the volume. Formatting: Volume is being formatted. Preparing Quick Format: Volume is being prepared for quick formatting. Quick Formatting: Volume is being quick-formatted. Correction Access: Access attribute is being corrected. Copying: Data in the volume is being copied. Read Only: Data cannot be written on a read-only volume. Shredding: Volume is being shredded. Hyphen (-): Any status other than the above.

Item	Description
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated). Either RAID level of the parity group appears.
Capacity	• Free: Capacity of the free space. The expanded capacity appears when existing parity groups with accelerated compression is enabled. The control information used by the storage system such as control cylinders is not included in the displayed capacity. • Total: The total capacity of the LDEVs and the "Capacity - Free" capacity is displayed. The expanded capacity appears when existing parity groups with accelerated compression is enabled.
Physical Capacity[1]	Capacity assured for writing data in the parity group.
Number of LDEVs	• Unallocated: Number of unallocated LDEVs. • Total: Total number of LDEVs.
Drive Type/RPM	Drive type and rpm in use on this LDEV.
Encryption	Encryption information: • Enable: encrypted parity group • Disable: non-encrypted parity group If the parity group in which the encryption setting is not defined, a hyphen (-) is displayed. This item is not available with Virtual Storage Platform G200.
Accelerated Compression[1]	Displays the information about the accelerated compression of the parity group. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. Hyphen (-): The parity group with the accelerated compression is not supported.
Expanded Space Used [1]	Displays the information that LDEV is allocated in the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.
Attribute	Displays the attribute of the parity group. Hyphen (-): The parity group in which the attribute is not defined.
Copy-Back Mode	Displays the setting of the copy-back mode. • Enable: Copy-back mode is set to parity groups. • Disable: Copy-back mode is not set to parity groups.
Resource Group Name (ID)	Resource group name and ID of which this parity group is a member.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine having the parity group.

Item	Description
Create Parity Groups(Internal)	Opens the **Create Parity Groups** window.
Create LDEVs	Opens the **Create LDEVs** window.
Format Parity Groups	Opens the **Format Parity Groups** window.
Format LDEVs[2]	Opens the **Format LDEVs** window.
Edit Encryption[2]	Opens the **Edit Encryption** window. This item is not available with Virtual Storage Platform G200.
Shred LDEVs[2]	Opens the **Shred LDEVs** window.
Edit Parity Groups[2]	Opens the Edit Parity Groups window.
Delete Parity Groups[2]	Opens the **Delete Parity Groups** window.
Block LDEVs[2]	Opens the **Block LDEVs** window.
Restore LDEVs[2]	Opens the **Restore LDEVs** window.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
[1] Does not appear by default. To display this item, change the **Column Settings** window. [2] Available when you click More Actions.	

LDEVs tab: Internal or external volumes

Use this window to view information about the LDEVs assigned to parity groups in an internal or external volume. Only the parity groups assigned to the logged-on user are available.



Summary

Item	Description
LDEV Status	Current status of the LDEV. Normal: Normal status. Blocked: Host cannot access a blocked volume. Warning: Problem occurs in the volume. Formatting: Volume is being formatted. Preparing Quick Format: Volume is being prepared for quick formatting. Quick Formatting: Volume is being quick-formatted. Correction Access: Access attribute is being corrected. Copying: Data in the volume is being copied. Read Only: Data cannot be written on a read-only volume. Shredding: Volume is being shredded. Hyphen (-): Any status other than the above.
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated).
Capacity	• Free: Capacity of the free space. The expanded capacity appears when existing parity groups with accelerated compression is enabled. The control information used by the storage system, such as control cylinders, is not included in the Free capacity. • Total: The total capacity of the LDEVs and the "Capacity - Free" capacity is displayed in the Total. The expanded capacity appears when existing parity groups with accelerated compression is enabled.
Drive Type/RPM	Drive type and rpm in use on this LDEV.
Interleaved Parity Groups	Interleaved (concatenated) parity groups.
Accelerated Compression	Displays information about the accelerated compression of the parity group that is created of LDEVs Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled.

Item	Description
	Hyphen (-): The parity group with the accelerated compression is not supported.
Copy-Back Mode	Displays the setting of the copy-back mode. • Enable: Copy-back mode is enabled in the parity groups. • Disable: Copy-back mode is disabled in the parity group
Number of LDEVs	• Unallocated: Number of unallocated LDEVs. • Total: Total number of LDEVs.

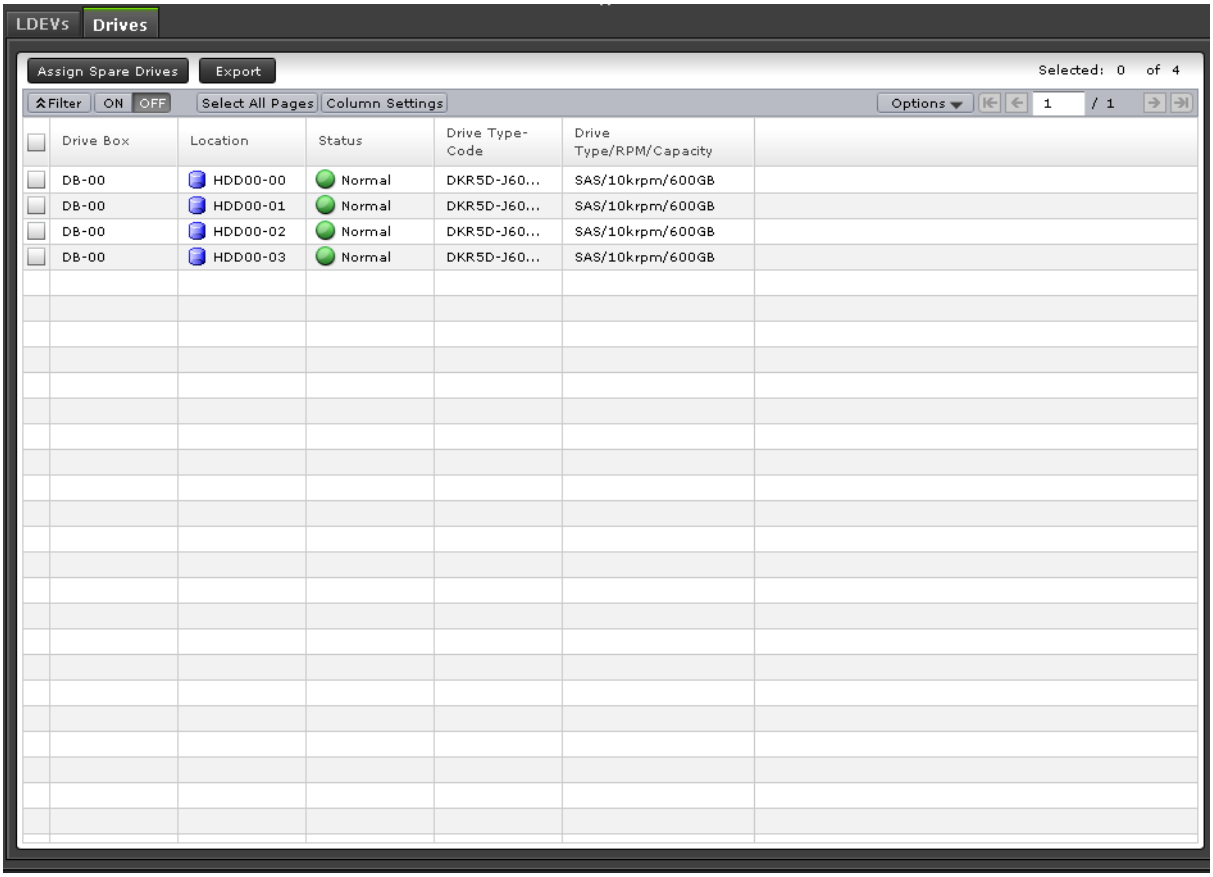
LDEVs tab

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Status	LDEV status.  Normal: Normal status.  Blocked: Host cannot access a blocked volume.  Warning: Problem occurs in the volume.  Formatting: Volume is being formatted.  Preparing Quick Format: Volume is being prepared for quick formatting.  Quick Formatting: Volume is being quick-formatted.  Correction Access: Access attribute is being corrected.  Copying: Data in the volume is being copied.  Read Only: Data cannot be written on a read-only volume.  Shredding: Volume is being shredded.  Hyphen (-): Any status other than the above.
Capacity	Capacity of the selected LDEV.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: The volume is a command device. • Remote Command Device: The volume is a remote command device. • JNL VOL: The volume is a journal volume. • Pool VOL: The volume is a pool volume. The number in the parenthesis indicates the pool identifier.

Item	Description
	• Quorum Disk: Quorum disk for global-active device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication System Data volume. • Hyphen (-): Volume in which the attribute is not defined
Resource Group Name (ID)	Resource group name and identifier of the LDEV.
Expanded Space Used[1]	Displays the information that LDEV is allocated in the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. This item displays whether the LDEV area is allocated in the expanded or physical area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.
Virtual Storage Machine[1]	Information about the virtual storage machine. • Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to the LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank. • Attribute[1]: Virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.
Create LDEVs	Opens the **Create LDEVs** window.
Edit LDEVs	Opens the **Edit LDEVs** window.
Format LDEVs	Opens the **Format LDEVs** window.
Delete LDEVs[2]	Opens the **Delete LDEVs** window.
Shred LDEVs[2]	Opens the **Shred LDEVs** window.
Block LDEVs[2]	Opens the **Block LDEVs** window.
Restore LDEVs[2]	Opens the **Restore LDEVs** window.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
Notes: **1.** Does not appear by default. To display this item, change the Column Settings of the table option.	

Item	Description
2. Available when you click More Actions.	

Drives tab

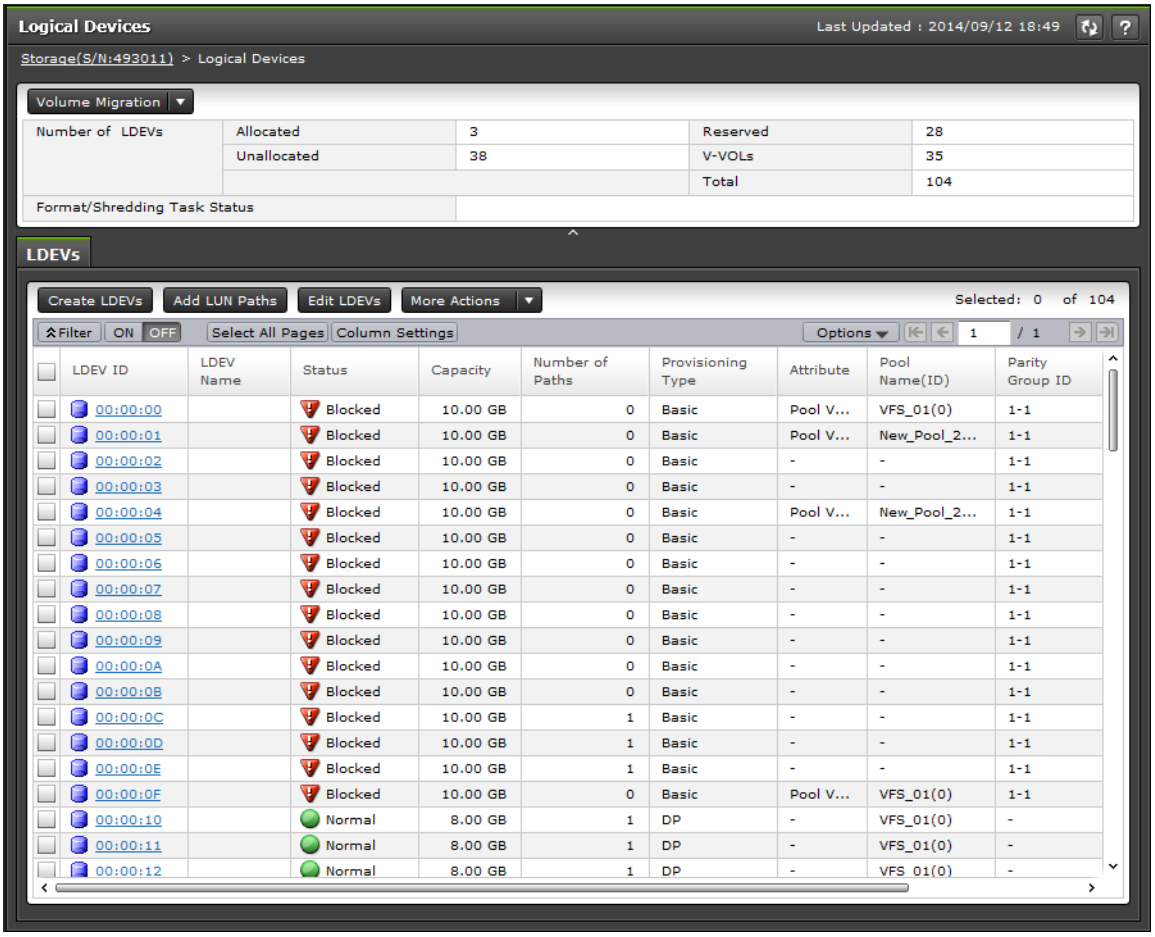


Only drives assigned to the logged-on user are displayed.

Item	Description
Drive Box	Displays the drive box number.
Location	Displays the location of the drive box.
Status	Displays the status of the drive box.
Drive Type-Code	Displays the drive type-code.
Drive Type/RPM/Capacity	Displays the drive type, RPM, and capacity. As for SSD, a hyphen (-) appears on the RPM field.
Assign Spare Drives	Displays the Assign Spare Drives window.
Export	Displays the window for outputting table information.

Logical Devices window

Use this window to view information about logical devices. Only the LDEVs assigned to the logged-on user are available.



Summary

Item	Description
Volume Migration	• View Migration Plans: Opens the **View Migration Plans** window. • View Histories: Opens the **View Histories** window.
Number of LDEVs	• Allocated: Number of allocated LDEVs. • Unallocated: Number of unallocated LDEVs. • Reserved: Number of reserved LDEVs. • V-VOLs: Number of allocated V-VOLs.
Total Number of LDEVs	Total number of LDEVs.
Format/Shredding Task Status	Formatting n %: Displays the percentage of the progress of formatting processing.

Item	Description
	Preparing Quick Format n %: Displays the percentage of the progress of the preparing quick format processing. Shredding n %: Displays the percentage of the progress of the shredding processing. Verifying n % (x / y parity groups): Displays the progress of the verifying. n represents the progress of the verifying. x represents the number of parity groups that are completed of verifying. y represents the number of all parity groups that are to be verified Blank: Displays a blank when formatting or shredding does not perform. If the information cannot be obtained, for example being changed of the storage system configuration, a blank is displayed.

LDEVs tab

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Status	LDEV status. Normal: Normal status. Blocked: Host cannot access a blocked volume. Warning: Problem occurs in the volume. Formatting: Volume is being formatted. Preparing Quick Format: Volume is being prepared for quick formatting. Quick Formatting: Volume is being quick-formatted. Correction Access: Access attribute is being corrected. Copying: Data in the volume is being copied. Read Only: Data cannot be written on a read-only volume. Shredding: Volume is being shredded. Hyphen (-): Any status other than the above.
PIN Status	Displays the PIN status.
V-VOL Management Task[1]	Displays the V-VOL management task being performed on a Dynamic Provisioning, Dynamic Tiering, or a V-VOL.

Item	Description
	• Reclaiming Zero Pages: The process is in progress. • Waiting for Zero Page Reclaiming: The process has been waited. • Blank: The V-VOL management task can be performed on the volume, but the task is not currently in process. • Hyphen(-): The V-VOL management task cannot be performed on the volume.
Capacity	LDEV capacity.
Capacity Saving[1]	Capacity saving setting of the LDEV: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used.
Capacity Saving Status[1]	Status of the capacity saving function: • Enabling: The format for enabling the capacity saving function is being performed. • Rehydrating: The format for disabling the capacity saving function is being performed. • Deleting Volume: The deletion of DP-VOL whose capacity saving function is Enabled is being performed. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured. • - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data[1]	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Number of paths	Number of paths set for the LDEV.
Provisioning Type	Provisioning type to be assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL • External: External volume. • External MF: Migration volume. • Snapshot: Thin Image volume. • ALU: LDEV of the ALU attribution.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Command Device: Volume is a command device. • Remote Command Device: Volume is a remote command device. • JNL VOL: Volume is a journal volume. • Pool VOL: Volume is a pool volume. The number in parentheses shows the pool identifier. • Quorum Disk: Quorum disk for global-active device.

Item	Description
	• ALU: LDEV of the ALU attribution. • SLU: LDEV of the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication System Data volume. • Hyphen (-): Volume other than the above.
Access Attribute[1]	Displays the access attribute of the LDEV.
Pool Name (ID)	Pool name (pool identifier).
Parity Group ID	Parity group identifier.
RAID Level	RAID level. An asterisk (*) indicates that the parity group that the LDEV belong to is interleaved (concatenated).
MP Unit ID[2]	MP unit identifier.
Encryption[1]	Encryption information: • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • Hyphen(-): External volume. For DP-VOL of Dynamic Provisioning, either the pool-VOL in the pool that owns DP-VOL is an external volume or that pool is being blocked. This item is not displayed when using Virtual Storage Platform G200.
Expanded Space Used[1]	Displays the information that LDEV is allocated in the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. This item displays whether the LDEV area is allocated in the expanded or physical area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.
ALUA Mode	Information about the ALUA mode. Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.

Item	Description
T10 PI[1]	The LDEV's T10 PI attribute setting (Enabled or Disabled).
External Storage System[1]	Information about the external storage system. If LDEV is the DP-VOL of the data direct mapping attribure, the information about the external storage system to which LDEV is being mapped appears. • Vender/Model/Serial Number: The information about these items of the external storage system is displayed. A hyphen(-) appears if an external storage system is not mapped to LDEV. • Path Group ID: The information about this item of the external storage system is displayed. If the link of the path group id is clicked, the Mapped Volumes tab appears. A hyphen(-) appears if an external storage system is not mapped to LDEV.
Data Direct Mapping[1]	Information about the data direct mapping. • LDEV ID: LDEV ID of the pool-VOL in the pool with data direct mapping enabled, or LDEV ID of the DP-VOL with data direct mapping enabled. If the link of LDEV ID is clicked, the LDEV Properties window appears. If data direct mapping is disabled, a hyphen (-) is displayed. If a DP-VOL with data direct mapping enabled is not created in the pool with data direct mapping enabled, this field is blank. • Parity Group ID: Parity Group ID of the pool-VOL in the pool with data direct mapping enabled. If data direct mapping is disabled, a hyphen (-) is displayed.
Resource Group Name (ID)[1]	Resource group name and ID of which this LDEV is a member.
Virtual Storage Machine[1]	Information about the virtual storage machine. • Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.
Create LDEVs	Opens the **Create LDEVs** window.
Add LUN Paths	Opens the **LUN Paths** window.
Edit LDEVs	Opens the **Edit LDEVs** window.
Format LDEVs[3]	Opens the **Format LDEVs** window.
Delete LDEVs[3]	Opens the **Delete LDEVs** window.
Shred LDEVs[3]	Opens the **Shred LDEVs** window.
Delete LUN Paths[3]	Opens the **Delete LUN Paths** window.
Edit Command Device[3]	Opens the **Edit Command Devices** window
Block LDEVs[3]	Opens the **Block LDEVs** window.
Restore LDEVs[3]	Opens the **Restore LDEVs** window.

Item	Description
Assign MP Blade[3]	Opens the **Assign MP Blade** window.
Delete UUIDs[3]	Opens the **Delete UUIDs** window.
Reclaim Zero Pages[3]	Opens the **Reclaim Zero Pages** window.
Stop Reclaiming Zero Pages[3]	Opens the **Stop Reclaiming Zero Pages** window.
Expand V-VOLs[3]	Opens the Expand V-VOLs window.
View Tier Properties[3]	Opens the View Tier Properties window.
Migrate Volumes[3]	Opens the **Migrate Volumes** window.
Interrupt LDEV Task	Select Shred to display the **Interrupt Shredding Task** window.
Force Delete Pairs	• TC Pairs: Opens the Force Delete Pairs (TC Pairs) window. For details see the *Hitachi TrueCopy® User Guide* . • UR Pairs: Opens the Force Delete Pairs (UR Pairs) window. For details see the *Hitachi Universal Replicator User Guide*. • GAD Pairs: Opens the Force Delete Pairs (GAD Pairs) window. For details see the *Global-Active Device User Guide*.
ALUs/SLUs[3]	Opens the ALUs / SLUs window.
Unbind SLUs[3]	Opens the Unbind SLUs window.
Export[3]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:

1. Does not appear by default. To display this item, change the Column Settings of the table option.
2. If an MP blade is blocked due to a failure, the processing to be performed by the MP blade where the failure occurred is taken over by another normal MP blade. See the following table.
3. Available when you click More Actions.

MP blade priorities after takeover

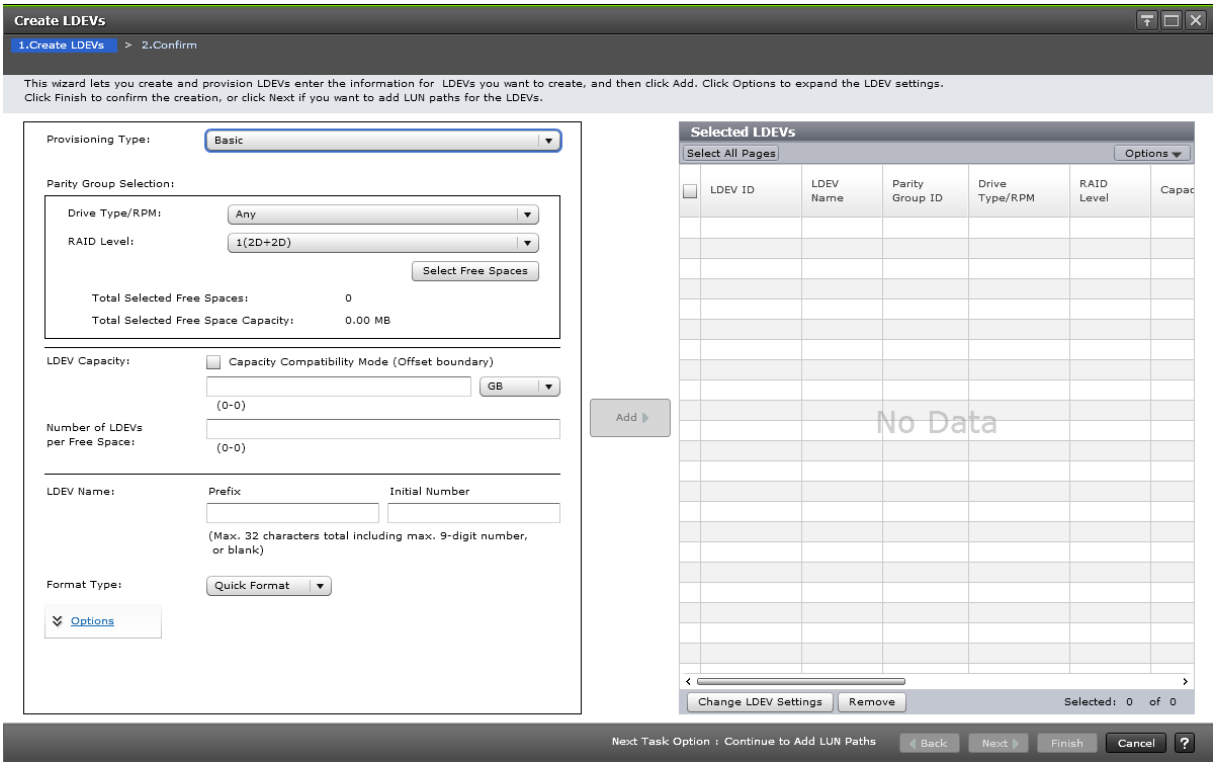
The following table shows the MP unit priorities after takeover.

MP unit blocked by failure	Priority 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

Create LDEVs wizard

Use this window to create and provision LDEVs. You can create multiple LDEVs at once when setting up your storage system.

Create LDEVs window



Setting fields

Item	Description
Provisioning Type	Select the type of LDEV. • Basic: Internal volume. • Dynamic Provisioning: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV of the ALU attribution.
Data Direct Mapping	Select Enable or Disable for the data direct mapping attribute. This item can be selected if the Provisioning Type is Dynamic Provisioning or External. If the Provisioning Type is External and an external volume with the data direct mapping attribute enabled does not exist, you cannot select Enable. • Enable: The data direct mapping attribute is enabled. • Disable: The data direct mapping attribute is disabled.
Capacity Saving	Select the option for the capacity saving functions: • Compression: Select to use the compression function. • Deduplication and Compression: Select to use the deduplication and compression functions. This option cannot be selected if Disable is set for Deduplication in the target pool or if the LDEV status of the deduplication system data volume in the target pool is other than Normal.

Item	Description
	• Disabled: Select to disable the capacity saving functions. Disabled is automatically selected when any of the following conditions is satisfied: - Enable is selected for Data Direct Mapping. - The license for the capacity saving functions is not installed. - Enable is set for Multi-Tier Pool. - The device emulation type is other than OPEN-V.
Multi-Tier Pool	Select Enable or Disable if using Dynamic Tiering. • Enable: The pool for Dynamic Tiering is displayed in the **Select Pool** window. • Disable: The pool for Dynamic Tieringis displayed in the **Select Pool** window.
Active Flash	Select to enable active flash. To select this item, all of the following conditions must be met: • The Multi-Tier Pool option is enabled. • Pool volumes whose drive type is SSD are installed.
Parity Group Selection, Pool Selection, or External Volume Selection	Select the parity group to which the LDEV is assigned. • Parity Group Selection: Displayed when you create internal volumes. • Pool Selection: Displayed when you create DP-VOLs. If the Data Direct Mapping is set to Enable, this item is not displayed. • External Volume Selection: Displayed when you create external volumes.
Drive Type/RPM	Select the data drive type and RPM. • Any: All types of drives that are supported by the system. • SSD(FMC): Flash module compression. (Open systems) Specify when creating an LDEV in a parity group with accelerated compression enabled. • SSD(FMD): Flash module drive. • SSD(MLC): Multi-level-cell flash drive. • SAS/RPM: SAS drive of the specified rotational speed (RPM). For VSP Fx00 models, SAS drives cannot be specified. • External Storage: External storage system. • Mixed: Mixed types of drives.
RAID Level	Select the RAID level. When External Storage is selected from the Drive Type/RPM field, a hyphen (-) is displayed.
Select Free Spaces	Displays the **Select Free Spaces** window.
Select Pool	Displays the **Select Pool** window.
Total Selected Free Spaces	Displays the number of the selected free spaces.
Total Selected Free Space Capacity	Displays the total capacity of the free spaces.
Selected Pool Name (ID)	Displays the selected pool name and ID.
Selected Pool Capacity	Displays the selected pool capacity.
LDEV Capacity	• Capacity Compatibility Mode (Offset boundary): ○ If you want to offset the specified LDEV capacity by boundary, set the Capacity Compatibility Mode (Offset boundary) to ON.

Item	Description
	• Input area: Specify the LDEV capacity to create in a free space, a pool, or an external volume. Detailed calculation of the LDEV capacity differs depending on the specification of the unit. If the Data Direct Mapping is set to enable, this item is not displayed. (Open systems) When creating of LDEVs carved from accelerated compression-enabled parity groups, estimate the LDEV capacity. For details, see Guidelines for pools when accelerated compression is enabled on page 417.
Number of LDEVs per Free Space, Number of LDEVs, or Number of LDEVs per External Volume	Specify the number of LDEVs to create in a free space, pool, or the external volume. If the Provisioning Type is set to Dynamic Provisioning and the Data Direct Mapping is set to enable, this item is not displayed. If the Provisioning Type is set to External and the Data Direct Mapping is set to enable, 1 is displayed in the Number of LDEVs per External Volume. (Open systems) When creating LDEVs in accelerated compression-enabled parity groups, estimate the number of LDEVs. For details, see Guidelines for pools when accelerated compression is enabled on page 417.
Available Volumes	Select available volumes. This item is displayed when the Provisioning Type is Dynamic Provisioning and data direct mapping is enabled. The following items are displayed: • LDEV ID • LDEV Name • Parity Group ID • Capacity: The capacity of LDEV • Vender/Model/Serial Number • Pool Name (ID) • Subscription Current (%): The percentage of the current subscription of the pool • Subscription Limit (%): The percentage of the limit subscription of the pool • Capacity: The capacity of the pool

LDEV Name	LDEV name. Specify the prefix characters and the initial number.
	• Prefix: A fixed character string.
	• Initial Number: The initial number of the LDEV name. Specify the prefix characters and the initial number according to the examples below. You can specify up to 32 characters total.
	Example:
	  • 1: Up to 9 numbers are added (1, 2, 3... 9).
	  • 08: Up to 92 numbers are added (08, 09, 10... 99).
	  • 23: Up to 77 numbers are added (23, 24, 25... 99).
	  • 098: Up to 902 numbers are added (098, 099, 100... 999).

Format Type	Specify the format type. This is displayed when an internal or external volume is used. • Quick Format (default): You cannot select this when the provisioning type is external volume or for an LDEV in a parity group with accelerated compression enabled.

Item	Description
	• Normal Format: Normal formatting. • Parity Group Format: Parity group is formatted. This type can be selected if no LDEV exists in the parity group. • No Format: Volumes are not formatted.
Initial LDEV ID	Specify the LDEV ID. LDKC is fixed to 00. Default of CU and DEV is 00:00. For creating multiple LDEVs, select the interval of the assigned LDEV ID from the Interval list.
View LDEV IDs	Displays the **View LDEV IDs** windows.
CLPR	Cache logical partition number, displayed as *ID*:*CLPR*.
MP Unit ID	Specify the MP unit you want to assign to the LDEV. You can select an ID from MPB0 to MPB7. If automatic assignment is enabled for one or more MPs, you can also select Auto. If Auto is enabled, the default is Auto. If Auto is disabled, the default is the lowest number of the MP unit.
Full Allocation	Select Enable to reserve pages in a pool that is associated with LDEVs. • Enable: Full allocation is performed. • Disable (default): Full allocation is not performed. You can select Enable only when all of the following conditions are satisfied: • The sum of the mapped capacity and the reserved capacity is same or less than the depletion threshold. • The specified pool is not undergoing the shrink processing. • The data direct mapping attribute is disabled.
Tiering Policy	Tiering Policy: All(0) is selected by default. You can change a level from Level1(1) to Level5(5) or from Level6(6) to Level31(31). See Notes on tiering policy settings on page 199. From Level 6 (6) to Level 31 (31), the names of tiering policies can also be changed. If these names have changed, the new names appear. You can specify this function when the multi-tier pool option is enabled.
New Page Assignment Tier	Specify the new page assignment tier you want to assign to the LDEV. Middle is selected by default. You can select from the levels of High, Middle, and Low. See New page assignment tier on page 202.You can specify this function when the multi-tier pool option is enabled.
Relocation Priority	Specify this option if the LDEV is to be relocated preferentially. You can select Default or Prioritize. You can specify this function when the Multi-Tier Pool is enabled.
T10 PI	Specify the LDEV's T10 PI attribute (Enabled or Disabled). This item can be specified only when the Provisioning Type is Basic, Dynamic Provisioning, or Snapshot.

Item	Description
Add	Adds the LDEVs that have settings specified in the setting field to the Selected LDEVs table.

The items that can be set in this window depend on the type of volume you are creating. The following table lists the items that can be set according to volume type.

Item	Internal volume	V-VOL	External volume	Snapshot volume	LDEV of the ALU attribution
Provisioning Type	Required	Required	Required	Required	N/A
Data Direct Mapping	N/A	Optional	Optional	N/A	N/A
Capacity Saving	N/A	Optional	N/A	N/A	N/A
Multi-Tier Pool	N/A	Required	N/A	N/A	N/A
Active Flash	N/A	Optional	N/A	N/A	N/A
Drive Type/RPM	Required	Required	Disabled	N/A	N/A
RAID Level	Required	Required	Disabled	N/A	N/A
Select Free Spaces	Required	N/A	Required	N/A	N/A
Select Pool	N/A	Required	N/A	N/A	N/A
Capacity Compatibility Mode (Offset boundary)	Optional	Optional	Optional	Optional	N/A
LDEV Capacity	Required	Required	Required	Required	N/A
Number of LDEVs per Free Space	Required	N/A	N/A	N/A	N/A
Number of LDEVs	N/A	Required	N/A	Required	Required
Number of LDEVs per External Volume	N/A	N/A	Required	N/A	N/A
Available Volumes	N/A	Optional	Optional	N/A	N/A
LDEV Name	Optional	Optional	Optional	Optional	Optional
Format Type	Required	N/A	Required	N/A	N/A
Initial LDEV ID	Optional	Optional	Optional	Optional	Optional
View LDEV IDs	Optional	Optional	Optional	Optional	Optional
CLPR	N/A	Optional	N/A	Optional	Optional
MP Unit ID	Optional	Optional	Optional	Optional	Optional
Full Allocation	N/A	Optional	N/A	N/A	N/A
Tiering Policy	N/A	Optional	N/A	N/A	N/A
New Page Assignment Tier	N/A	Optional	N/A	N/A	N/A
Relocation Priority	N/A	Optional	N/A	N/A	N/A
T10 PI	Optional	Optional	N/A	Optional	N/A

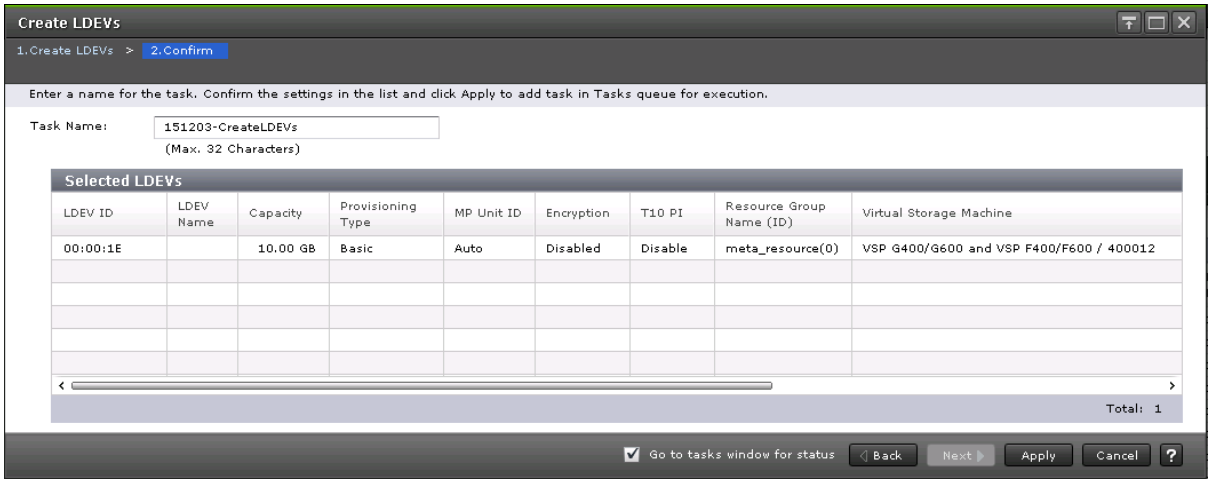
Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name, including the combination of prefix characters and the initial number.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Data Direct Mapping	Information about the data direct mapping. • LDEV ID: LDEV ID of the pool-VOL in the pool with data direct mapping enabled, or LDEV ID of the DP-VOL with data direct mapping enabled. If data direct mapping is disabled, a hyphen (-) is displayed. • Parity Group ID: Parity Group ID of the pool-VOL in the pool with data direct mapping enabled. If data direct mapping is disabled, a hyphen (-) is displayed.
Drive Type/RPM	Drive type and rpm in use on this LDEV.
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated).
Capacity	LDEV capacity.
Format Type	Format type.
CLPR	Cache logical partition number, displayed as *ID*:*CLPR*. For detailed information about CLPRs, see the Performance Guide.
MP Unit ID	MP unit identifier. If Auto is selected, the ID is automatically assigned.
Multi-Tier Pool	Indicates whether Dynamic Tiering is enabled or disabled. • Enabled: The LDEV is for Dynamic Tiering . • Disabled: The LDEV is not for Dynamic Tiering .
Full Allocation	Displays the status of the setting for the full allocation in a pool associated with the V-VOL. • Enable: Full allocation of all DP-VOL pages is performed. • Disable: Full allocation of all DP-VOL pages is not performed.
Active Flash	Indicates whether active flash is enabled or disabled. Enabled: The LDEV is for active flash . Disable: The LDEV is for Dynamic Tiering . - (hyphen): The LDEV is for Dynamic Provisioning .
Tiering Policy	The tiering policy name and ID for the LDEV.
New Page Assignment Tier	Displays the new page assignment tier for the LDEV.
Relocation Priority	Displays the relocation priority assigned to the LDEV.
Capacity Saving	Displays the capacity saving setting: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The Capacity Saving function is not used.

Item	Description
Attribute	Displays the attribute of the LDEV. • ALU: LDEV of the ALU attribution • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • - (hyphen): Volume for which the attribute is not defined.
Encryption	Encryption information: • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume or migration volume. As for DP-VOL of Dynamic Provisioning, the pool-VOL in the pool of which DP-VOL belongs is an external volume, or the pool of which DP-VOL belongs is being blocked. This item is not displayed when using Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group that is created of LDEVs Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. - (hyphen): The parity group with accelerated compression is not supported.
T10 PI	Displays the LDEV's T10 PI attribute information (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and ID of which this LDEV is a member.
Virtual Storage Machine	Displays the information about the virtual storage machine. • Model / Serial Number: The model name and serial number of the virtual storage machine having the LDEV. • Attribute: Virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.
Change LDEV Settings	Opens the **Change LDEV Settings** window.
Remove	Removes the added LDEV.

Create LDEVs confirmation window

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, and then click Help.



Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name, including the combination of prefix characters and the initial number.
Data Direct Mapping	Information about the data direct mapping. • LDEV ID: LDEV ID of the pool-VOL in the pool with data direct mapping enabled, or LDEV ID of the DP-VOL data direct mapping enabled. If the data direct mapping attribute is disabled, a hyphen (-) is displayed. • Parity Group ID: Parity Group ID of the pool-VOL in the pool with data direct mapping enabled. If the data direct mapping attribute is disabled, a hyphen (-) is displayed.
Parity Group ID	Parity group identifier.
Drive Type/RPM	Drive type and rpm in use on this LDEV.
Pool Name (ID)	Pool name (pool identifier).
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated).
Capacity	LDEV capacity.
Provisioning Type	Type of LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume.

Item	Description
	• ALU: LDEV of the ALU attribution.
Format Type	Format type.
CLPR	Cache logical partition number, in *ID*:*CLPR* format. For detailed information about CLPRs, see the Performance Guide.
MP Unit ID	MP unit identifier. If Auto is selected, the ID is automatically assigned.
Multi-Tier Pool	Displays whether Dynamic Tiering is enabled or disabled. Enable: The LDEV for Dynamic Tiering . Disable: The LDEV for Dynamic Provisioning .
Active Flash	Indicates whether active flash is enabled or disabled. Enabled: The LDEV is for active flash or active flash for mainframe. Disable: The LDEV is for Dynamic Tiering. Hyphen (-): The LDEV is for Dynamic Provisioning.
Full Allocation	Displays the status of the setting for the full allocation in a pool associated with the V-VOL. • Enable: Full allocation of all DP-VOL pages is performed. • Disable: Full allocation of all DP-VOL pages is not performed.
Tiering Policy	Displaying the tiering policy name and ID for the LDEV.
New Page Assignment Tier	Displays the new page assignment tier for the LDEV.
Relocation Priority	Relocation priority assigned to the LDEV.
Capacity Saving	Displays the capacity saving setting: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The Capacity Saving function is not used.
Attribute	Displays the attribute of the LDEV. ALU: LDEV of the ALU attribution. Data Direct Mapping: LDEV with the data direct mapping attribute enabled. Hyphen (-): Volume in which attribute is not defined.
Encryption	Encryption information: • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled.

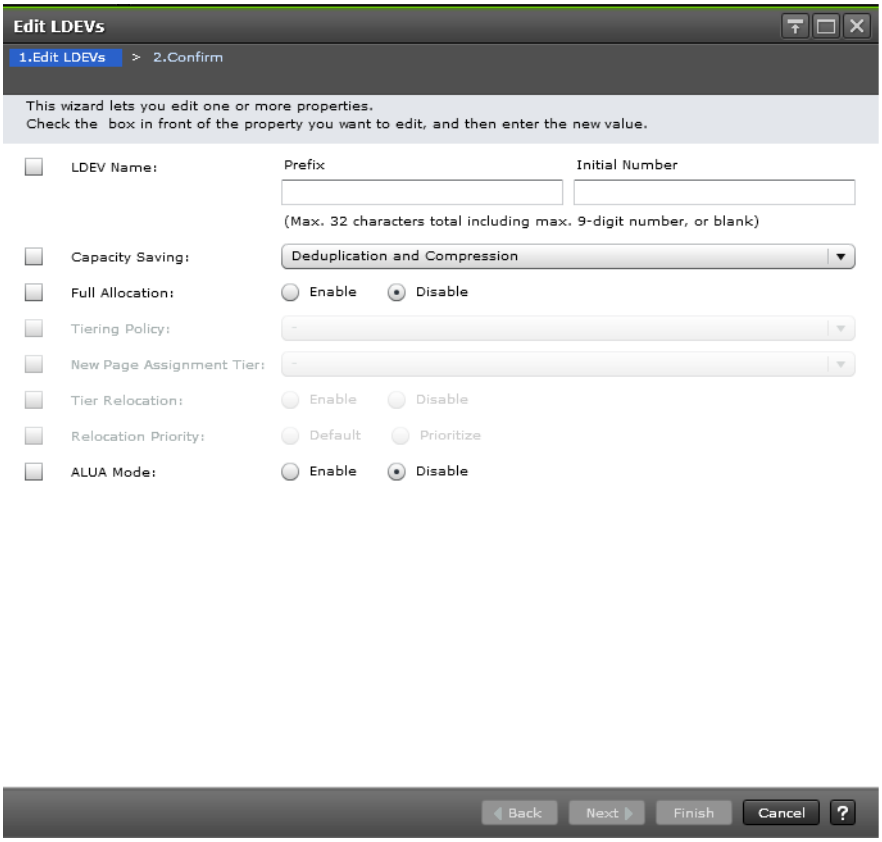
Item	Description
	○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • Hyphen(-): External volume or migration volume. As for DP-VOL of Dynamic Provisioning , the pool-VOL in the pool of which DP-VOL belongs is an external volume, or the pool of which DP-VOL belongs is being blocked.
Accelerated Compression	Displays information about the accelerated compression of the parity group that is created of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. Hyphen (-): The parity group with accelerated compression is not supported.
T10 PI	Displays the LDEV's T10 PI attribute information (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and ID of which this LDEV is a member.
Virtual Storage Machine	Displays the information about the virtual storage machine. • Model / Serial Number: The model name and serial number of the virtual storage machine having the LDEV. • Attribute: Virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.

Edit LDEVs wizard

Use this window to change the LDEV name.

Edit LDEVs window

Use this window to edit LDEV properties.

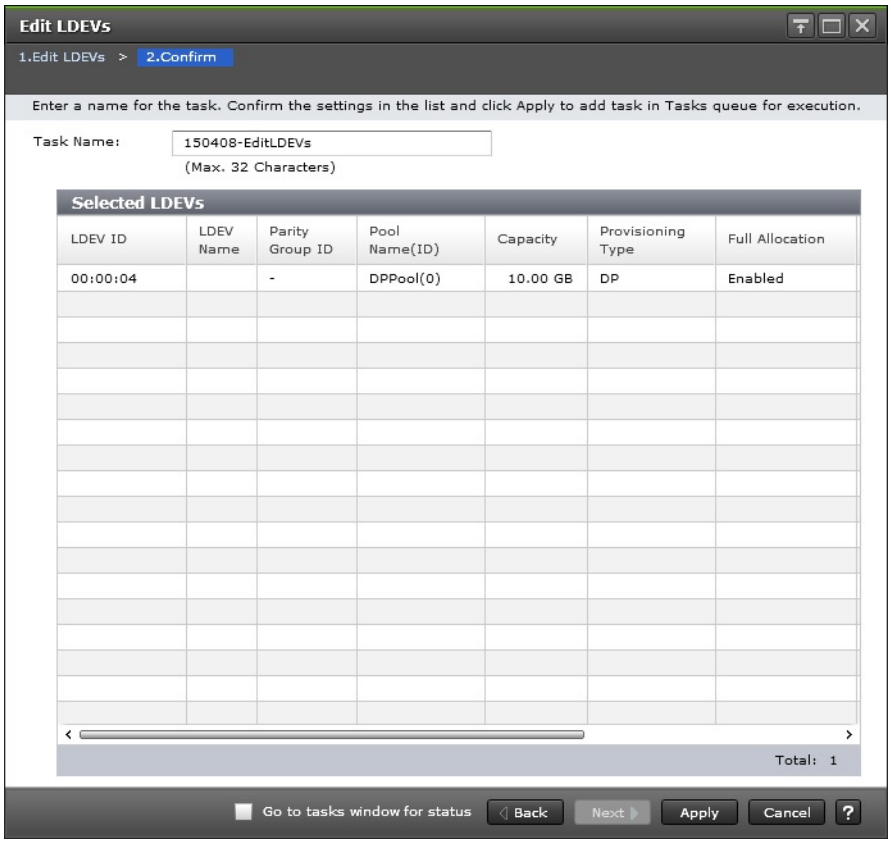


Item	Description
LDEV Name	Specify the LDEV name, using up to 32 characters. • Prefix: Fixed character string. • Initial Number: Initial number. Specify the prefix characters and the initial number according to these examples. Example: • 1: Up to 9 numbers are added (1, 2, 3 ... 9). • 08: Up to 92 numbers are added (08, 09, 10 ... 99). • 23: Up to 77 numbers are added (23, 24, 25 ... 99). • 098: Up to 902 numbers are added (098, 099, 100 ... 999).
Capacity Saving	Select the option for the capacity saving function. • Compression: Select this option to use the compression function. • Deduplication and Compression: Select this option to use the deduplication and compression functions. If Deduplication is disabled in the target pool, this option cannot be selected. • Disabled: Select this option to disable the Capacity Saving function. If any of the following conditions is satisfied, Disabled is set for Capacity Saving: • Data Direct Mapping is enabled. • The license for the capacity saving function is not installed. • Multi-Tier Pool is enabled.

Item	Description
	• There are not enough cache management devices. • A journal volume for Universal Replicator is selected.
Full Allocation	Select Enable to allocate all pages of LDEVs on the current pool. The default is Disable. If LDEVs are satisfied of all following conditions, you can select Enable. • All LDEVs are V-VOLs of Dynamic Provisioning. • The sum of the mapped capacity and the reserved capacity is same or less than the depletion threshold. • The specified pool is not in the shrink processing of the pool capacity. • The status of LDEV is Normal. • The data direct mapping attribute is disabled.
Tiering Policy	Specify the tiering policy for the LDEV. You can specify this function only for Dynamic Tiering V-VOLs.
New Page Assignment Tier	Specify the new page assignment tier you want to assign to the LDEV. Middle is set by default. You can select from High, Middle, or Low. You can specify this function only for Dynamic Tiering V-VOLs.
Tier Relocation	Specify Enable or Disable for the performing of the tier relocation. You can specify this function only for Dynamic Tiering V-VOLs.
Relocation Priority	Specify the relocation priority assigned to the LDEV. You can set this function only for Dynamic Tiering V-VOLs with tier relocation enabled.
ALUA Mode	Select to Enable or Disable ALUA mode for global-active device pairs. For details, see the *Global-Active Device User Guide*.

Edit LDEVs confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

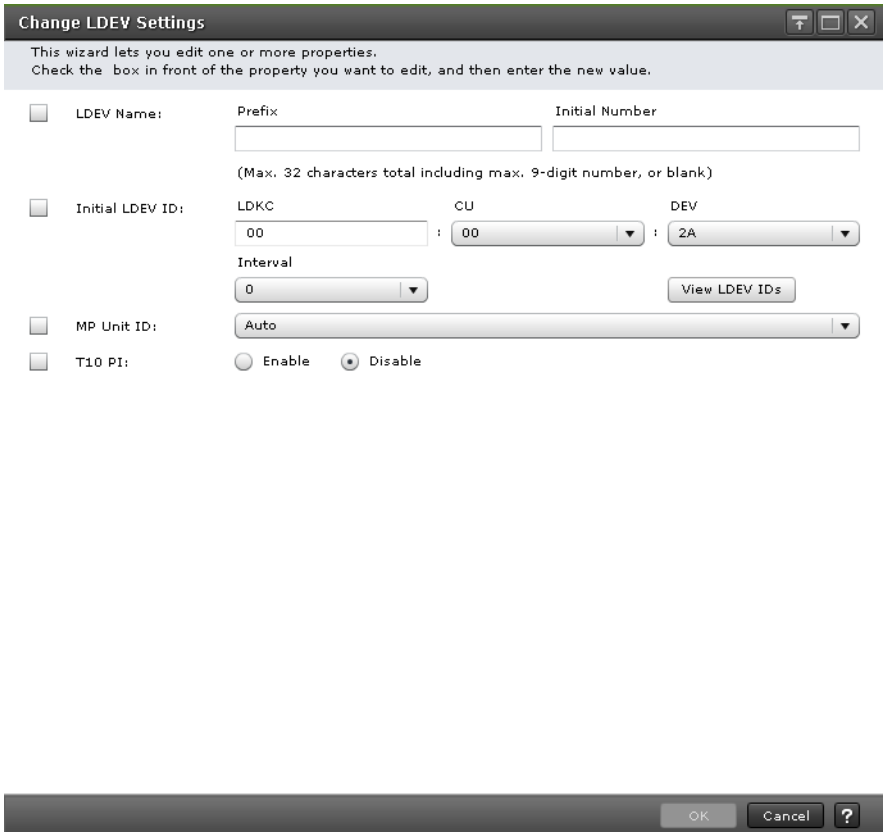


Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name, including the combination of prefix characters and the initial number.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Type of LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV with the ALU attribution.
Capacity Saving	Displays the capacity saving setting of the LDEV. • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used. • - (hyphen): The LDEV does not support the capacity saving function.
Full Allocation	Displays the status of the setting for the full allocation in a pool associated with the V-VOL. • Enable: Full allocation is performed.

Item	Description
	• Disable: Full allocation is not performed. • - (hyphen): LDEVs other than V-VOLs for Dynamic Provisioning.
Tiering Policy	Tiering policy. A hyphen (-) is displayed for volumes other than Dynamic Tiering volumes.
New Page Assignment Tier	Displays the new page assignment tier for the LDEV. A hyphen (-) is displayed for volumes other than Dynamic Tiering volumes.
Tier Relocation	Displays whether tier relocation is enabled or disabled. A hyphen (-) is displayed for volumes other than Dynamic Tiering volumes.
Relocation Priority	Displays the relocation priority assigned to the LDEV. A hyphen is displayed if the LDEV is the one of following: • LDEV other than Dynamic Tiering. • The tier relocation of LDEV is set to disabled.
ALUA Mode	Information about the ALUA mode. • Enabled: LDEV can be used in ALUA. • Disabled: LDEV cannot be used in ALUA.

Change LDEV Settings window

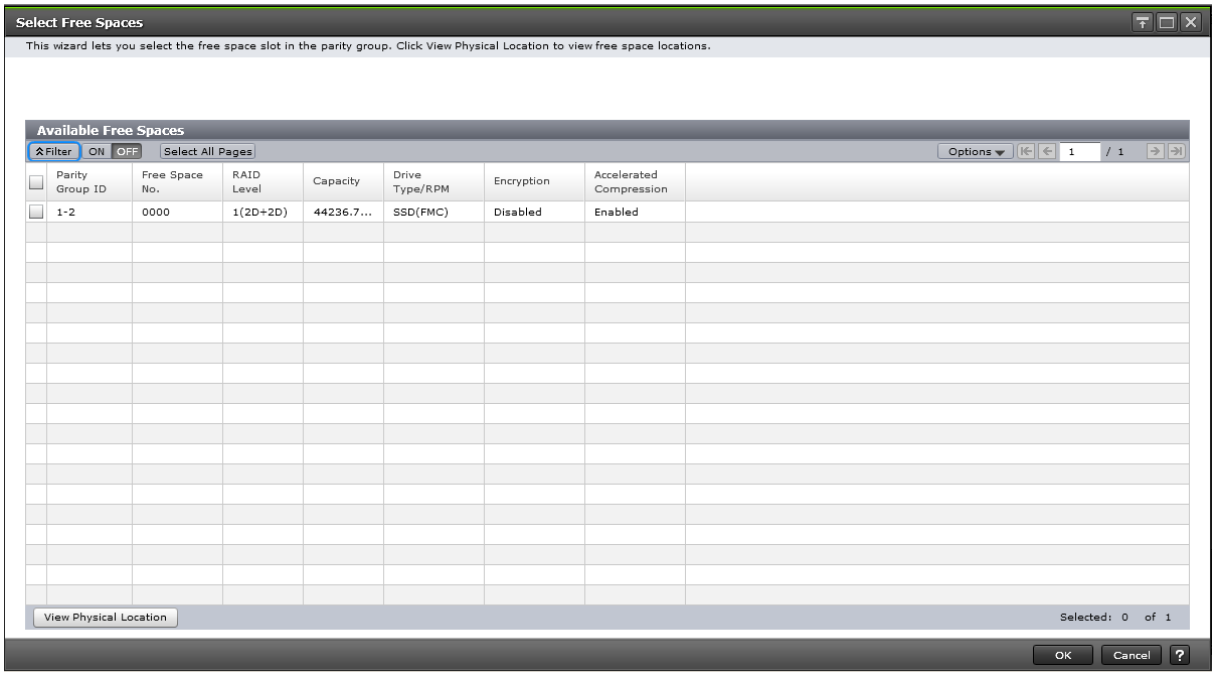
Use this window to edit one or more LDEV properties.



Item	Description
LDEV Name	Specify the LDEV name, using up to 32 characters. • Prefix: Fixed character string. • Initial Number: Initial number. Specify the initial number according to these examples. Examples: • 1: Up to 9 numbers are added (1, 2, 3 ... 9) • 08: Up to 92 numbers are added (08, 09, 10 ... 99) • 23: Up to 77 numbers are added (23, 24, 25 ... 99) • 098: Up to 902 numbers are added (098, 099, 100 ... 999)
Initial LDEV ID	Specify the LDEV identifier, which is the combination of LDKC, CU, and LDEV. Assigns the ID at a certain interval starting with the ID you specify. • LDKC: Specify the LDKC number. It is fixed to 00. • CU: Specify the CU number. • DEV: Specify the LDEV number. • Interval: Specify the interval of the assigned LDEV ID. • View LDEV IDs: Opens the **View LDEV IDs** window.
MP Unit ID	Select the MP unit ID you want to assign to the LDEV. Select any ID or Auto. Select an ID from MPB0 to MPB7. If automatic assignment is enabled for one or more MPs, you can also select Auto.
T10 PI	Specify the LDEV's T10 PI attribute (Enabled or Disabled). This item can be specified if the Provisioning Type is Basic, Dynamic Provisioning, or Snapshot.

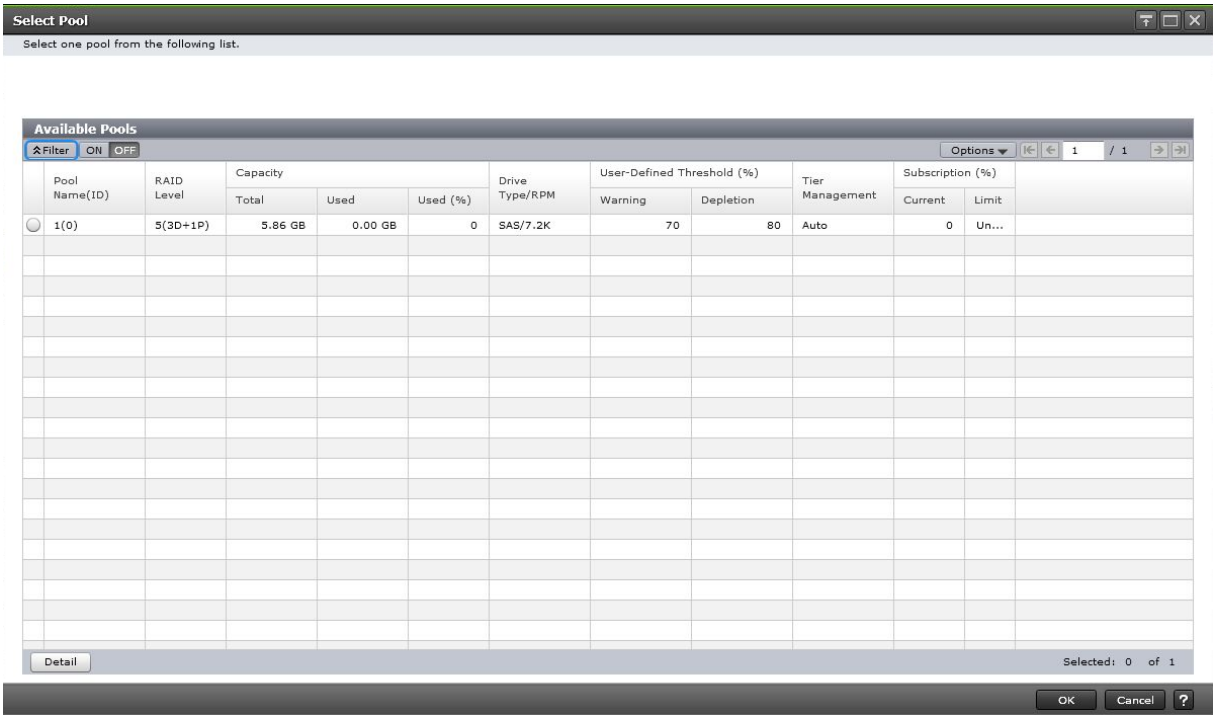
Select Free Spaces window

Use this window to view information about available free space slots in the parity group. Only the free spaces in the parity groups assigned to the logged-on user are available.



Item	Description
Parity Group ID	Parity group identifier.
Free Space No.	Sequence number for identifying free space in the parity group.
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated).
Capacity	Capacity of free space.
Drive Type/ RPM	Drive type and rpm in use on this LDEV.
Encryption	Encryption information. • Enable: encrypted parity group • Disable: non-encrypted parity group If the parity group in which the encryption setting is not defined, a hyphen (-) is displayed. This item is not available with Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. Hyphen (-): The parity group with the accelerated compression is not supported.
View Physical Location	Opens the **View Physical Location** window.

Select Pool window



Available Pools table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level.
Capacity	Displays information about the pool capacity. • Total: Total capacity of pool. As for a pool using pool volumes assigned by accelerated compression-enabled parity groups, the writeable capacity might be smaller than the displayed capacity. • Used: Sum of the mapped capacity and reserved capacity. The displayed value of Used might be larger than the displayed value of Total due to following reason: ○ Used displays the sum of the mapped capacity and reserved capacity, which are rounded up on each page. ○ If the emulation type is 3390-A, the mapped capacity of V-VOL includes the capacity of control cylinders (7 Cyl is required per 1,113 Cyl). ○ If the emulation type is 3390-A and the TSE attribute is enabled, the mapped capacity for DP-VOL contains the management area capacity. ○ The mapped capacity of DP-VOL includes the capacity of the control information (uses a maximum of 168 MB per 3,145,548 MB).

Item	Description
	○ DP-VOL with data direct mapping attribute includes the control information (168 MB is used per 3,145,548 MB) and capacity for one page. • Used (%): Percentage of the sum of the mapped capacity and the reserved capacity of a pool. The Used (%) field displays the value which is truncated after the decimal point of the actual value.
Drive Type/RPM	Displays the data drive type and RPM. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
Encryption	Encryption information: • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): Pool is created by external volumes, or pool is being blocked. This item is not available with Virtual Storage Platform G200.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed.
Tier Management	Displays Auto or Manual according to the Tier Management setting when Dynamic Tiering is enabled. Displays Manual for pools other than Dynamic Tiering which are available for monitoring. For other pools, a hyphen (-) is displayed.
Subscription (%)	Displays information about subscription of the pool. • Current: Percentage of the total V-VOL capacity assigned to the pool and the V-VOL capacity to be created. • Limit: Percentage of the subscription limit of the pool.
Detail	Displays the **Pool Properties** window when selecting a row and clicking this button

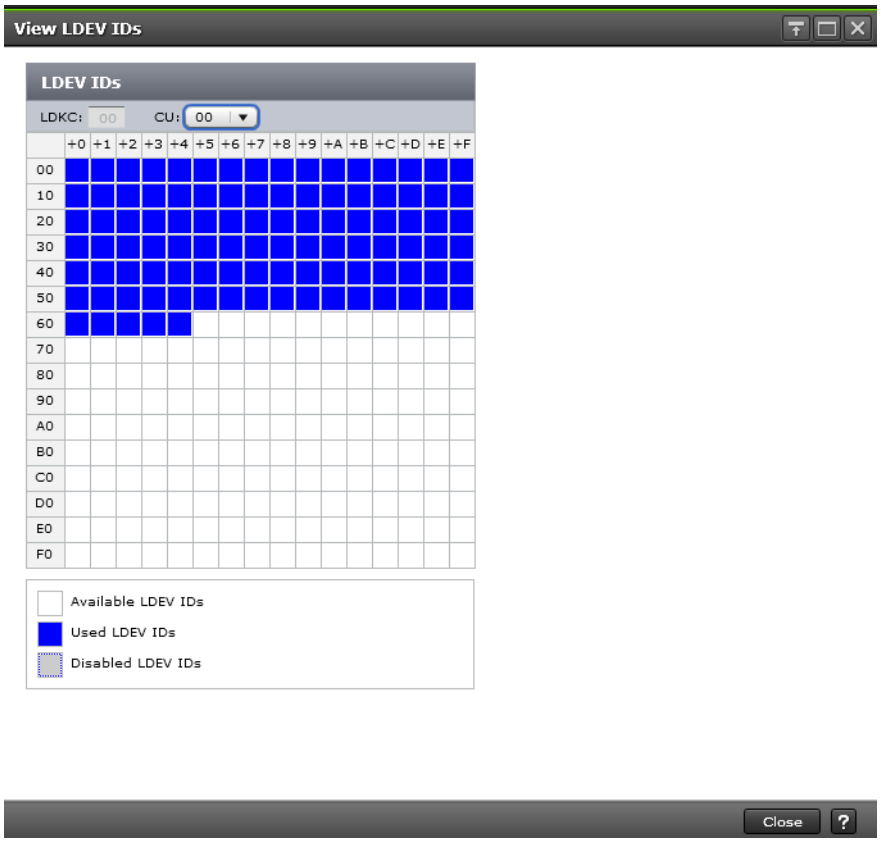
View LDEV IDs window

Use this window to view available, used, and disabled LDEV IDs in matrix format. The vertical scale in the matrix indicates the second-to-last digit of

the LDEV number, and the horizontal scale indicates the last digit of the LDEV number.

In the matrix, used LDEV numbers are displayed in blue, unselectable LDEV numbers are displayed in gray, and unused LDEV numbers are displayed in white. The LDEV numbers corresponding to any one of the following conditions cannot be specified:

- LDEV is already in use.
- LDEV is already assigned to another emulation group (grouped every 32 LDEVs).
- LDEV is not assigned to the user.
- If the following values are not identical when a mainframe volume or multiplatform volume is created:
  - The LDEV ID and the virtual LDEV ID
  - The model and serial number of the storage system and the virtual storage machine



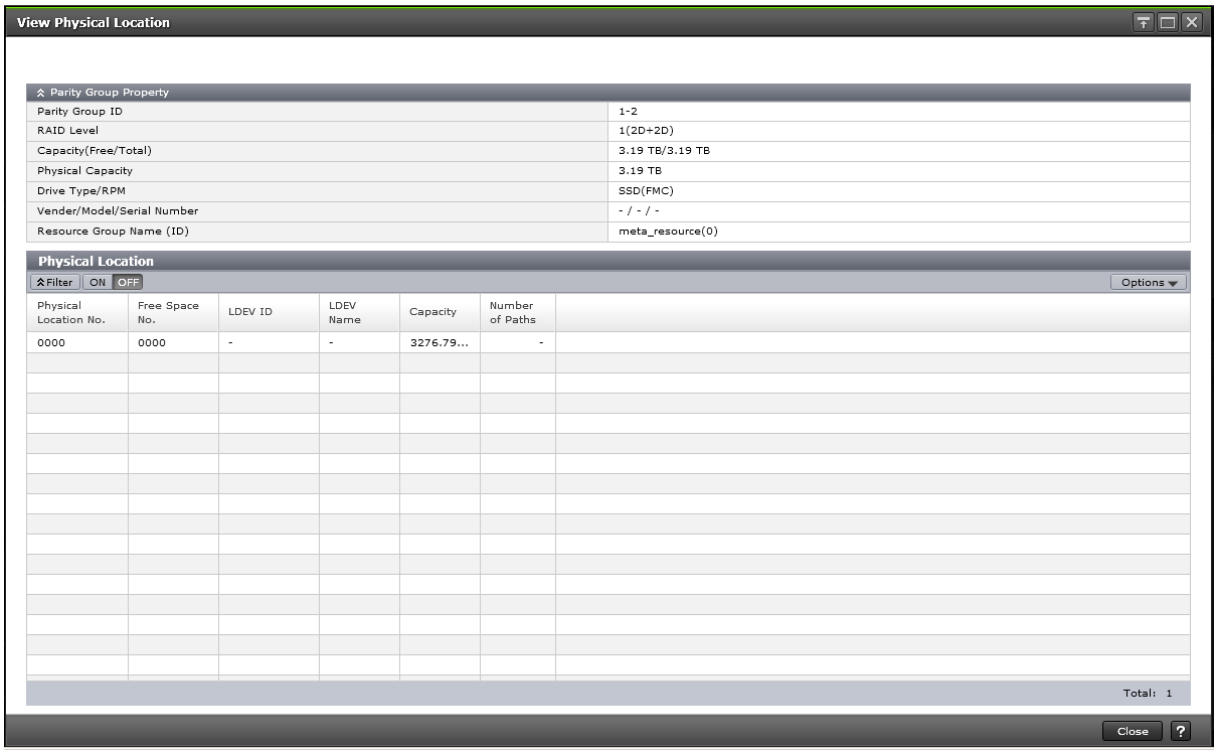
Summary

Item	Description
LDEV IDs	LDEV identifier, which is the combination of LDKC, CU, and LDEV.

Item	Description
	LDKC: Indicates the LDKC number. CU: Indicates the CU number. The CU number range for each storage system type is: • VSP G800 or VSP F800: 00 to 3F • VSP G400, G600 or VSP F400, F600: 00 to 0F • VSP G200: 00 to 07

View Physical Location window

Use this window to view information about the physical location of where free spaces and LDEVs are assigned in a parity group.



Parity Group Property table

Item	Description
Parity Group ID	Parity group identifier. For an interleaved parity group, all parity groups that are contained in the interleaved parity group are shown.
RAID Level	RAID level. An asterisk "*" indicates that the parity group to which the LDEV belongs is interleaved (concatenated).
Capacity (Free/Total)	Free capacity and total capacity of the parity group. The control information used by the storage system, such as control cylinders,

Item	Description
	is not included in the Free capacity. The total capacity of the LDEVs and Free capacity is displayed in the Total.
Physical Capacity	Capacity assured for writing data in the parity group.
Drive Type/ RPM	Drive type and rpm in use on this LDEV.
Vendor/Model/Serial Number	For external volumes, vendor name, model name, and serial number appear. For internal volumes, -/-/- appears.
Resource Group Name (ID)	Resource group name and ID of which this parity group is a member.

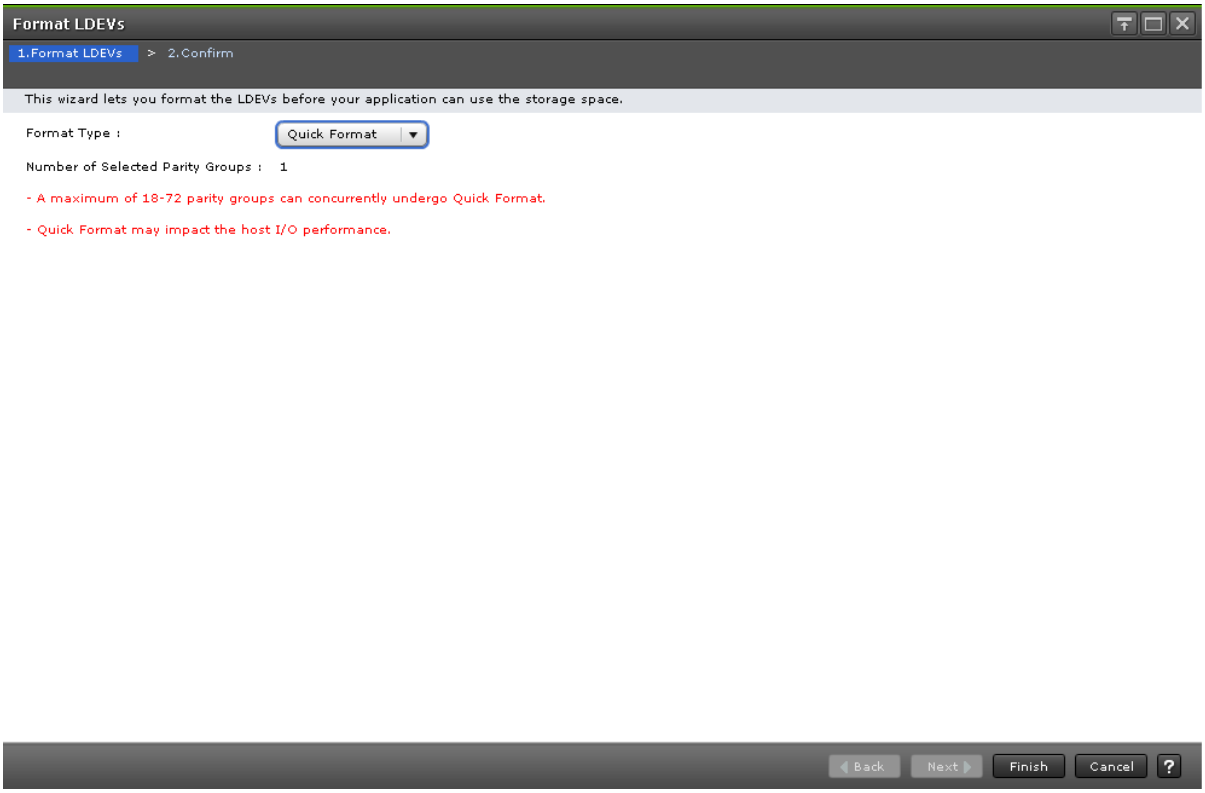
Physical Location table

Item	Description
Physical Location No.	Location where the free spaces and LDEVs are assigned.
Free Space No.	Free space number. The hyphenation appears for volumes other than free spaces.
LDEV ID	LDEV identifier. A hyphen (-) appears for other than LDEV IDs.
LDEV Name	LDEV name. A hyphen (-) appears for volumes other than LDEVs.
Capacity	Capacity of the LDEV.
Number of Paths	Number of paths set for the LDEV. A hyphen (-) appears for volumes other than LDEVs.

Format LDEVs wizard

Use this window to format LDEVs. LDEVs must be formatted before you can use the storage space.

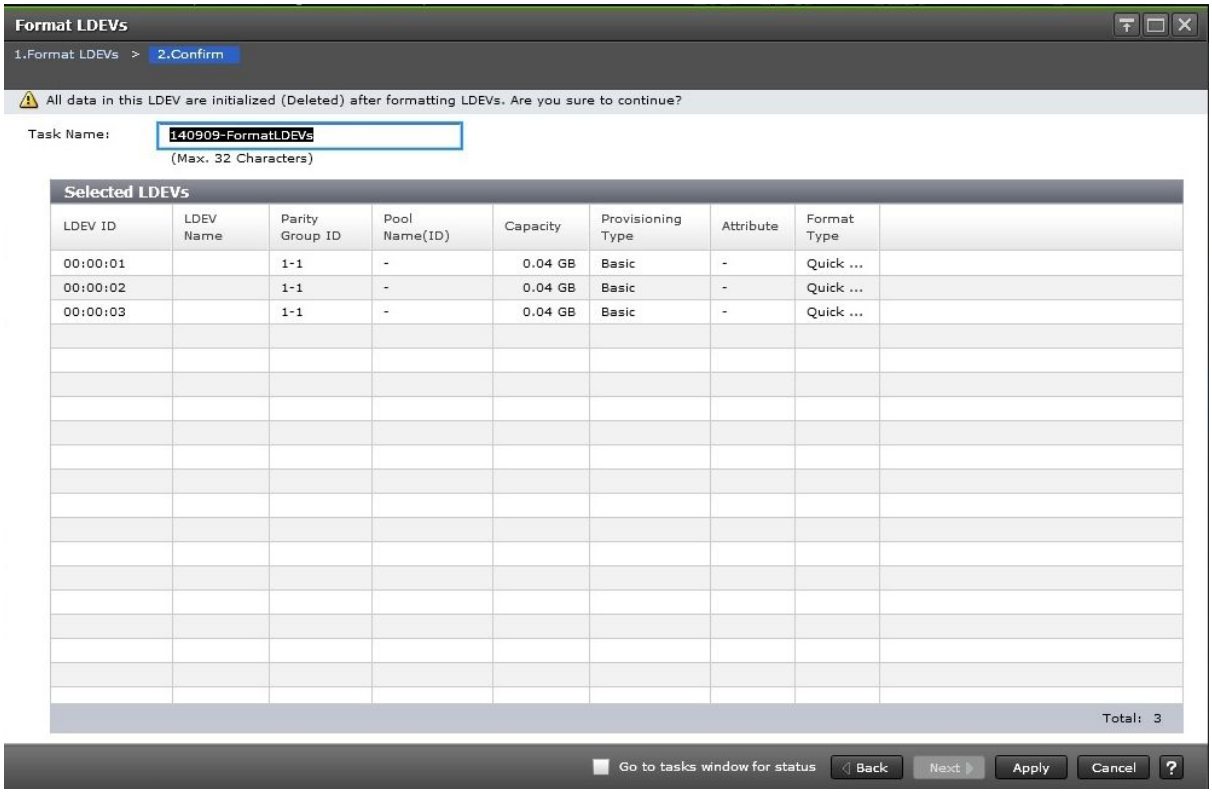
Format LDEVs window



Item	Description
Format Type	Select the type of formatting to be used on this LDEV. • Quick Format (default): Select this to perform quick-formatting. This option is available only for formatting an internal volume. • Normal Format: Select this to perform normal-formatting. This option is available for formatting an internal volume, or an external volume whose emulation type is OPEN.
Number of Selected Parity Groups	Number of selected parity groups.

Format LDEVs confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

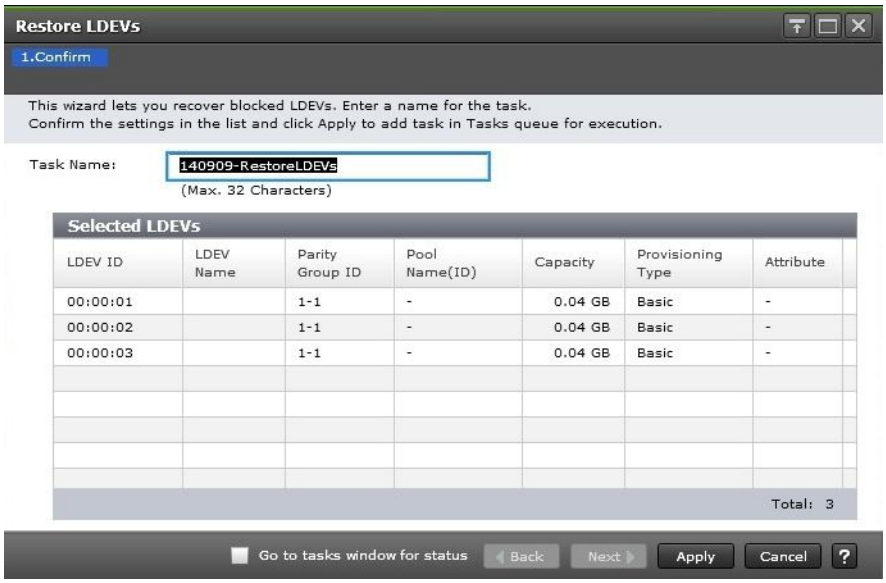


Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Provisioning type to be assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV with the ALU attribution.
Attribute	Displays the attribute of the LDEV. • Command Device: CCI command device. • TSE: TSE-VOL for Compatible FlashCopy® SE. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed.

Item	Description
	• NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data Volume: LDEV used to manage data deduplication. • Hyphen (-): LDEV for which the attribute is not defined.
Format Type	Type of formatting operation. • Quick Format: Quick formatting is performed. • Normal Format: Normal formatting is performed.

Restore LDEVs window

Use this window to recover blocked LDEVs.

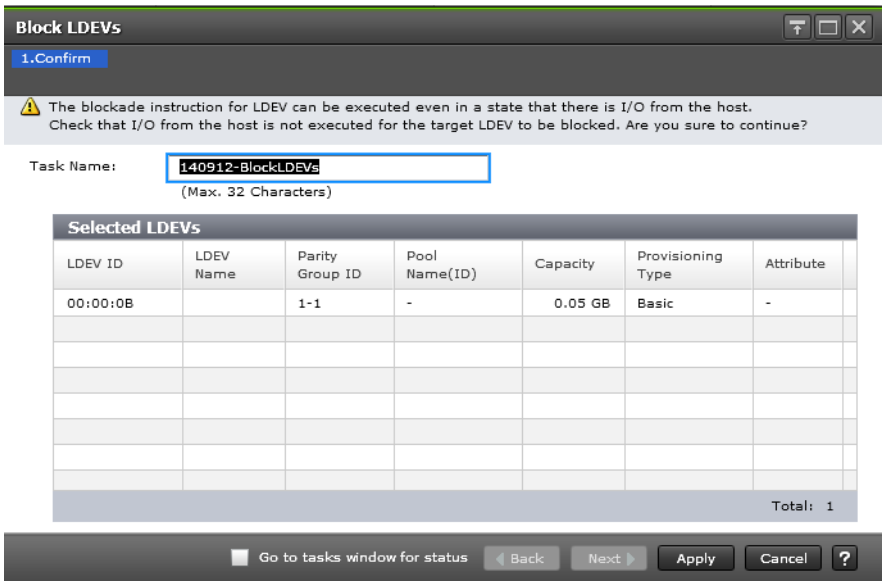


Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Provisioning type assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV with the ALU attribution.

Item	Description
Attribute	Displays the attribute of the LDEV. • Command Device: CCI command device. • Remote Command Device: Remote command device for CCI. • JNL VOL: Journal volume for Universal Replicator. • Quorum Disk: Quorum disk for global-active device. • TSE: TSE-VOL for Compatible FlashCopy® SE. • ALU: LDEV of the ALU attribution. • SLU: LDEV of the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data Volume: LDEV used to manage data deduplication. • - (hyphen): LDEV for which the attribute is not defined.

Block LDEVs window

Use this window to block specific LDEVs. The data on the LDEV cannot be accessed when the LDEV is blocked.

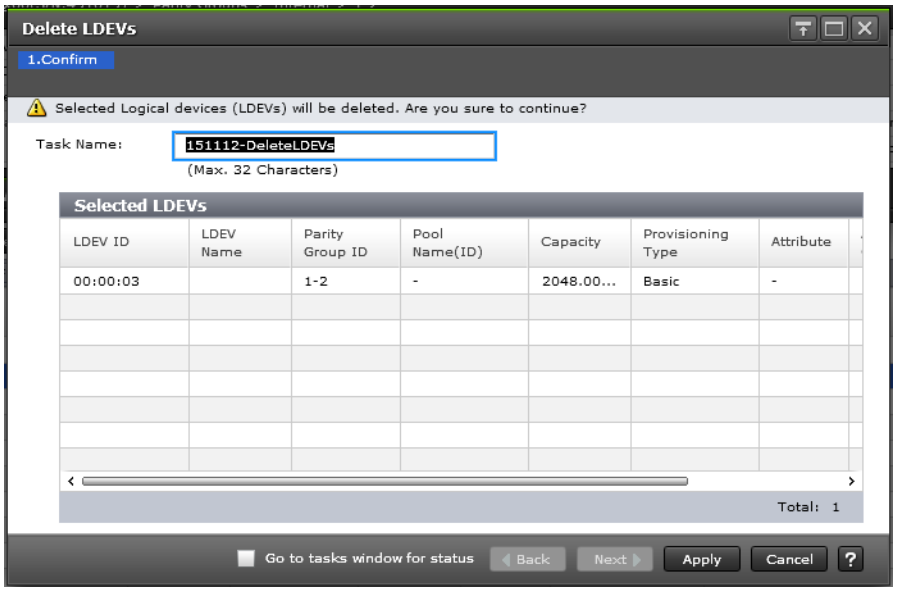


Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.

Item	Description
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Provisioning type assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV with the ALU attribution.
Attribute	Displays the attribute of the LDEV. • Command Device: CCI command device. • Remote Command Device: Remote command device for CCI. • TSE: TSE-VOL for Compatible FlashCopy® SE. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data Volume: LDEV used to manage data deduplication. • - (hyphen): LDEV for which the attribute is not defined.

Delete LDEVs window

Use the window to delete an LDEV from a parity group.

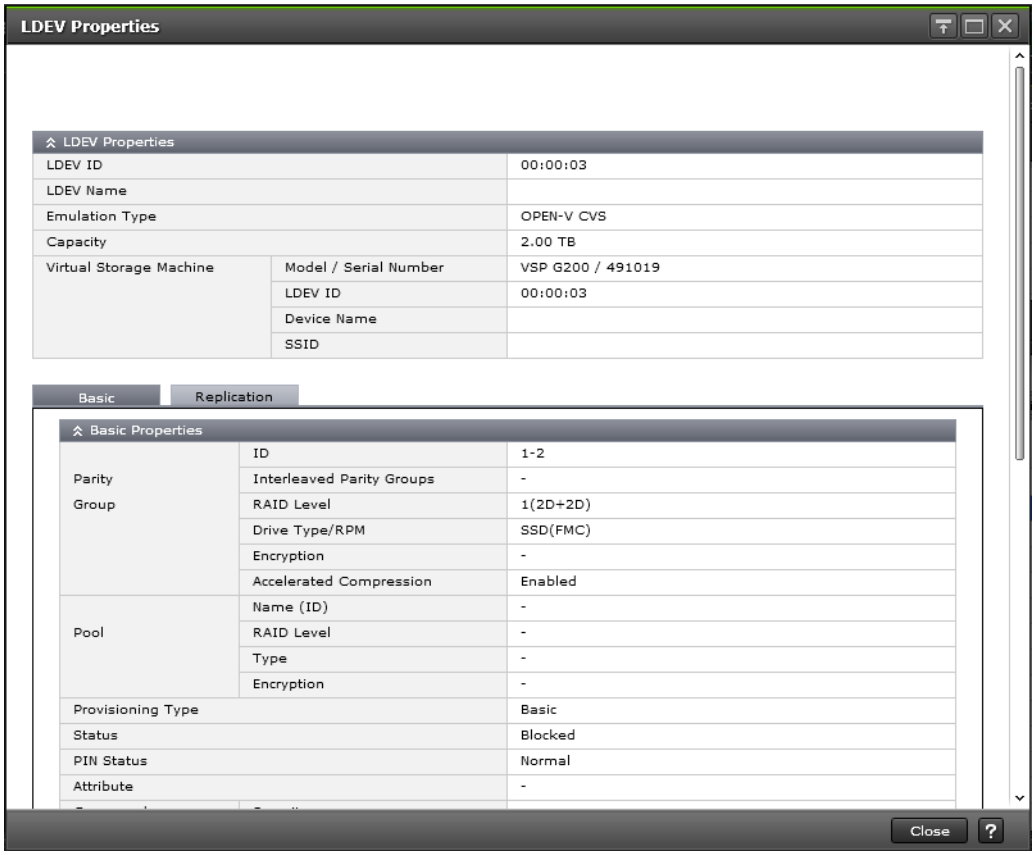


Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Provisioning type assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV with the ALU attribution.
Attribute	Displays the attribute of the LDEV. • Command Device: CCI command device. • TSE: TSE-VOL for Compatible FlashCopy® SE. • ALU: LDEV with the ALU attribution. • SLU: LDEV with the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data Volume: LDEV used to manage data deduplication. • - (hyphen): LDEV for which the attribute is not defined.
Accelerated Compression	Displays information about the accelerated compression of the parity group that is created of LDEVs

Item	Description
	Enabled: The accelerated compression function for the parity group is enabled. Disabled: The accelerated compression function for the parity group is disabled. - (hyphen): The parity group does not support the accelerated compression function.
Expanded Space Used	Displays the information that LDEV is allocated in the expanded area or the physical area. If accelerated compression is enabled, LDEVs are initially allocated in the physical area, and then LDEVs are allocated in the expanded area. This item is displayed whether the LDEV area is allocated in the expanded area or physical area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.
Capacity Saving	Displays the capacity saving setting of the LDEV. • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used. • - (hyphen): The LDEV does not support the capacity saving function.

LDEV Properties window

Use this window to view properties assigned to a selected LDEV.



LDEV Properties table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Capacity	Displays the LDEV capacity.
Virtual Storage Machine	Information about the virtual storage machine. • Model / Serial Number: Model name and serial number of the virtual storage machine that has LDEV. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.

Basic tab

LDEV basic information is displayed in the Basic Properties, LUNs, and Hosts.

Basic Properties table

Item	Description
Parity Group	• ID: Displays the parity group ID. • Interleaved Parity Groups: Displays the interleaved parity groups. • RAID Level: Displays the RAID level of parity group. The asterisk (*) indicates the parity group is the interleaved parity group. • Drive Type/RPM: Displays the data drive type and RPM. • Encryption: Displays the encryption setting (enable or disable). If the parity group in which the encryption setting is not defined, a hyphen (-) is displayed. • Accelerated compression: Displays the accelerated compression setting (enable or disable). If the parity group with accelerated compression setting is not defined, a hyphen (-) is displayed.
Pool	Name (ID): Displays the pool name and ID. RAID Level: Displays the RAID level of pool. Type: Displays the data drive type of pool. Encryption: The encryption information of the pool. • Enabled: Pool which is created by pool-VOLs whose encryption settings are enabled. • Disable: Pool which is created by pool-VOLs whose encryption settings are disabled. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • Hyphen(-): Pool is created by external volumes. Or pool is being blocked. This item is not displayed when using Virtual Storage Platform G200
Provisioning Type	Display the type of LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume. • ALU: LDEV of the ALU attribution.
Status	Displays the LDEV status. • Normal: Normal status. • Blocked: Host cannot access blocked volumes.

Item	Description
	• Warning: Problem occurs in the volumes. • Formatting: Volumes are being formatted. • Preparing Quick Format: Volumes are being prepared for quick formatting. • Quick Formatting: Volumes are being quick-formatted. • Correction Access: Access attribute is being corrected. • Copying: Data in the volumes are being copied. • Read Only: Data cannot be written on the Read Only volumes. • Shredding: Volumes are being shredded.
PIN status	Displays the PIN status.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • JNL VOL: Journal volume. • Pool VOL: Pool volume. The number in parentheses shows the pool ID. • Quorum Disk: Quorum disk for global-active device. • ALU: LDEV of the ALU attribution. • SLU: LDEV of the SLU attribution. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication system data volume • Hyphen (-): Volume in which the attribute is not defined.
Command Device Attribute	• Security: Displays the setting (Enable or Disable) of Command Device Security. • User Authentication: Displays the setting (Enable or Disable) of user authentication. • Device Group Definition: Displays the setting (Enable or Disable) of Device Group Definition.
Number of Paths	Displays the number of paths of the selected LDEV.
UUID	Displays the UUID.
CLPR	Displays the ID and name of the CLPR in *ID*:*CLPR* format.
Access Attribute	Displays the access attribute of the LDEV.
SSID	Displays the SSID.
Cache Mode	Displays the cache mode.
V-VOL Management Task	Displays the V-VOL management task being performed on a Dynamic Provisioning,Dynamic Tiering, or a V-VOL.
Current MP Unit ID	Displays the current MP unit ID.
Assigned MP Unit ID	Displays the assigned MP unit ID.
ALUA Mode	Information about the ALUA mode.

Item	Description
	Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.
T10 PI	Displays the LDEV's T10 PI attribute information (Enabled or Disabled).
External Storage System	Information about the external storage system. If LDEV is the DP-VOL of the data direct mapping attribure, the information about the external storage system to which LDEV is being mapped appears. • Vendor/Model/Serial Number: The information about these items of the external storage system is displayed. A hyphen(-) appears if an external storage system is not mapped to LDEV. • Path Group ID: The information about this item of the external storage system is displayed. If the link of the path group id is clicked, the Mapped Volumes tab appears. A hyphen(-) appears if an external storage system is not mapped to LDEV.
Data Direct Mapping	Information about the data direct mapping. • LDEV ID: LDEV ID of the pool-VOL in the pool with data direct mapping enabled, or LDEV ID of the DP-VOL with data direct mapping enabled. If the link of LDEV ID is clicked, the LDEV Properties window appears. If the data direct mapping attribute is disabled, a hyphen (-) is displayed. If a DP-VOL with data direct mapping enabled is not created in the pool with data direct mapping enabled, this field is blank. • Parity Group ID: Parity Group ID of the pool-VOL in the pool with data direct mapping enabled. If the data direct mapping attribute is disabled, a hyphen (-) is displayed.
Resource Group Name (ID)	Displays the resource group name and ID of the LDEV. The ID is provided in parentheses.
Full Allocation	Displays the status of the setting for the full allocation with V-VOLs for Dynamic Provisioning. • Enabled: Full allocation is performed. • Disabled: Full allocation is not performed. • Hyphen (-): LDEVs other than V-VOLs for Dynamic Provisioning.
Tiering Policy	Displays the tiering policy name and ID.
New page Assignment Tier	Displays the new page assignment tier.
Tier Relocation	Displays the tier relocation setting.
Relocation Priority	Displays the relocation priority setting.
Expanded Space Used	Displays the information that LDEV is allocated in the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. This item displays whether the LDEV area is allocated in the expanded or physical area. Yes: LDEV is allocated in the expanded area.

Item	Description
	No: LDEV is allocated in the physical area.
Capacity Saving	Displays the capacity saving setting of the LDEV. • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used. • - (hyphen): The LDEV does not support the capacity saving function.
Capacity Saving Status	The status of the capacity saving function. • Enabling: The format for enabling the capacity saving function is being performed. • Rehydrating: The format for disabling the capacity saving function is being performed. The processing progress is displayed as a percentage in parentheses. • Deleting Volume: The deletion of DP-VOL whose capacity saving function is Enabled is being performed. The processing progress is displayed as a percentage in parentheses. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured. • - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Virtual Attribute	Displays the virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.

LUNs table

This table is not displayed if the path is not set.

Item	Description
Port ID	Port name.
Type	Types of ports • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports.

Item	Description
	• NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Host Group Name / iSCSI Target Alias	Host group name or iSCSI target alias.
iSCSI Target Name	iSCSI target name.
LUN ID	Identifier of the logical unit.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.

Hosts table

This table provides information about the host that can view LDEVs. This table is not available if the WWN is not registered in the host to which the path is set.

Item	Description
Type	Types of ports: • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
HBA WWN / iSCSI Name	HBA WWN or iSCSI name.
Host Name	Host name.

Replication Tab

Information about the volume of the local replication pair is displayed in the Replication Properties, SI Pairs, TI Pairs, TC Pairs, UR Pairs, and GAD Pairs tables.

For details about each item, see the following:

- *Hitachi ShadowImage® User Guide*
- *Hitachi Thin Image User Guide*

- *Hitachi Compatible FlashCopy/FlashCopy SE User Guide*
- *Hitachi TrueCopy® User Guide*
- *Hitachi Universal Replicator User Guide*
- *Global-Active Device User Guide*

Replication Properties table

Item	Description
Local Replication	• ShadowImage L1: Displays the status of the ShadowImage L1 pair. • ShadowImage L2: Displays the status of the ShadowImage L2 pair. • Thin Image: Displays the status of the Thin Image pair.
Remote Replication	• TrueCopy: Displays the status of the TrueCopy pair. • Universal Replicator: Displays the status of the Universal Replicator pair.

SI Pairs table

Item	Description
Primary Volume	• LDEV ID: Displays LDEV ID of the primary volume. • LDEV Name: Displays LDEV name of the primary volume. • Emulation Type: Displays emulation type of the primary volume. • Capacity: Displays capacity of the primary volume. • CLPR: Displays CLPR ID of the primary volume.
Copy Type	Displays copy type of the pair.
Status	Displays the pair status.
Secondary Volume	• LDEV ID: Displays LDEV ID of the secondary volume. • LDEV Name: Displays LDEV name of the secondary volume. • Capacity: Displays capacity of the secondary volume. • CLPR: Displays CLPR ID of the secondary volume.
Copy Pace	Displays the pace of copying of the pair.
CTG ID	Displays the consistency group number of the pair.
Mirror Unit	Displays the mirror unit number of the pair.
Detail	Displays the **View Pair Properties** window.

HTI Pairs table

Item	Description
Primary Volume	• LDEV ID: Displays LDEV ID of the primary volume. • LDEV Name: Displays LDEV name of the primary volume. • Capacity: Displays capacity of the primary volume. • CLPR: Displays CLPR ID of the primary volume.
Snapshot Group	Displays the snapshot group name.

Item	Description
	Information is shown for this item only if you have configured a snapshot group for the HTI pair.
Status	Displays the pair status.
Snapshot Date	Displays the date and time when you created the pair to store snapshot.
Secondary Volume	• LDEV ID: Displays LDEV ID of the secondary volume. • LDEV Name: Displays LDEV name of the secondary volume. • Capacity: Displays capacity of the secondary volume. • CLPR: Displays CLPR ID of the secondary volume.
Pool Name (ID)	Displays pool name and identification number.
CTG ID	Displays the consistency group identification number.
Mirror Unit	Displays the mirror unit number of the pair.
Cascade	Indicates whether a cascade pair can be created by using the pair. • Enabled: Cascade pair can be created. • Disabled: Cascade pair cannot be created.
Type	Displays the type of the pair. • Snapshot: Pair with the snapshot attribute.
Topology ID	Displays the topology ID of the pair. The topology ID indicates the layer of the pair location based on the mirror unit. The topology ID consists of the LDEV ID of the root volume and the mirror unit.
Root Volume	Displays the LDEV ID of the root volume of the pair.
Detail	Displays the **View Pair Properties** window.

TC Pairs table

Item	Description
Pair Position	Displays whether the volume is a primary or secondary volume.
Status	Displays the pair status.
Remote Storage System	• Model / Serial Number: Displays the model and serial number of the remote storage system. • LDEV ID: Displays LDEV ID of the remote storage system. • Port ID: Displays Port ID of the remote storage system. • Host Group ID / iSCSI Target ID: Displays Host Group ID or iSCSI Target ID of the remote storage system. • LUN ID: Displays LUN ID of the remote storage system.
Path Group ID	Displays the path group ID.
Update Type	Displays the update type.
CTG ID	Displays the consistency group ID.
CTG Utilization	Displays whether the consistency group is shared by multiple local and remote storage systems.
Fence Level	Displays the fence level.

Item	Description
Detail	Displays the **View Pair Properties** window.

UR Pairs table

Item	Description
Journal ID	Displays the journal ID.

Pair 1	Displays the pair 1 information.
	• Pair Position: Displays whether the volume is a primary or secondary volume.
	• Mirror ID: Displays the mirror ID.
	• Status: Displays the pair status.
	• Remote Storage System: Displays the information about the remote storage system.
	  ○ Model / Serial Number: Displays the model and serial number of the remote storage system.
	  ○ LDEV ID: Displays LDEV ID of the remote storage system.
	  ○ Port ID: Displays Port ID of the remote storage system.
	  ○ Host Group ID / iSCSI Target ID: Displays Host Group ID or iSCSI Target ID of the remote storage system.
	  ○ LUN ID: Displays LUN ID of the remote storage system.
	  ○ Journal ID: Displays journal ID of the remote storage system.
	• Path Group ID: Displays the path group ID.
	• CTG ID: Displays the consistency group ID.
	• Error Level: Displays the error level.

Pair 2	Displays the pair 2 information.
	• Pair Position: Displays whether the volume is a primary or secondary volume.
	• Mirror ID: Displays the mirror ID.
	• Status: Displays the pair status.
	• Remote Storage System: Displays the information about the remote storage system.
	  ○ Model / Serial Number: Displays the model and serial number of the remote storage system.
	  ○ LDEV ID: Displays LDEV ID of the remote storage system.
	  ○ Port ID: Displays Port ID of the remote storage system.
	  ○ Host Group ID / iSCSI Target ID: Displays Host Group ID or iSCSI Target ID of the remote storage system.
	  ○ LUN ID: Displays LUN ID of the remote storage system.
	  ○ Journal ID: Displays journal ID of the remote storage system.
	• Path Group ID: Displays the path group ID.
	• CTG ID: Displays the consistency group ID.
	• Error Level: Displays the error level.

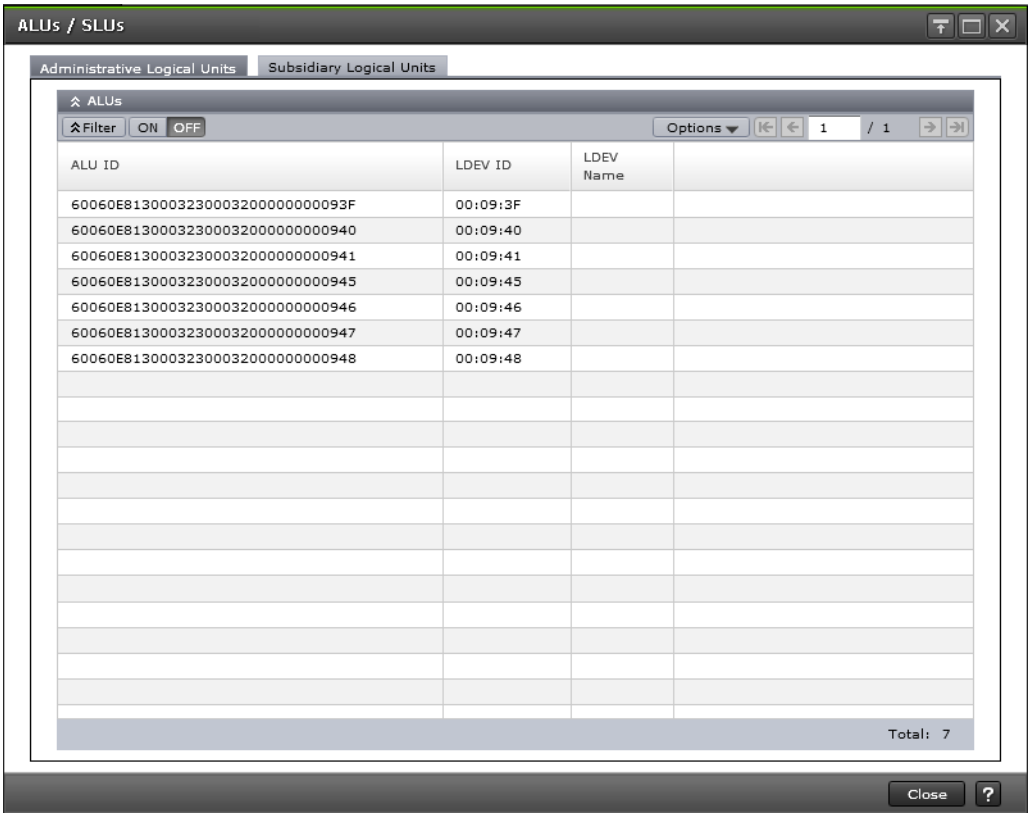
Detail	Displays the **View Pair Properties** window.

GAD Pairs table

Item	Description
Pair Position	Displays whether the volume is a primary or secondary volume.
Status	Displays the pair status.
Remote Storage System	• Model / Serial Number: Displays the model and serial number of the remote storage system. • LDEV ID: Displays LDEV ID of the remote storage system. • Port ID: Displays Port ID of the remote storage system.
Path Group ID	Displays the path group ID.
Quorum Disk ID	Displays the quorum disk ID.
Mirror ID	Displays the mirror ID.
Detail	Displays the **View Pair Properties** window.

ALUs / SLUs window

Use this window to view the LDEVs with the ALU attribute and the LDEVs with the SLU attribute. To open this window, open the Logical Devices window, and then in the LDEVs pane click More Actions > View ALUs/SLUs.



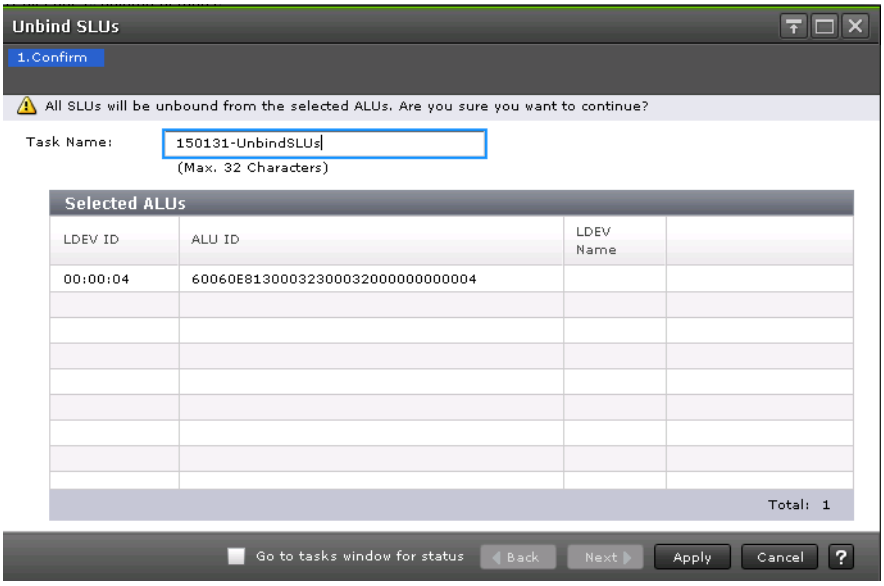
Administrative Logical Units tab

Item	Description
ALU ID	ALU attribution identifier of the LDEV. If the ALU ID is not assigned, a question mark (?) appears.
LDEV ID	LDEV identifier, which consists of the LDKC, CU, and LDEV.
LDEV Name.	Name of the LDEV.

Subsidiary Logical Units tab

Item	Description
SLU ID	SLU attribution identifier of the LDEV. If the ALU ID is not assigned, a question mark (?) appears.
LDEV ID	LDEV identifier, which consists of the LDKC, CU, and LDEV.
LDEV Name.	Name of the LDEV.
Provisioning Type	Provisioning type to be assigned to the LDEV. DP: DP-VOL Snapshot: Thin Image volume.

Unbind SLUs window

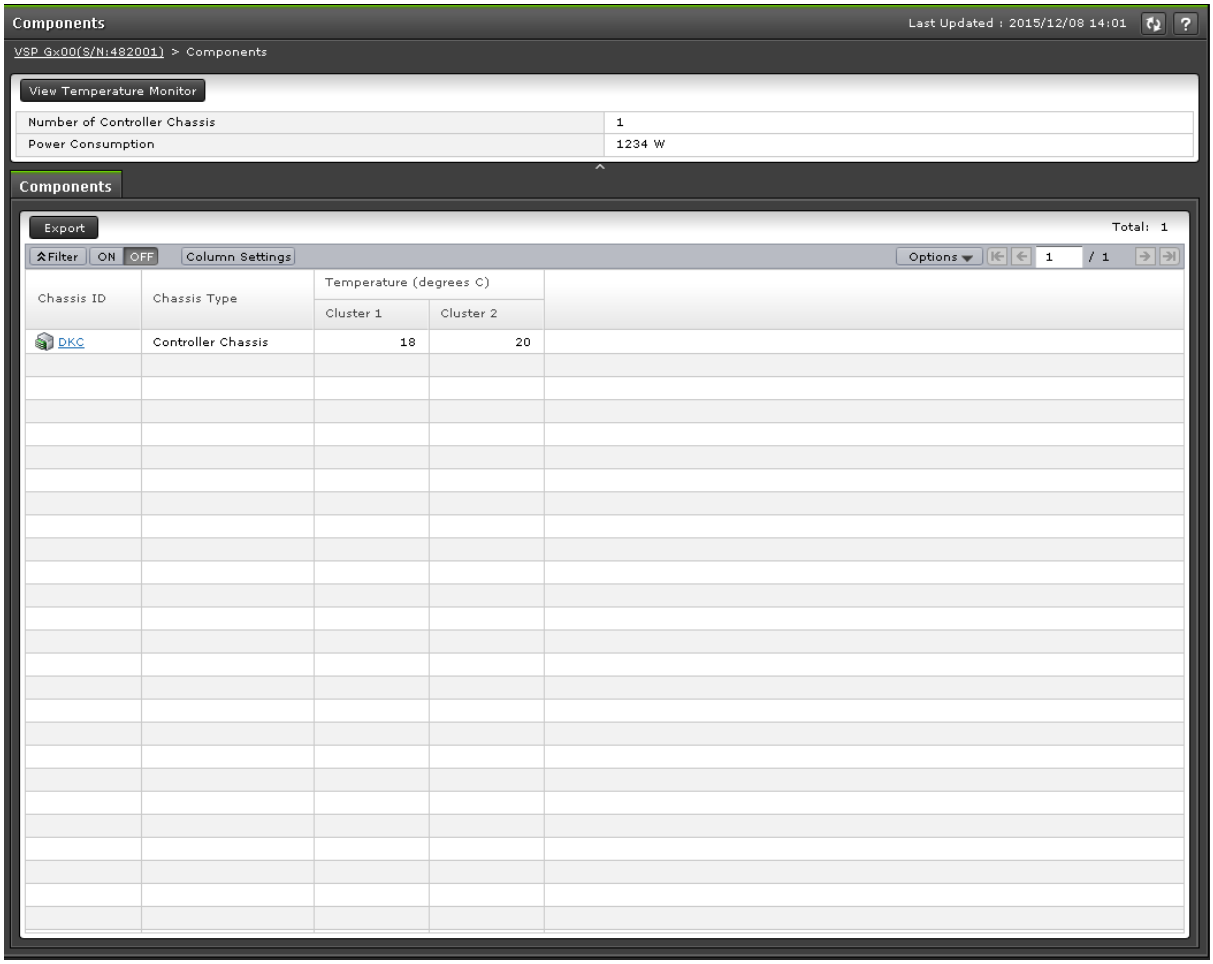


Selected ALUs

Item	Description
LDEV ID	LDEV identifier, a combination of LDKC, CU, and LDEV.
ALU ID	ALU attribution identifier of an LDEV.
LDEV Name	Name of the LDEV.

Components window

Use this window to view information about the controller chassis components in the storage system.



Summary

Item	Description
Number of Controller Chassis	Number of controller chassis

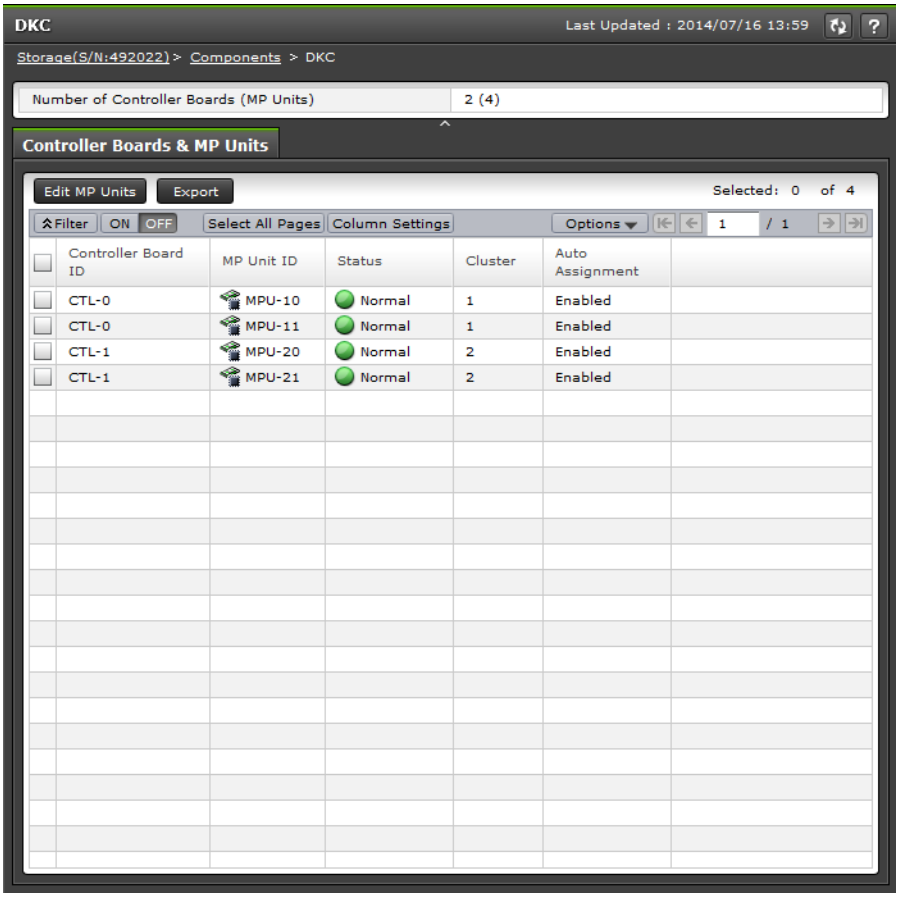
Item	Description
Power Consumption	Total power consumption of the controller chassis and drive box. When the power information cannot be acquired because of a failure in the component or network, the power information is not added to the power consumption information. In the following cases, the power consumption value might temporarily displays lower: • When starting the storage system • After replacing a part of the storage system • When updating the microcode or after updating the microcode
View Temperature Monitor	Opens the **Temperature Monitor** window

Components tab

Item	Description
Chassis ID	Chassis identifier of the storage system.
Chassis Type	Chassis type.
Temperature (degrees C)	Temperature of the cluster. • Cluster 1: Temperature of the cluster 1. • Cluster 2: Temperature of the cluster 2. A question mark (?) appears when the temperature information cannot be acquired because of a failure in the component or network.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

DKC: Controller Boards & MP Units tab

Use this window to view information about MP units in the storage system.



Summary

Item	Description
Controller Boards (MP Units)	Number of Controller Boards and MP Units. The number of the MP unit is displayed in a parenthesis.

Controller Boards & MP Units tab

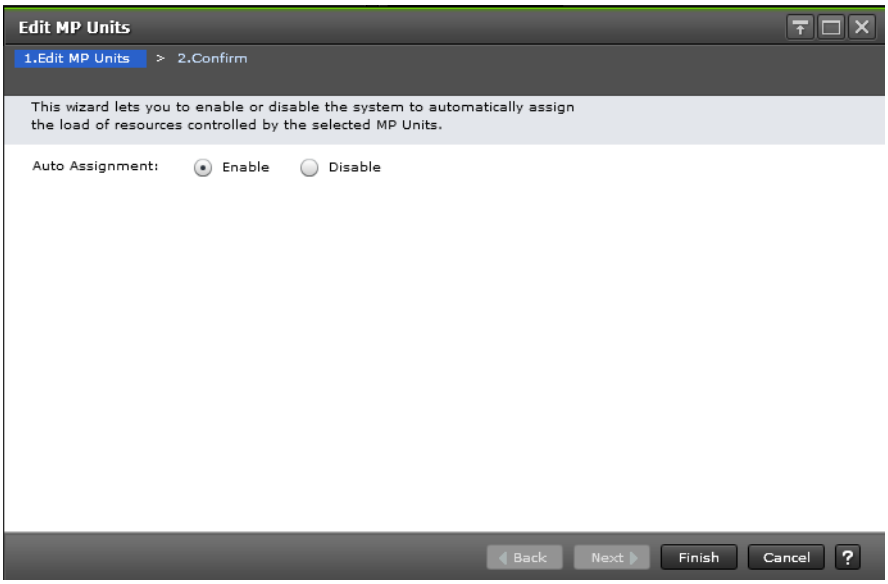
Item	Description
Controller Board ID	Identifier of the controller board.
MP Unit ID	Identifier of the MP unit.
Status	Status of the MP unit. Normal: Available. Warning: The MP unit is partially blocked. Blocked: The MP unit is blocked.

Item	Description
	Failed: The MP unit is in abnormal status.
Cluster	Cluster number of the MP unit.
Auto Assignment	Indicates whether the MP unit is automatically assigned to resources. Enabled: The MP unit is automatically assigned to resources (logical devices, external volumes, and journal volumes). Disabled: The MP unit is not automatically assigned to resources.
Edit MP Units	Opens the **Edit MP Units** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Edit MP Units wizard

Use this wizard to enable or disable the storage system to automatically assign the load of resources controlled by the selected MP units.

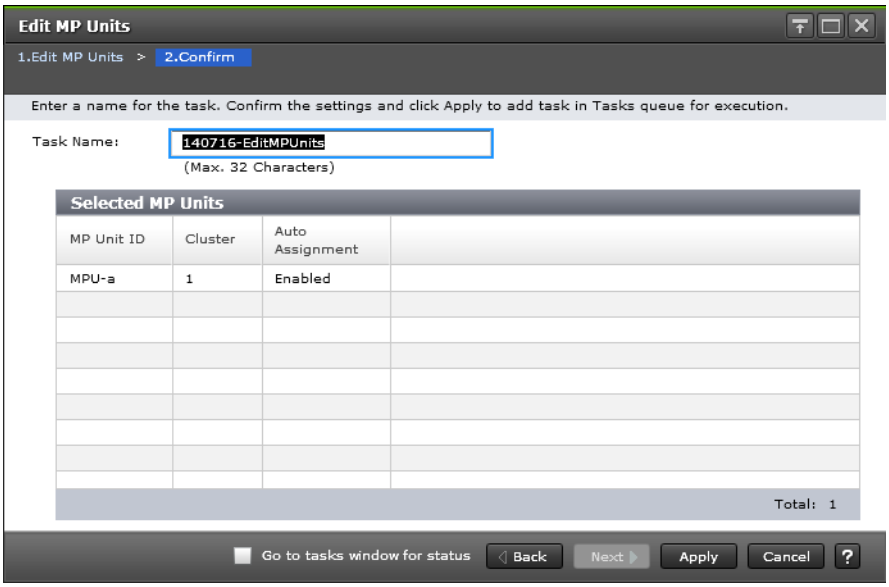
Edit MP Units window



Item	Description
Auto Assignment	Specify whether to automatically assign an MP unit to resources (logical devices, external volumes, and journal volumes). • Enable: Resources will be automatically assigned to the specified MP unit. • Disable: Resources will not be automatically assigned to the specified MP unit.

Edit MP Units confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



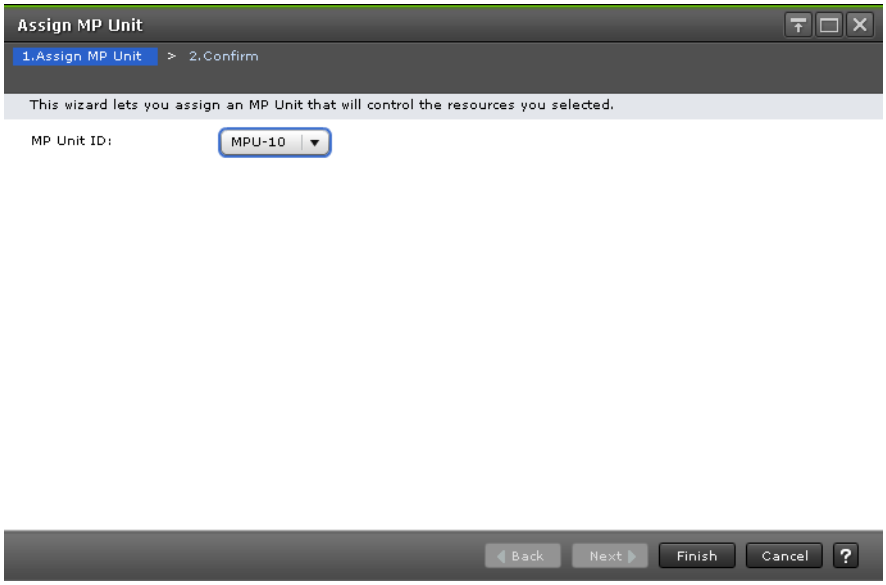
Item	Description
MP Unit ID	MP unit identifier.
Cluster	Cluster number of the MP unit.
Auto Assignment	Indicates whether automatic assignment of MP units is in use. • Enabled: An MP unit is automatically assigned to resources (logical devices, external volumes, and journal volumes). • Disabled: An MP unit is not automatically assigned to resources.

Assign MP Unit wizard

Use this wizard to assign an MP unit that will control selected resources.

Assign MP Unit window

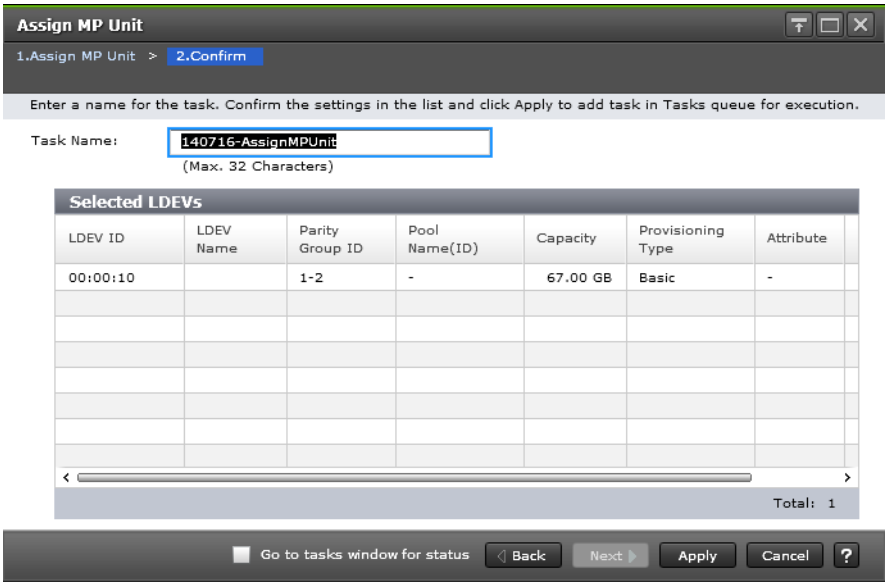
Use this window to select an MP unit to assign to an LDEV.



Item	Description
MP Unit ID	Change the MP unit identifier assigned to the LDEV. *MP-unit ID*: The selected MP unit identifier is assigned to the LDEV.

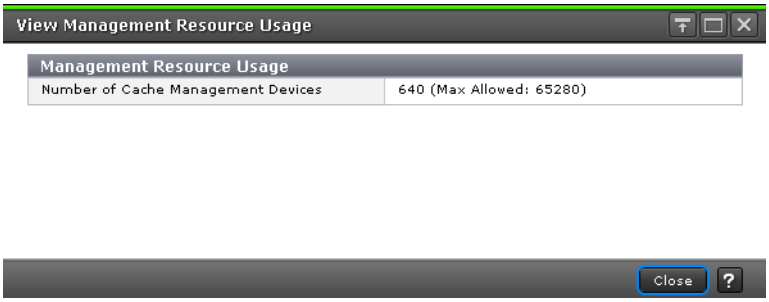
Assign MP Unit confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	LDEV name.
Parity Group ID	Parity group identifier.
Pool Name (ID)	Pool name and pool identifier.
Capacity	LDEV capacity.
Provisioning Type	Provisioning type to be assigned to the LDEV. • Basic: Internal volume. • DP: DP-VOL. • External: External volume. • Snapshot: Thin Image volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device • Remote Command Device: Remote command device • JNL VOL: Journal volume • Pool VOL: Pool volume. The number in parentheses shows the pool ID. • Quorum Disk: Quorum disk for global-active device • TSE: TSE-VOL (mainframe systems) • ALU: LDEV of the ALU attribution • SLU: LDEV of the SLU attribution • Data Direct Mapping: LDEV of the data direct mapping attribute • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data: Deduplication System Data volume (open systems) • Hyphen (-): Volume in which the attribute is not defined
MP Unit ID	MP unit identifier to be set.

View Management Resource Usage window



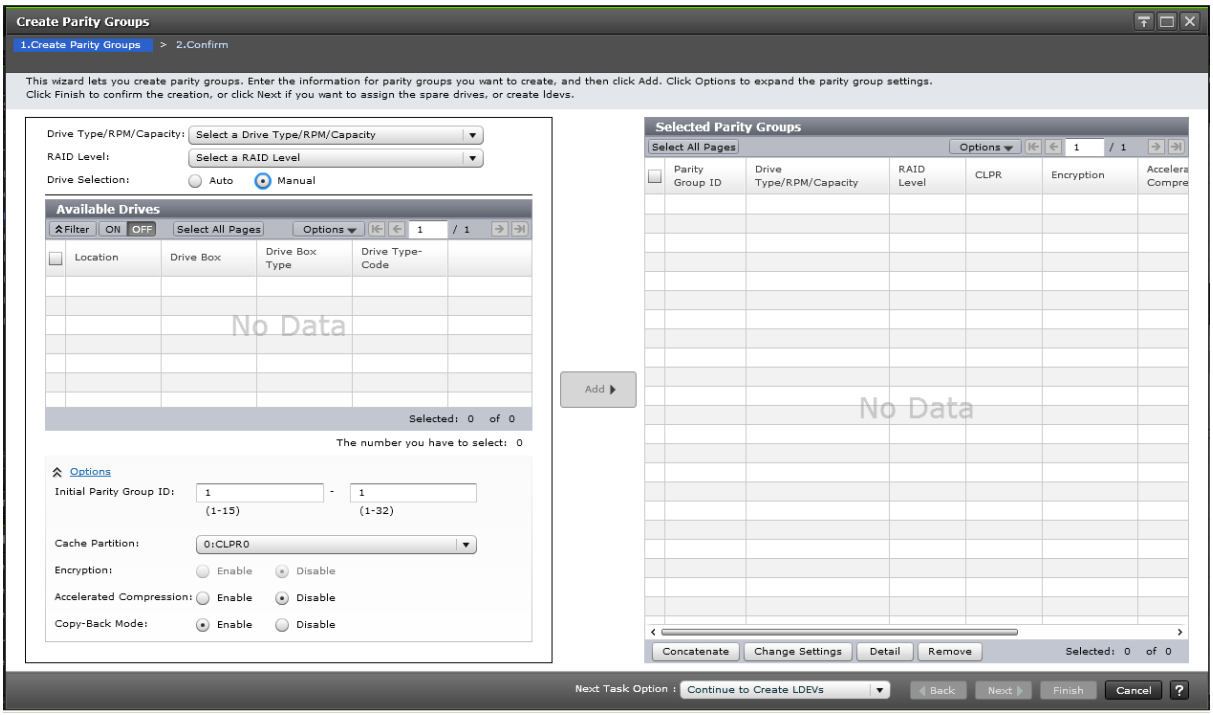
Management Resource Usage table

Item	Description
Number of Cache Management Devices	The current number and maximum allowed number of cache management devices in the storage system are displayed.

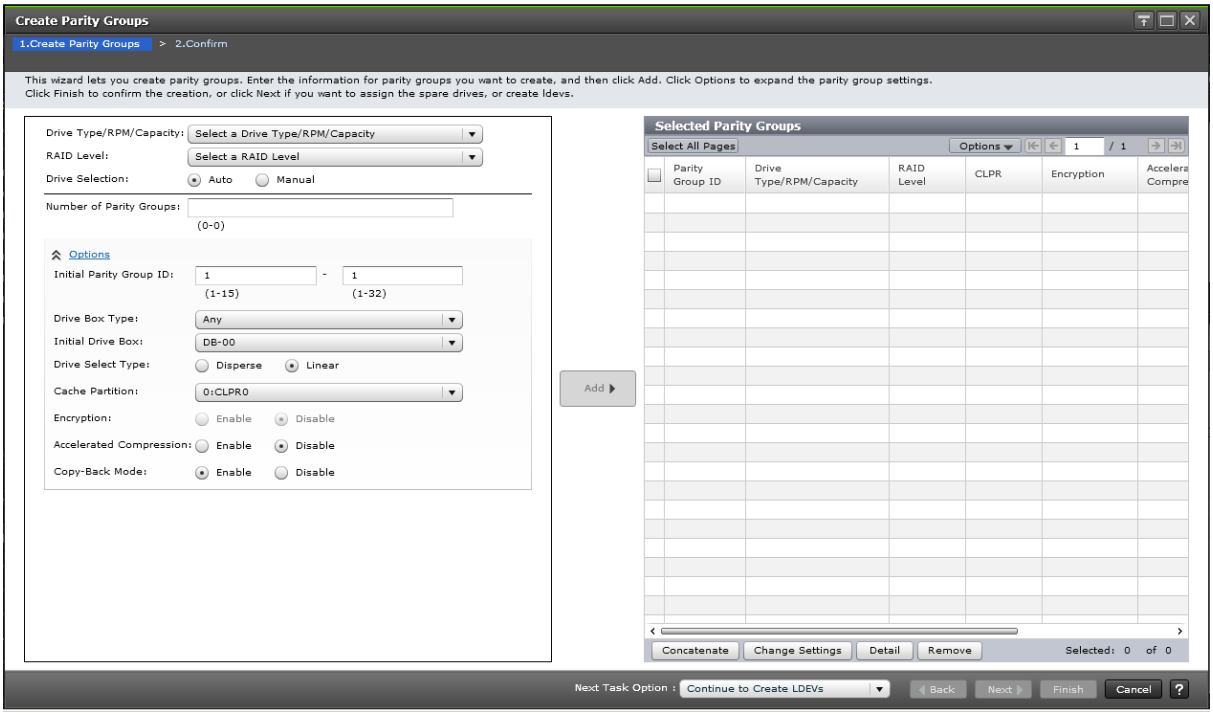
Create Parity Groups wizard

Create Parity Groups window

When selecting drives manually



When selecting drives automatically



Setting Fields

Item	Description
Drive Type/RPM/Capacity	Select the type of the drive box.
RAID level	Select the RAID level.
Drive Selection	Select the mode of the drive selection from Auto or Manual.
Number of Parity Groups	Enter the number of parity groups. This item appears when selected Auto as your drive selection.
Available Drives	This item appears when selected Manual as your drive selection. For drives to be incorporated to a parity group, set the check box of a row to ON. • Location: Displays the location of the drive box. • Drive Box: Displays the name of the drive box. • Drive Box Type: Displays the type of the drive box. • Drive Type-Code: Displays the type code of the drive box.
The number you have to select	Displays the number of drives that you must select. This item appears when selected Manual as your drive selection.
Initial Parity Group ID	Enter the parity group ID.

Item	Description
	Text box on the left side: Enter the alphanumeric characters, which are fixed characters of the head of the parity group names. Characters are case-sensitive. Text box on the right side: Enter the initial number following the prefix name.
Drive Box Type	Select the type of drive box. This item appears when selected Auto as your drive selection.
Initial Drive Box	This item appears when selected Auto as your drive selection. The smallest available number is entered in the text box as a default. No number appears in the text box if no available parity group ID exists. If you specify the parity group ID which is already used, the minimum parity group ID after that the specified parity group ID is automatically set.
Drive Select Type	This item appears when selected Auto as your drive selection. Select the method for the selecting of drives in a parity group. • Disperse: Selected drives where are located dispersedly. • Linear: Selected drives where are located linearly. This item is not available with Virtual Storage Platform G200. If this storage system is used, only Linear is available.
Cache Partition	Select a CLPR number which is displayed as *ID:CLPR*.
Encryption	Specify if encrypted parity groups are created. • Enable: Encrypted parity groups are created. • Disable: Non-encrypted parity groups are created. This item is not available with Virtual Storage Platform G200.
accelerated compression	Displays the accelerated compression setting (enable or disable). If Enable is selected in the Encryption field, you cannot select Enable in the accelerated compression field. If the accelerated compression field is not defined, a hyphen (-) is displayed.
Copy-Back Mode	Specify if the copy-back mode is set to a parity group. • Enable: Copy-back mode is enabled in a parity group. • Disable: Copy-back mode is disabled in a parity group

Item	Description
Add	When you click Add, the configured information is added to the right side of the Selected Parity Groups table.

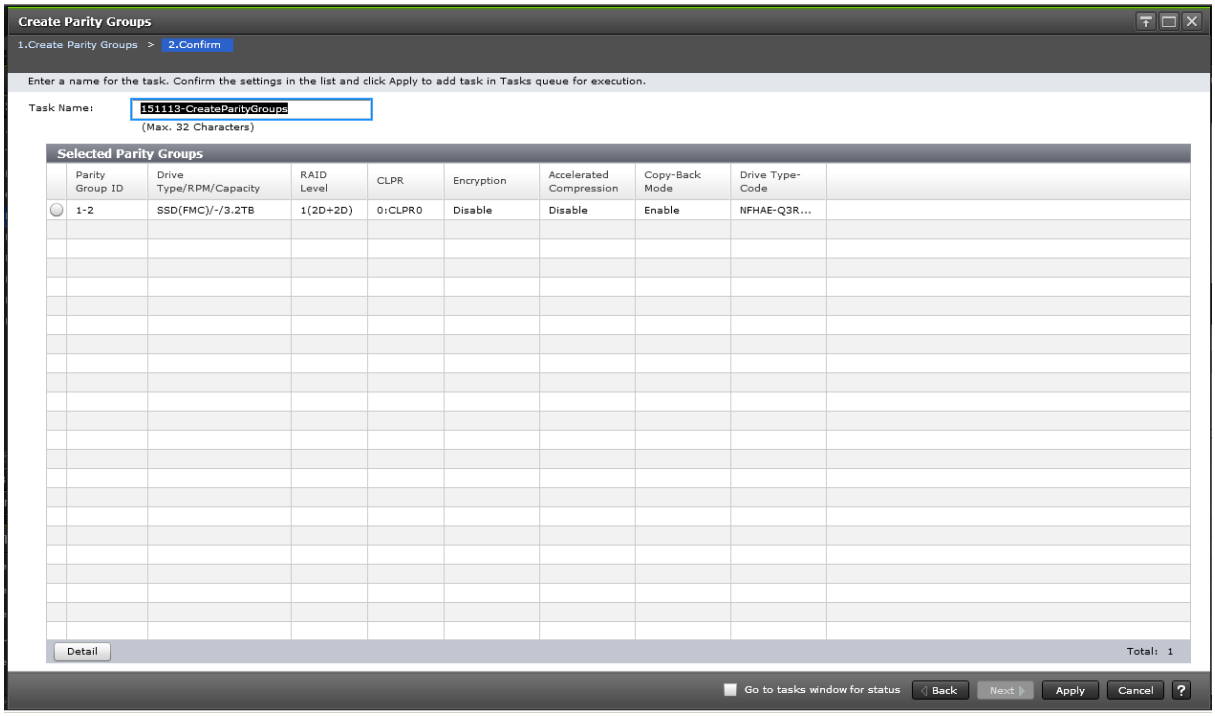
Selected Parity Groups table

Item	Description
Parity Group ID	Displays a parity group ID.
Drive Type/RPM/Capacity	Displays the drive type, RPM, and capacity. As for SSD, a hyphen (-) appears on the RPM field.
RAID Level	Displays a RAID level.
CLPR	Displays the CLPR ID and name that is displayed as *ID:CLPR*.
Encryption	Displays the encryption information. • Enable: Encrypted parity group. • Disable: Non-encrypted parity group. This item is not available with Virtual Storage Platform G200.
Accelerated Compression	Displays the accelerated compression setting (enable or disable). If the accelerated compression field is not defined, a hyphen (-) is displayed.
Copy-Back Mode	Displays the copy-back mode setting information. • Enable: Copy-back mode is set to enable in a parity group • Disable: Copy-back mode is set to disable in a parity group.
Drive Type-Code	Displays the drive type-code.
Concatenate	Creates a concatenated parity group by selecting multiple rows. When clicked this button with selecting multiple rows, a message asking whether a concatenated parity group is created is displayed.
Change Settings	Changes the setting of the parity group. When clicked this button with selecting a row, the **Change Settings** window is displayed.
Detail	Displays the **Parity Group Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.
Remove	Deletes the parity group selected in the **Selected Parity Groups** window. Displays the error window when a row is not selected.

Next Task Option

Click Next to go to the task setting window, which is indicated in Task Next Option.

Create Parity Groups confirmation window



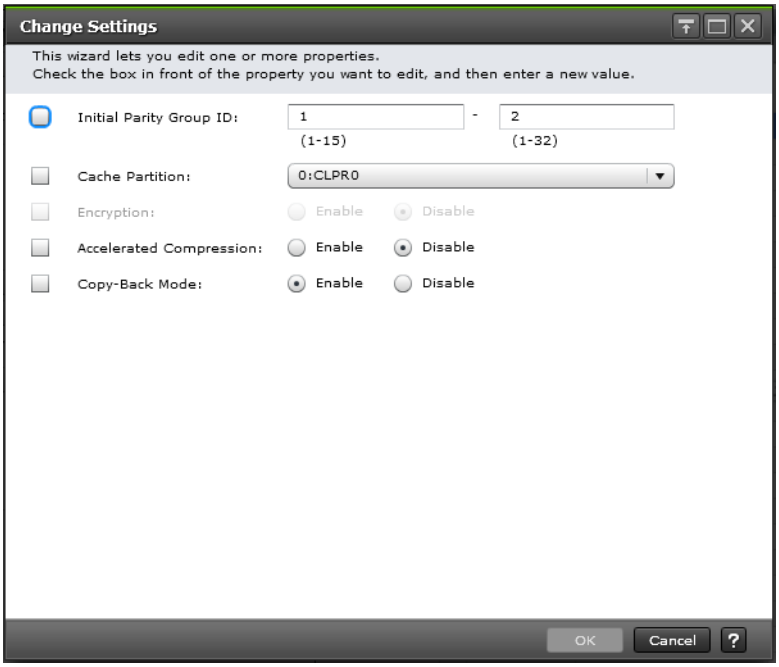
Selected Parity Groups

Item	Description
Parity Group ID	Displays a parity group ID.
Drive Type/RPM/Capacity	Displays the drive type, RPM, and capacity. As for SSD, a hyphen (-) appears on the RPM field.
RAID Level	Displays a RAID level.
CLPR	Displays the CLPR ID and name that is displayed as *ID:CLPR*.
Encryption	Displays the encryption information. • Enable: Encrypted parity group. • Disable: Non-encrypted parity group. This item is not available with Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group. • Enabled: The accelerated compression of the parity group is enabled. . • Disabled: The accelerated compression of the parity group is disabled.

Item	Description
	• Hyphen (-): accelerated compression is not supported on the parity group.
Copy-Back Mode	Displays the copy-back mode setting information. • Enable: Copy-back mode is set to enable in a parity group • Disable: Copy-back mode is set to disable in a parity group.
Drive Type-Code	Displays the drive type-code.
Detail	Displays the **Parity Group Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, then click Help.

Change Settings (Parity Group) window

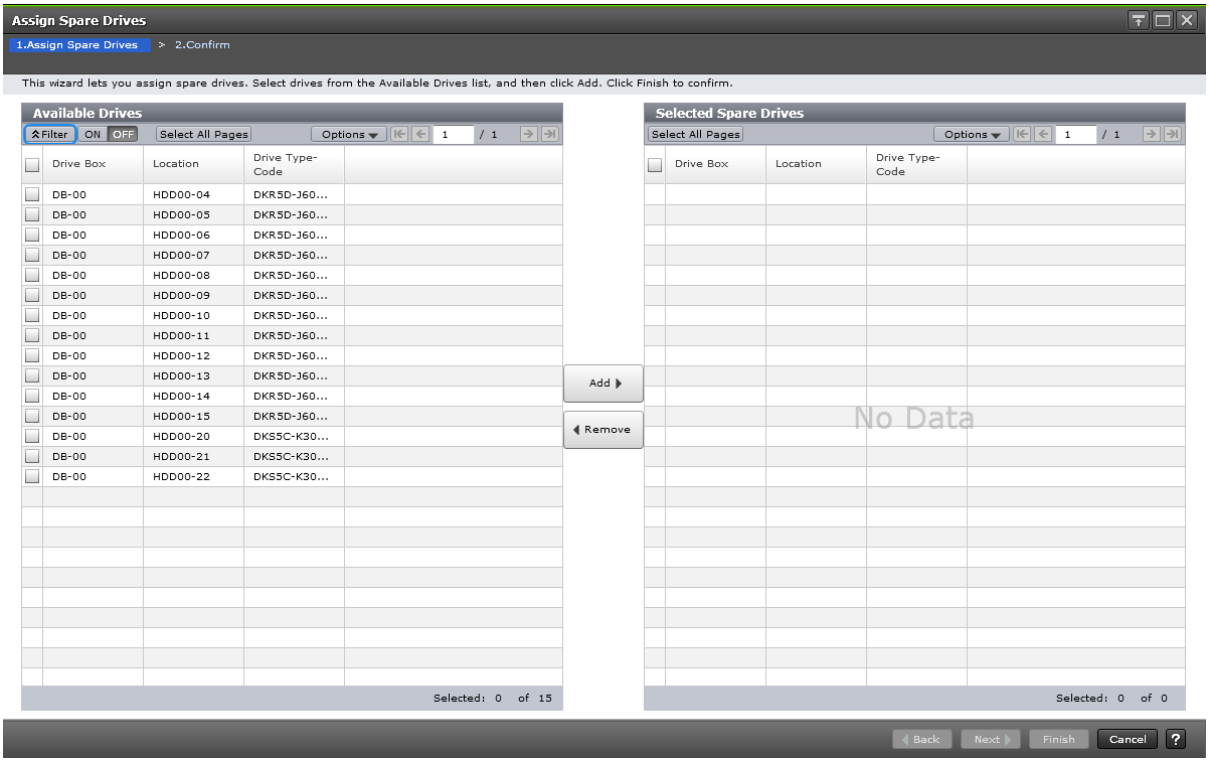


Item	Description
Initial Parity Group ID	Set the check box to ON and enter the parity group ID.

Item	Description
	• Text box on the left side: Enter the alphanumeric characters, which are fixed characters of the head of the parity group names. Characters are case-sensitive. • Text box on the right side: Enter the initial number following the prefix name.
Cache Partition	Set the check box to ON and select a CLPR number which is displayed as *ID:CLPR*.
Encryption	Set the check box to ON and specify if encrypted parity groups are created. You cannot specify the setting of the combination where both Encryption and accelerated compression are Enabled. • Enable: Encrypted parity groups are created. • Disable: Non-encrypted parity groups are created. This item is not available with Virtual Storage Platform G200.
Accelerated Compression	Specify the accelerated compression of the parity group. This item can be selected if drives with accelerated compression are selected. You cannot specify the setting of the combination where both Encryption and accelerated compression are Enabled. • Enabled: The accelerated compression of the parity group is enabled. • Disabled: The accelerated compression of the parity group is disabled.
Copy-Back Mode	Set the check box to ON and specify if the copy-back mode is set to a parity group. • Enable: Copy-back mode is set to enable in a parity group • Disable: Copy-back mode is set to disable in a parity group.

Assign Spare Drives wizard

Assign Spare Drives window



Available Drives table

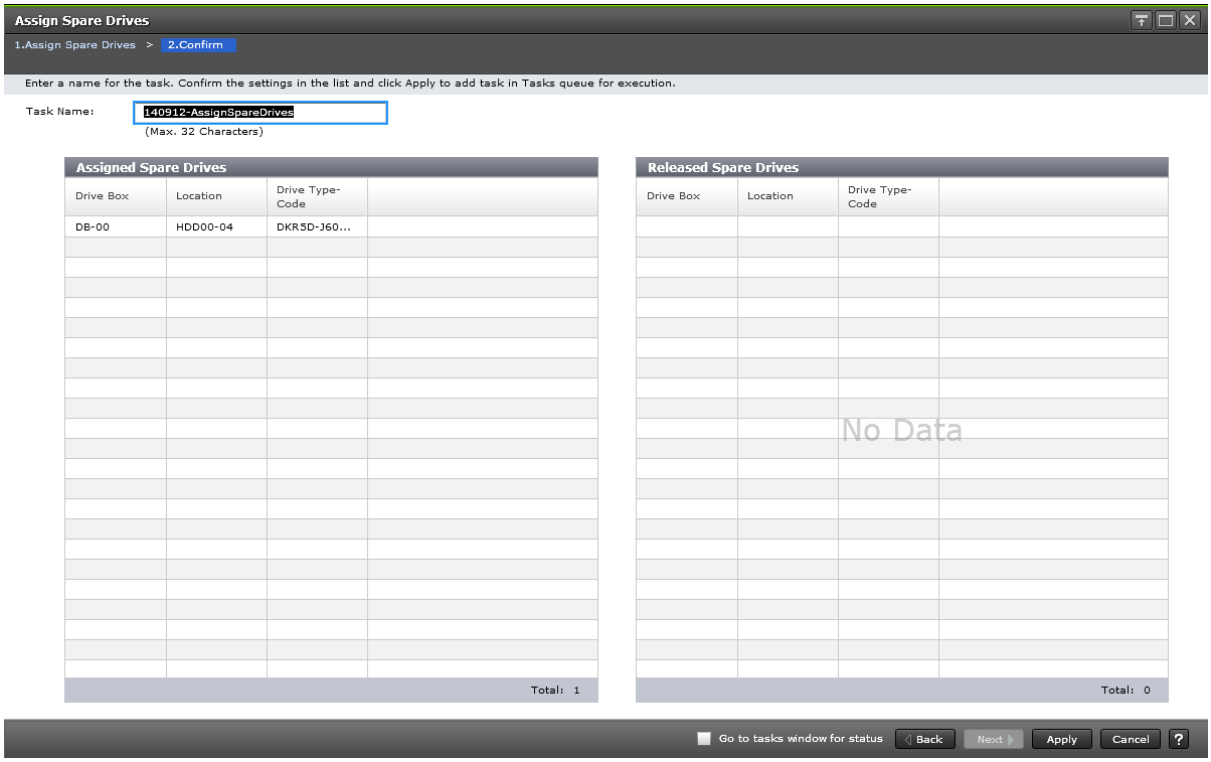
This table lists drives for spare drives. Only drives assigned to the logged-on user are available.

Item	Description
Drive Box	Displays the drive box number.
Location	Displays the location of the drive box.
Drive Type-Code	Displays the drive type code
Add	Adds one or more drives selected in the Available Drives table to the Selected Spare Drives table.
Remove	Removes one or more selected drives from the Selected Spare Drives table, and relocates drives to the Available Drives table.

Selected Spare Drives table

Item	Description
Drive Box	Displays the drive box number.
Location	Displays the location of the drive box
Drive Type-Code	Displays the drive type code.

Assign Spare Drives confirmation window



Assigned Spare Drives table or Released Spare Drives table

Item	Description
Drive Box	Displays the drive box number.
Location	Displays the location of the drive box.
Drive Type-Code	Displays the drive type code.

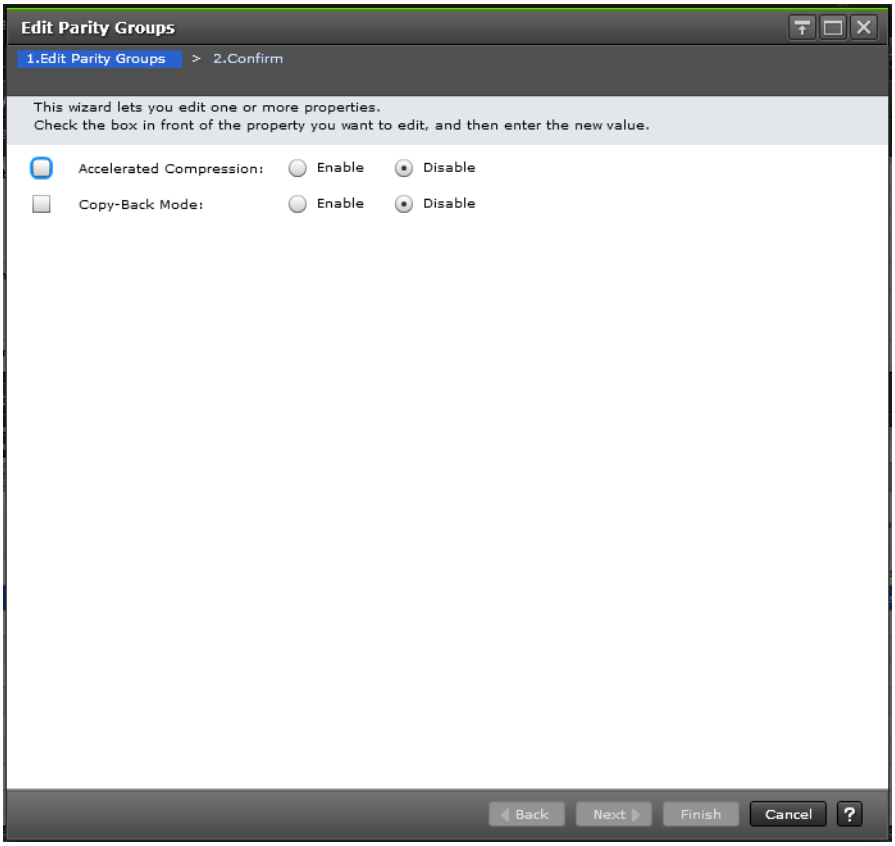
Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, then click Help.

Edit Parity Groups wizard

Use this wizard to edit parity groups.

Edit Parity Groups window

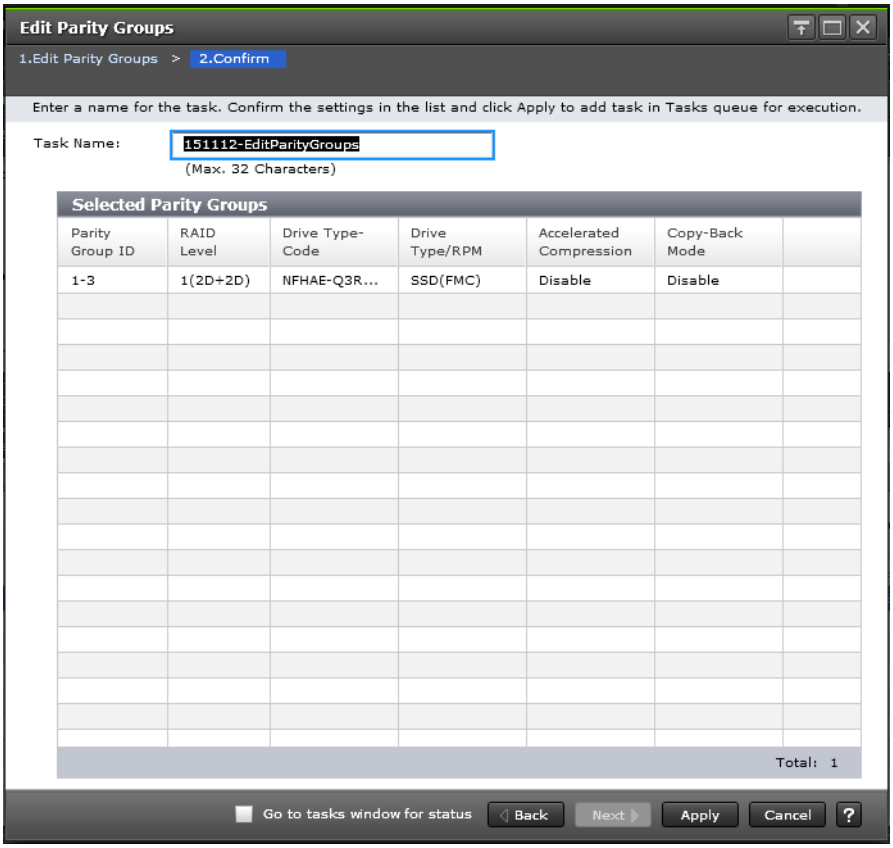
Use this window to edit the accelerated compression of selected parity groups.



Item	Description
Accelerated Compression	Specify the accelerated compression in a parity group. If the parity group with accelerated compression is selected, this item can be specified. Enabled: accelerated compression is enabled. Disabled: accelerated compression is disabled.
Copy-Back Mode	Specify the copy-back mode in a parity group. Enable: Copy-back mode is enabled. This function performs when failure data-drives are replaced. Disable: Copy-back function is disabled.

Edit Parity Groups confirmation window

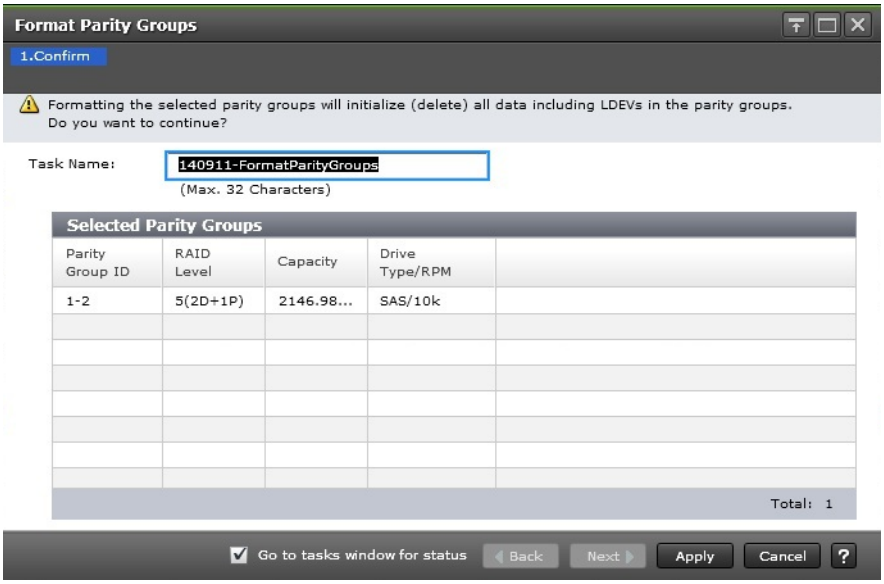
Use this window to confirm the accelerated compression setting of selected parity groups.



Item	Description
Parity Group ID	Displays the parity group ID.
RAID Level	Displays the RAID level.
Drive Type-Code	Displays the drive type code.
Drive Type/RPM	Displays the drive type and RPM.
Accelerated Compression	Displays the accelerated compression setting for the parity group. Enabled: accelerated compression is enabled. Disabled: accelerated compression is disabled.
Copy-Back Mode	Displays the copy-back mode that is set for the parity group. Enable: Copy-back mode is enabled. Disable: Copy-back function is disabled.

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of other configured items, click Back to display related setting windows, then click Help.

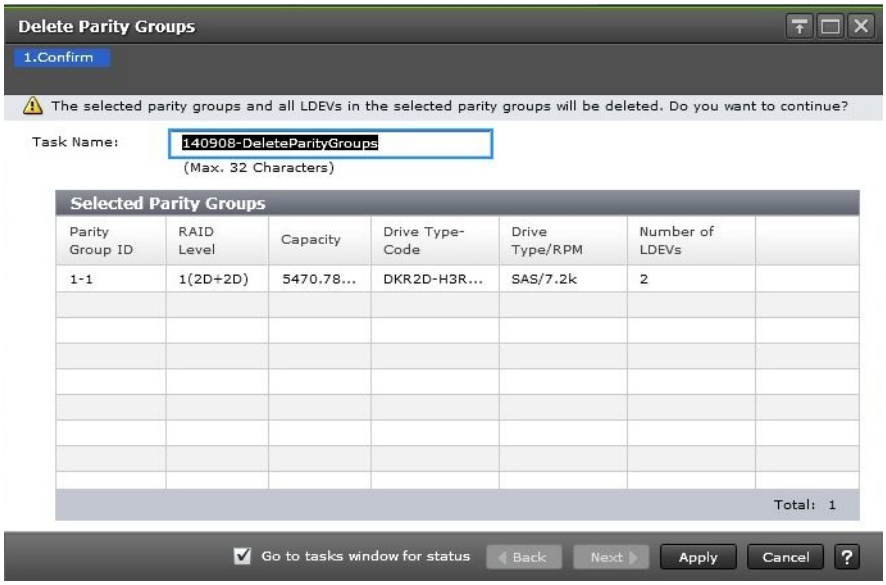
Format Parity Groups window



Selected Parity Groups table

Item	Description
Parity Group ID	Displays the parity group ID.
RAID Level	Displays the RAID level.
Capacity	Displays the capacity of the parity group.
Drive Type/RPM	Displays the drive type and RPM.

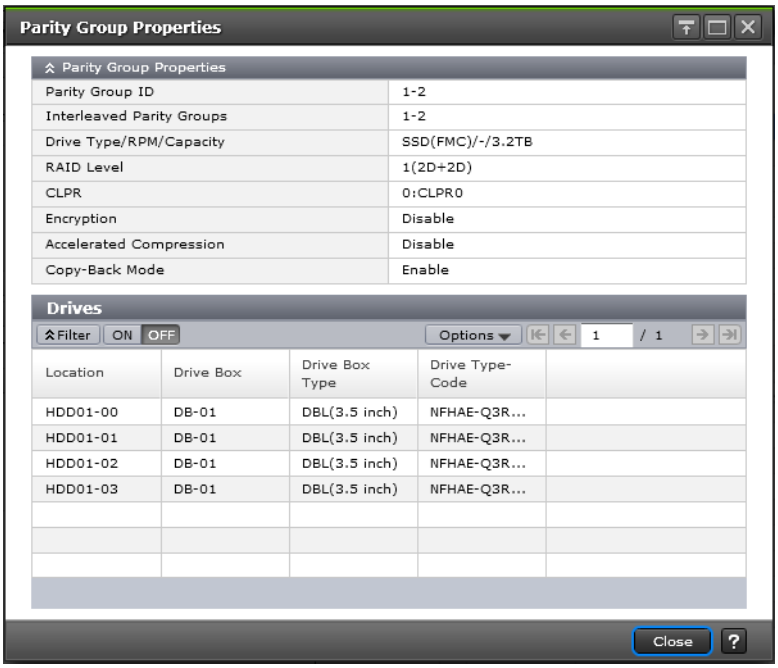
Delete Parity Groups window



Selected Parity Groups table

Item	Description
Parity Group ID	Displays the parity group ID.
RAID Level	Displays the RAID level.
Capacity	Displays the capacity of the parity group.
Drive Type-Code	Displays the drive type code.
Drive Type/RPM	Displays the drive type and RPM.
Number of LDEVs	Displays the number of LDEVs in the parity group.

Parity Group Properties window



Parity Group Properties table

Item	Description
Parity Group ID	Displays the parity group ID.
Interleaved Parity Groups	Displays interleaved (concatenated) parity groups
Drive Type/RPM/Capacity	Displays the drive type, RPM, and capacity. As for SSD, a hyphen (-) appears on the RPM field.
RAID Level	Displays the RAID level. The asterisk (*) indicates the parity group is the interleaved parity group.
CLPR	Displays the identifier and name of the CLPR in *ID:CLPR* format.
Encryption	Displays the encryption function which is set for the parity group. If the parity group is encrypted, Enabled is displayed. If the parity group is not encrypted, Disabled is displayed. This item is not available with Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group created of LDEVs. • Enabled: The accelerated compression of the parity group is enabled. • Disabled: The accelerated compression of the parity group is disabled. • Hyphen (-): accelerated compression is not supported on the parity group.

Item	Description
Copy-Back Mode	Displays the copy-back mode that is set for the parity group. If the copy-back mode is enabled, Enabled is displayed. If the period mode is not enabled, Disabled is displayed.

Drives table

Only drives assigned to the logged-on user are displayed.

Item	Description
Location	Displays the location of the drive box.
Drive Box	Displays the drive box number.
Drive Box Type	Displays the drive box type.
Drive Type-Code	Displays the drive type code.

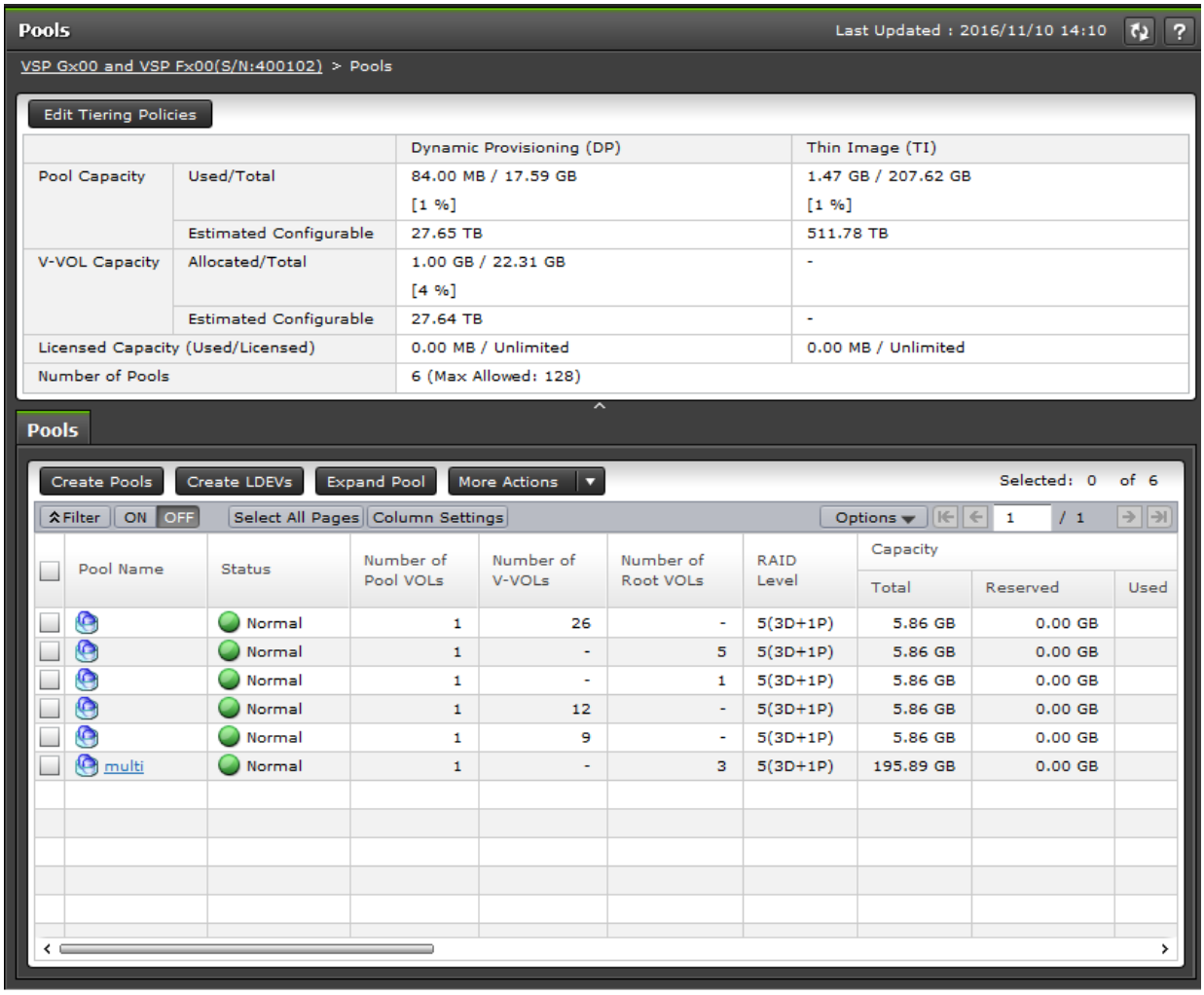
Dynamic Provisioning, Dynamic Tiering, and active flash GUI reference

The Dynamic Provisioning and Dynamic Tiering windows in Hitachi Device Manager - Storage Navigator display the Dynamic Provisioning and Dynamic Tiering information for the storage system and allow you to perform Dynamic Provisioning and Dynamic Tiering operations.

For general information about the Device Manager - Storage Navigator GUI, see the *System Administrator Guide*.

- Stop Reclaiming Zero Pages window
- Pool Property window
- Tier Properties window
- Monitor Pools window
- Stop Monitoring Pools window
- Start Tier Relocation window
- Stop Tier Relocation window
- View Pool Management Status window
- Edit External LDEV Tier Rank wizard
- Edit Tiering Policies wizard
- Change Tiering Policy window
- Change Pool Configuration Pattern window
- Change Deduplication System Data Volume Options window
- Edit Deduplication System Data Volume window

Pools window



Summary

Item	Description
Pool Capacity[1]	Displays information about the pool capacity. • Used/Total ○ Dynamic Provisioning(DP): Displays the pool capacity (the sum of the used capacity and the total pool capacity) of Dynamic Provisioning, Dynamic Tiering, and active flash. ○ Thin Image(TI): Displays the pool capacity (used/total) of Thin Image. For each value, if the Estimated Configurable capacity is zero, ⚠ is displayed in the cell.

Item	Description
	• Estimated Configurable[2] ○ Dynamic Provisioning(DP): Displays the estimated pool capacity of Dynamic Provisioning, Dynamic Tiering, and active flash. ○ Thin Image(TI): Displays the remaining physical pool capacity that is configurable for Thin Image.
V-VOL Capacity[1]	Displays information about the DP-VOL capacity. • Allocated/Total ○ Dynamic Provisioning(DP): In the Allocated field, total capacity of the Dynamic Provisioning, and active flashDynamic Tiering DP-VOLs to which LU paths are allocated is displayed. In the Total field, total capacity of the Dynamic Provisioning, Dynamic Tiering, and active flashDP-VOLs is displayed. For each value, if the Estimated Configurable capacity is zero, ⚠ is displayed in the cell. • Estimated Configurable[2] ○ Dynamic Provisioning(DP): Displays the DP-VOL estimated configurable capacity of Dynamic Provisioning, Dynamic Tiering, and active flash.
Licensed Capacity (Used / Licensed)	Displays information about available licensed capacity. • Dynamic Provisioning(DP): Displays the licensed capacity of Dynamic Provisioning. Used displays the total capacity of pools for Dynamic Provisioning, Dynamic Tiering, and active flash. • Thin Image(TI): Displays the licensed capacity of the Thin Image. **Caution:** In the Licensed Capacity(Used/Licensed) field, the total capacity of the system is displayed. The total capacity of the system includes capacities of LDEVs assigned to each user and resources other than LDEVs. Therefore, the value displayed as the "Used" Licensed Capacity (Used/ Licensed) might differ from the value of the "Total" Pool Capacity.
Number of Pools	Displays the total number of pools for Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image.
Edit Tiering Policies	Displays the **Edit Tiering Policies** window.

Notes:

1. The total value of the Total cells under Capacity of each pool type in the Pools tab window and the total Used capacity of the Pool Capacity in the Summary table are almost same, but small differences might occur.
   If the pool-VOL or DP-VOL for Dynamic Provisioning is created, the estimated configurable pool capacity and estimated configurable V-VOL capacity for Dynamic Provisioning(DP) change. The estimated capacity is calculated based on the configuration of current pools and DP-VOL, and remaining capacity of the shared memory.
2. The estimated configurable capacity of Dynamic Provisioning is the estimate of the DP-VOL capacity or the pool capacity that can be created by using the remaining capacity of the shared memory after deduction of the capacity of the shared memory used by the current pool and DP-VOL. The values of the Estimated Configurable Pool Capacity and the Estimated Configurable V-VOL Capacity can be used only as a guide, but are not guaranteed to create pools and DP-VOLs having the estimated configurable capacity. If the pool-VOL or DP-VOL for Dynamic Provisioning is created or deleted, the estimated configurable pool capacity and estimated configurable V-VOL capacity for Dynamic Provisioning change.

Pools tab

Item	Description
Pool Name	Displays the pool name. Clicking the pool name takes you to the pool information window in the lower hierarchy.
Pool ID[1]	Displays pool ID.
Status	Displays information about the pool status. Normal: Pool is in a normal status. Warning: Pool-VOL in the pool is blocked, or the pool is being shrunk. Exceeded Threshold: Used capacity of the pool exceeds the pool threshold. Shrinking: Pool-VOL is being reduced. Blocked: Pool is full, or an error occurred in the pool, indicating that the pool is blocked. If the pool is in both Warning and Blocked status, only Blocked is displayed.
Number of Pool VOLs	Displays the number of pool-VOLs associated with the pool.
Number of V-VOLs	Displays the number of V-VOLs associated with the pool. For a Thin Image pool, a hyphen (-) is displayed.
Number of Root VOLs	Displays the number of root volumes of the Thin Image pairs. If the pool is other than a Thin Image pool, a hyphen (-) is displayed.
RAID level	Displays RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays information about the pool capacity. • Total: Total capacity of pool. As for a pool comprised of pool-volumes assigned to accelerated compression-enabled parity groups, the writeable capacity might be smaller than the displayed capacity. Using Option, you can select unit of capacity. ○ One block means 512 bytes and one page means 42 megabytes in a pool capacity of Dynamic Provisioning, Dynamic Tiering,active flash, or Thin Image. • Reserved: Displays the reserved page capacity of the pool. The displayed value of Reserved might be larger than the displayed value of Total due to the following reasons: ○ Reserved displays reserved page capacity that is rounded up on each page. ○ The mapped capacity of DP-VOL includes the capacity of the control information (Requires a maximum of 168 MB per 3,145,548 MB). • Used: Sum of the mapped capacity and reserved capacity. The displayed value of Used might be larger than the displayed value of Total due to following reason: ○ Used displays the sum of the mapped capacity and reserved capacity, which are rounded up on each page.

Item	Description
	○ The mapped capacity of DP-VOL includes the capacity of the control information (uses a maximum of 168 MB per 3,145,548 MB). ○ DP-VOL with data direct mapping attribute includes the control information (168 MB is used per 3,145,548 MB) and capacity for one page. • Used (%): On a pool capacity basis, percentages of the sum of the mapped capacity and the reserved page capacity. Used (%) displays the value which is truncated after the decimal point of the actual value. For the pool of Dynamic Provisioning, Dynamic Tiering, and Thin Image, a hyphen (-) is displayed if the unit of capacity is changed into Cylinder.
Saving Effect[1]	The capacity saving rates and capacity that is reduced by accelerated compression and the capacity saving function (compression and deduplication). A hyphen appears if the pool does not support accelerated compression or the capacity saving function. • Saving (%)[1]: Displays the ratio of the Saving capacity with respect to the user data capacity. The total value of Deduplication (%) and Compression (%). • Saving[1]: Displays the saved capacity for a pool. The total value of the capacity expansion function and the capacity saving function. • Deduplication (%)[1]: Displays the data capacity ratio reduced by the deduplication function in the user data capacity. • Compression (%)[1]: Displays the data capacity ratio reduced by accelerated compression and the compression function in the user data capacity.
Physical Capacity[1]	For a pool containing pool volumes that support accelerated compression, this item displays the capacity assured for writing. If accelerated compression is not supported, a hyphen (-) is displayed. • Total: Displays the total pool capacity assured for writing. • Used: Displays the used capacity of the pool. The used capacity is the capacity deducted from the free capacity assured for writing from the total pool capacity assured for writing. For a pool comprised of pool volumes assigned to accelerated compression-enabled parity groups, the compressed data capacity is included in the used capacity. • Used (%): Displays the percentage of the used pool capacity against the total capacity assured for writing
Capacity Expansion Rate (%)[1]	For a pool containing pool volumes that support accelerated compression, this item displays the percentage of the total capacity with respect to the capacity assured for writing. If the accelerated compression is not supported, a hyphen (-) is displayed.
Physical FMC Pool Volumes Capacity [1]	For FMC pool volumes used in the pool, this item displays the capacity guaranteed for writing. If the pool does not include FMC pool volumes, a hyphen (-) is displayed. • Total: Displays the total capacity of FMC pool volumes for which writing is assured.

Item	Description
	• Used: Displays the used capacity of FMC pool volumes after they are compressed.
FMC Pool Volumes Capacity	Displays the capacity of FMC pool volumes used in the pool. If the pool does not include FMC pool volumes, a hyphen (-) is displayed. • Total[1]: Displays the total capacity of FMC pool volumes. • Used[1]: Displays the used capacity of FMC pool volumes. • Saving[1]: Displays the capacity reduced by the FMC data compression function. • Saving (%)[1]: Displays the ratio of the Saving (capacity) with respect to the Used (capacity) for Pool Volumes Capacity. • Expansion Rate (%): Displays the percentage of the total capacity of FMC pool volumes with respect to the total capacity of FMC pool volumes assured for writing. If either the used pool capacity or the used physical pool capacity exceeds 50% of the depletion threshold (the warning threshold for the Thin Image pool), an icon of one of following statuses appears: : In all accelerated compression-enabled parity groups, this status shows that the expansion rate and the saving ratio are balanced. : In one or more accelerated compression-enabled parity groups, this status show that an excess of the unanticipated usage might occur. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417. : In one or more accelerated compression-enabled parity groups, this status shows that the accelerated compression function is not performed in the effective utilization. However, if there is a parity group with a status (see above) in the pool, then this icon does not appear. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417.
Pool Saving (Post Process Data)	The data capacity reduction provided by the capacity saving function, which includes compression and deduplication. A hyphen (-) is displayed if the capacity saving function is not supported. • Saving (%): Displays the capacity reduction (%) provided by the capacity saving function, which is calculated as the ratio of Saving to Pre Saving Used. • Saving: Displays the capacity reduction (bytes) provided by the capacity saving function. • Used (Pre Processed Data): Displays the data capacity before the reduction provided by the capacity saving function.
User-Defined Threshold (%)	Displays information about the threshold of a pool. • Warning: Warning threshold. • Depletion: Depletion threshold. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Subscription (%)	Displays information about subscription of the pool. • Current: Percentage of the total V-VOL capacity assigned to the pool. • Limit: Percentage of the subscription limit of the pool.

Item	Description
	For a Thin Image pool, a hyphen (-) is displayed for Current and Limit.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM of the pool. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.

Encryption	Encryption: The encryption information of the pool.
	• Enabled: Pool which is created by pool-VOLs whose encryption settings are enabled.
	• Disable: Pool which is created by pool-VOLs whose encryption settings are disabled.
	• Mixed: This status is displayed when two or more of the following are specified as pool-VOLs:
	  ○ Volume encryption setting is enabled.
	  ○ Volume encryption setting is disabled.
	  ○ External volume
	
	Caution: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled.
	• Hyphen(-): Pool is created by external volumes. Or pool is being blocked.
	
	This item is not displayed when using Virtual Storage Platform G200.

Tier Management	Displays whether Dynamic Tiering is enabled or disabled. If it is enabled Auto or Manual is displayed. If it is disabled, a hyphen (-) is displayed. For a Thin Image pool, a hyphen (-) is displayed.
Shrinkable	Displays whether the pool-VOL can be removed. While the pool is being shrunk, a hyphen (-) is displayed.
Monitoring Mode	Displays the monitoring mode that is set for the pool. If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Status	Displays the status of pool monitoring. • In Progress: The monitoring is being performed. • During Computation: The calculating is being processed. Other than these cases, a hyphen (-) is displayed.

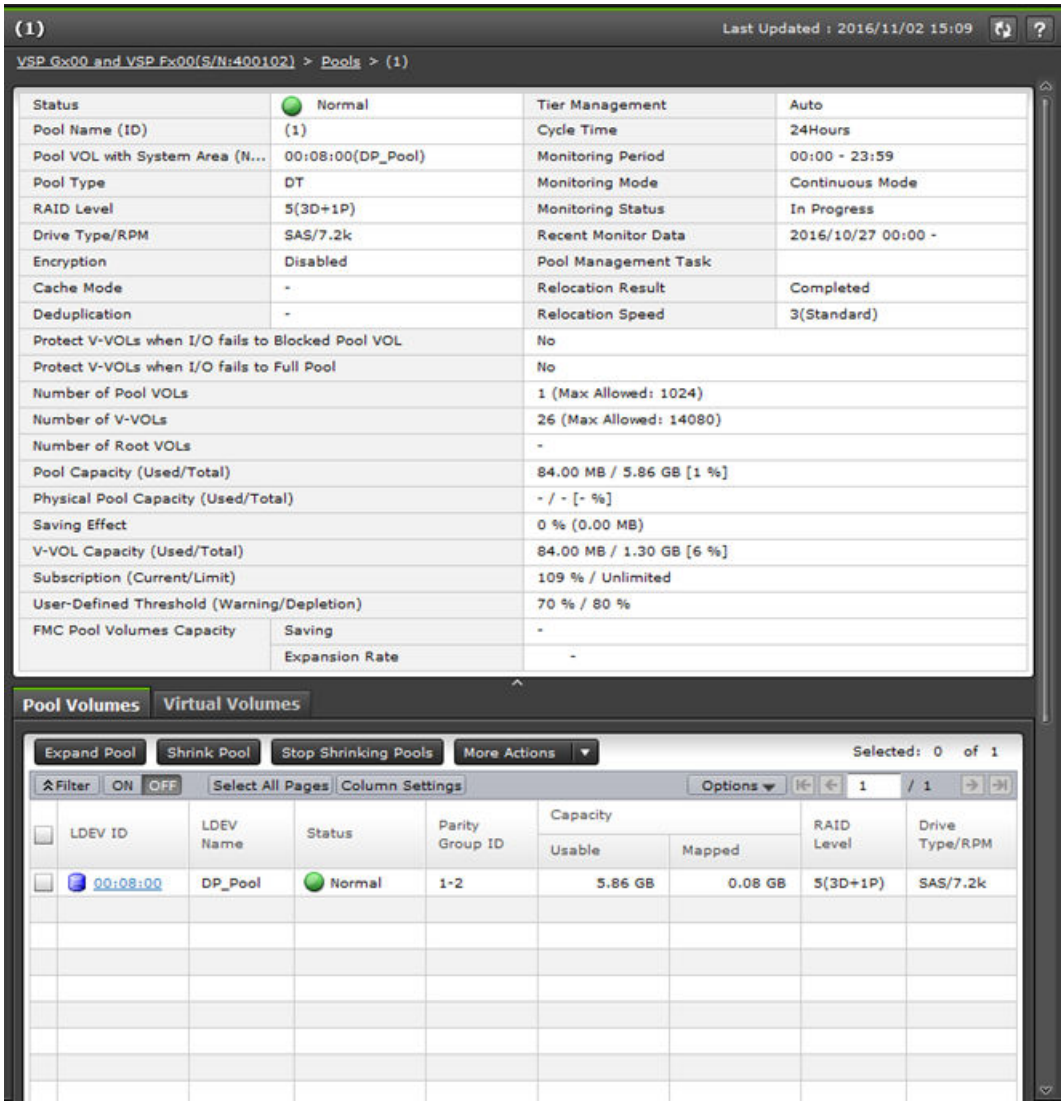
Item	Description
Recent Monitor Data	Displays the latest monitoring data. • If the monitoring data exists, the monitoring period of time is displayed. Example: 2010/11/15 00:00 - 2010/11/15 23:59 • If the monitoring data is being obtained, only the starting time is displayed. Example: 2010/11/15 00:00 - • If the latest monitoring data does not exist, a hyphen (-) is displayed.
Pool Management Task	Displays the pool management task being performed to the pool. • Waiting for Rebalance: The rebalance process is being waited. • Rebalancing: The rebalance process is being performed. • Waiting for Relocation: The tier relocation process is being waited. • Relocating: The tier relocation process is being performed. • Waiting for Shrink: The pool shrinking process is being waited. • Shrinking: The pool shrinking process is being performed. • Blank: The pool management task is not being performed to the pool. For details about the tier relocation, see the tier relocation log file.
Relocation Result	Displays the status of the tier relocation processing. In Progress: The status of Pool Management Task is Waiting for Relocation or Relocating. Completed: The tier relocation operation is not in progress, or the tier relocation is complete. Uncompleted (n% relocated): The tier relocation is suspended at the indicated percentage progression. Hyphen (-): The pool is not a Dynamic Tieringor active flash pool.
Relocation Speed	Displays the tier relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest).
Protect V-VOLs when I/O fails to Blocked Pool VOL	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of following: • Data Retention Utility is not installed. • Pool type is other than DP or DT.
Protect V-VOLs when I/O fails to Full Pool	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of following: • Data Retention Utility is not installed. • Pool type is other than DP or DT.
Deduplication[1]	For a DP pool, the deduplication setting of the pool. • Available: The deduplication setting for the pool is enabled.

Item	Description
	• Not Available: The deduplication setting for the pool is disabled.
Create Pools	Displays the **Create Pools** window.
Create LDEVs	Displays the **Create LDEVs** window.
Expand Pool	Displays the **Expand Pool** window.
Delete Pools[2]	Displays the **Delete Pools** window.
Restore Pools[2]	Displays the **Restore Pools** window.
Edit Pools[2]	Displays the **Edit Pools** window.
Monitor Pools[2]	Displays the **Monitor Pools** window.
Stop Monitoring Pools[2]	Displays the **Stop Monitoring Pools** window.
Start Tier Relocation[2]	Displays the **Start Tier Relocation** window.
Stop Tier Relocation[2]	Displays the **Stop Tier Relocation** window.
View Tier Properties[2]	Displays the **View Tier Properties** window. This window can be viewed only for the pools for which Dynamic Tiering is enabled.
View Pool Management Status[2]	Displays the **View Pool Management Status** window.
Export Tier Relocation Log[2]	Displays the window to download the result of the tier relocation.
Export[2]	Displays the window for outputting table information.

Notes:

1. Does not appear by default. To display this item, change the **Column Settings** of the table option.
2. Available when you click More Actions.

Pools: Volume tabs



Summary

Item	Description
Status	Displays information about the pool status. • Normal: Pool is in a normal status. • Warning: Pool-VOL in the pool is blocked, or the pool is being shrunk.

Item	Description
	• Exceeded Threshold: Percentages of the sum of the mapped capacity of the pool and the reserved capacity of the pool exceed the pool threshold. • Shrinking: Pool-VOL is being reduced. • Blocked: The pool is full, or an error occurred in the pool, indicating that the pool is blocked. If the pool is in both Warning and Blocked status, only Blocked is displayed.
Pool Name (ID)	Displays the pool name and pool ID.
Pool VOL with System Area (Name)	Displays the LDEV ID and LDEV name of the pool-VOL which includes the pool management area.
Pool Type	Displays the pool type. • For a Dynamic Provisioning pool, DP is displayed. • For a Dynamic Tiering pool, DT is displayed. • For a pool being used for active flash, DT(Active Flash) is displayed. • For a pool with the data direct mapping attribute enabled, DT (data direct mapping) is displayed. • For a Thin Image pool, TI is displayed.
RAID Level	Displays RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Drive Type/RPM	Displays the data drive type and RPM of the pool. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
Encryption	Encryption: The encryption information of the pool. • Enabled: Pool which is created by pool-VOLs whose encryption settings are enabled. • Disable: Pool which is created by pool-VOLs whose encryption settings are disabled. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: Data encryption is not ensured in a pool that has the Mixed encryption setting. To manage data encryption securely, use a pool with the encryption setting of Enabled or Disabled. • - (hyphen): Pool is created by external volumes, or pool is being blocked. This item is not displayed when using Virtual Storage Platform G200.
Cache Mode	For a configuration of external volumes, cache mode is displayed as enabled or disabled. For other configurations, a hyphen (-) is displayed.

Item	Description
Deduplication	The deduplication setting. • Available: The deduplication setting is enabled on the pool. • Not Available: The deduplication setting is disabled on the pool. • - (hyphen): The pool type is other than DP.
Protect V-VOLs when I/O fails to Blocked Pool VOL	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen is displayed if the pool corresponds with one of following: • Data Retention Utility is not installed. • The pool type is other than DP or DT.
Protect V-VOLs when I/O fails to Full Pool	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of following: • Data Retention Utility is not installed. • Pool type is other than DP or DT.
Number of Pool VOLs	Displays the number of pool-VOLs set for the pool, and the maximum number of pool-VOLs that can be set for the pool.
Number of V-VOLs	Displays the number of V-VOLs associated with the pool, and the maximum number of V-VOLs that can be associated with the pool. As for the pool with the data direct mapping attribute, a hyphen (-) appears for the maximum number of V-VOLs which can associate with the pool. For a Thin Image, a hyphen (-) is displayed.
Number of Root VOLs	Displays the number of root volumes of the Thin Image pairs. When the applicable volume does not exist, a hyphen (-) is displayed.
Pool Capacity (Used/Total)	Displays the sum of the mapped capacity and reserved capacity for the pool, and the total capacity of the pool. If the pool consists of multiple pool-VOLs, the sum of its capacities is displayed in the Total field.
Physical Pool Capacity (Used/Total)	Used capacity assured for writing data in the pool and the total capacity assured for writing data in the pool. If the accelerated compression is not supported, a hyphen(-) is displayed. As for a pool comprised of pool volumes assigned to accelerated compression-enabled parity groups, the writable capacity might be smaller than the displayed capacity.
Saving Effect	The data capacity saving rates provided by the capacity expansion function and the capacity saving function, which includes the compression and deduplication functions.
V-VOL Capacity (Used/Total)	Displays the sum of the mapped capacity and the reserved capacity for virtual volumes, and the total capacity of virtual

Item	Description
	volumes. For a Thin Image pool, a hyphen (-) is displayed along with the used and total V-VOL capacity.
Subscription (Current/Limit)	Displays the subscription (Rate of total V-VOL capacity associated with a pool to the pool capacity/Subscription that is set). For a Thin Image, a hyphen (-) is displayed for Current or Limit.
User-Defined Threshold (Warning/Depletion)	Displays the user-defined threshold (Warning/Depletion). For a Thin Image, a hyphen (-) is displayed for Depletion.
FMC Pool Volumes Capacity	Displays the saving rate and expansion rate of FMC pool volumes. • Saving: Displays the percentage of the capacity reduced by data compression with respect to the used capacity before the data compression. • Expansion Rate: Displays the percentage of the total capacity of FMC pool volumes with respect to the total capacity of FMC pool volumes assured for writing. If either the used pool capacity or the used physical pool capacity exceeds 50% of the depletion threshold (the warning threshold for the Thin Image pool), an icon of one of following statuses appears:  : In all accelerated compression-enabled parity groups, this status shows that the expansion rate and the saving ratio are balanced.  : In one or more accelerated compression-enabled parity groups, this status show that an excess of the unanticipated usage might occur. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417.  : In one or more accelerated compression-enabled parity groups, this status shows that the accelerated compression function is not performed in the effective utilization. However, if there is a parity group with a  status (see above) in the pool, then this icon does not appear. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417.
Tier Management	If Dynamic Tiering is enabled, Auto or Manual is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed. For a Thin Image, a hyphen (-) is displayed.
Cycle Time	Displays the cycle of performance monitoring and tier relocation. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Period	Displays the time of starting and ending of performance monitoring. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Mode	Displays the monitoring mode that is set for the pool. If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Status	Displays the status of pool monitoring.

Item	Description
	If the monitoring is being performed, In Progress is displayed. A hyphen (-) is displayed other than this case.
Recent Monitor Data	Displays the latest monitoring data. • If the monitoring data exists, the monitoring period of time is displayed. Example: 2010/11/15 00:00 - 2010/11/15 23:59 • If the monitoring data is being obtained, only the starting time is displayed. Example: 2010/11/15 00:00 - • If the latest monitoring data does not exist, a hyphen (-) is displayed.
Pool Management Task	Displays the pool management task being performed to the pool. • Waiting for Rebalance: The rebalance process is being waited. • Rebalancing: The rebalance process is being performed. • Waiting for Relocation: The tier relocation process is being waited. • Relocating: The tier relocation process is being performed. • Waiting for Shrink: The pool shrinking process is being waited. • Shrinking: The pool shrinking process is being performed. • Blank:The pool management task is not being performed to the pool. For details about the tier relocation, see the tier relocation log file.
Relocation Result	Displays the status of the tier relocation processing. In Progress: The status of Pool Management Task is Waiting for Relocation or Relocating. Completed: The tier relocation operation is not in progress, or the tier relocation is complete. Uncompleted (n% relocated): The tier relocation is suspended at the indicated percentage progression. - (hyphen): The pool is not a Dynamic Tiering pool.
Relocation Speed	Displays the tier relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest).

Pool Volumes tab

Only the LDEVs assigned to the logged-on user are available.

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Status	Displays the following information about the pool-VOL status. • Normal: Pool-VOL is in the normal status. • Shrinking: Pool-VOL is being reduced.

Item	Description
	• Blocked: Pool-VOL is blocked.
Parity Group ID	Displays the parity group ID.
Capacity	Displays the pool capacity. • Usable: The usable capacity in the pool-VOL that is offset on the basis of the page appears. For the pool-VOL with system area, the displayed capacity does not include the capacity of the management area. • Mapped: The mapped capacity in the pool-VOL that is offset on the basis of the page appears. For the pool of Dynamic Provisioning, Dynamic Tiering, active flash, and Thin Image, a hyphen (-) is displayed if the unit of capacity is changed to Cylinder.
RAID Level	Displays the RAID level.
Drive Type/RPM	Displays the data drive type and RPM. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
Tier ID	Displays the tier ID. For a Dynamic Provisioning, or a Thin Image pool, a hyphen (-) is displayed.
Provisioning Type	Displays the type of the LDEV. • Basic: Internal volume. • External: External volume.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • - (hyphen): LDEV for which the attribute is not defined.
Cache Mode	For the external volume, this item is displayed as enabled or disabled. If the LDEV is not an external volume, a hyphen (-) is displayed.
Shrinkable	Displays whether the pool-VOL can be removed while the pool is being shrunk, a hyphen (-) is displayed.

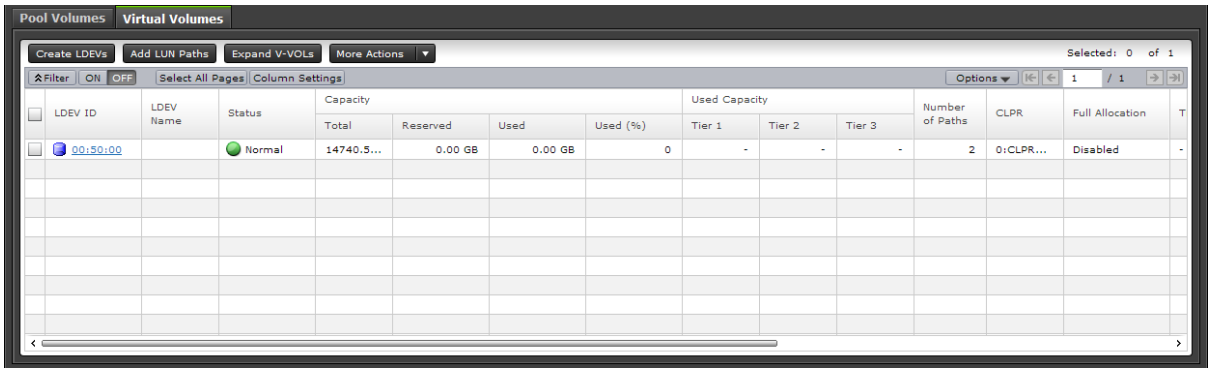
Encryption[1]	Displays the information about parity group encryption.
	• Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the pool-VOL which is enabled of the encryption setting.
	• Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the pool-VOL which is enabled of the encryption setting.
	• Mixed: This status is displayed when two or more of the following are specified as pool-VOLs:
	  ○ Volume encryption setting is enabled.
	  ○ Volume encryption setting is disabled.
	  ○ External volume

Item	Description
	Caution: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume. This item is not displayed when using Virtual Storage Platform G200.
Accelerated Compression[1]	Displays information about the accelerated compression of the parity group comprised of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. - (hyphen): The parity group with accelerated compression is not supported.
Expanded Space Used[1]	Displays the information that LDEV is allocated in the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated in the physical area, then LDEVs are allocated in the expanded area. This item displays whether the LDEV area is allocated in the expanded or physical area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.
Data Direct Mapped LDEV	Displays LDEV ID of pool-VOL in the pool with data direct mapping enabled. If the link of LDEV ID is clicked, the LDEV Properties window appears. A hyphen (-) appears if data direct mapping is disabled. If a DP-VOL with data direct mapping enabled is not created in the pool with data direct mapping enabled, this item is blank.
Resource Group Name (ID)	Displays the resource group names and IDs of the LDEV. The ID is provided in parentheses.
Physical Parity Group Capacity Expansion Rate (%)	For accelerated compression-enabled parity groups of which pool volumes are created, the capacity expansion rate appears. If either the used pool capacity or the used physical pool capacity exceeds 50% of the depletion threshold (the warning threshold for the Thin Image pool), an icon of one of the following statuses appears:  : In all accelerated compression-enabled parity groups, this status shows that the expansion rate and the saving ratio are balanced.  : In one or more accelerated compression-enabled parity groups, this status show that an excess of the unanticipated usage might occur. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417.  :

Item	Description
	In one or more accelerated compression-enabled parity groups, this status shows that the accelerated compression function is not performed in the effective utilization. However, if there is a parity group with a ⚠ status (see above) in the pool, then this icon does not appear. In this case, consider revising the total capacity of LDEVs (pool volumes) carved from these parity groups. For details, see Guidelines for pools when accelerated compression is enabled on page 417.
Expand Pool	Displays the **Expand Pool** window.
Shrink Pool	Displays the **Shrink Pool** window.
Stop Shrinking Pools	Displays the **Stop Shrinking Pools** window.
Edit External LDEV Tier Rank[2]	Displays the **Edit External LDEV Tier Rank** window. You cannot operate the pool other than the pool of Dynamic Provisioning, Dynamic Tiering, active flash, .
Edit External Volumes[2]	Displays the Edit External Volumes window. If the volume type of the specified pool-VOL is other than the external volume, you cannot operate this button. For details, see Hitachi Universal Volume Manager User Guide.
Export[2]	Displays the window for outputting table information.
Notes: **1.** This item does not appear in the window by default. To display this item, change the Column Settings of the table option. **2.** Appears when you click More Actions.	

Virtual Volumes tab

This tab is displayed unless you select a Thin Image pool.



Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Status	• Normal: Normal status. • Blocked: Host cannot access a blocked volume.

Item	Description
	• Warning: Problem occurs in the volume. • Formatting: Volume is being formatted. • Preparing Quick Format: Volume is being prepared for quick formatting. • Quick Formatting: Volume is being quick-formatted. • Correction Access: Access attribute is being corrected. • Copying: Data in the volume is being copied. • Read Only: Data cannot be written to a read-only volume. • Shredding: Volume is being shredded. • - (hyphen): Any status other than the above.
Capacity	Displays information about the V-VOL capacity. • Total: Displays the V-VOL capacity. • Reserved: Displays the reserved capacity of the V-VOL. The displayed value of Reserved might be larger than the displayed value of Total due to following reasons: ○ Reserved displays the reserved capacity that is rounded up on each page. ○ The mapped capacity of V-VOL for Dynamic Provisioning includes the capacity of control information (168 MB is required per 3,145,548 MB). • Used: Displays the sum of the mapped capacity and the reserved capacity. The displayed value of Used might be larger than the displayed value of Total due to following reasons: ○ Used displays the sum of the mapped capacity and the reserved capacity that is rounded up on each page. ○ The mapped capacity of DP-VOL includes the capacity of the control information (uses a maximum of 168 MB per 3,145,548 MB). ○ DP-VOL with data direct mapping enabled includes the control information (168 MB is used per 3,145,548 MB) and the capacity for one page. If used capacity is referenced during I/O or copy processing by software such as ShadowImage or Universal Replicator, the used capacity displayed might be different from the actual capacity even if the full allocation is enabled on the V-VOL. This is caused by a gap between the times that information is gathered about the mapped capacity and the reserved capacity.

Item	Description
	• Used(%): For the entire capacity of V-VOL, this item displays percentages of the sum of the mapped capacity and the reserved capacity.
Used Capacity	Displays information about the mapped capacity of a V-VOL. • Tier1: Displays the used capacity of tier 1. A hyphen (-) is displayed if the logical volume is a not a V-VOL of Dynamic Tieringor active flash. • Tier2: Displays the used capacity of tier 2. A hyphen (-) is displayed if tier 2 does not exist or if the logical volume is a not a V-VOL of Dynamic Tieringor active flash. • Tier3: Displays the used capacity of tier 3. A hyphen (-) is displayed if tier 3 does not exist or if the logical volume is a not a V-VOL of Dynamic Tiering or active flash. The reserved page capacity is not included in the used capacity for each tier of the V-VOL. Therefore, the Used value in the Capacity column might not correspond with the Used Capacity value.
Capacity Saving	The setting of the capacity saving function. • Compression: The compression function is set. • Deduplication and Compression: The deduplication and compression function is set. • Disabled: The capacity saving function is not set. • - (hyphen): The LDEV does not support the capacity saving function.
Capacity Saving Status	The status of the capacity saving function. • Enabling: The format operation for enabling the capacity saving function is being performed. • Rehydrating: The format operation for disabling the capacity saving function is being performed. • Deleting Volume: A DP-VOL with the capacity saving function enabled is being deleted. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured. • - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data[1]	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Number of Paths	Displays the number of alternate paths.
CLPR	Displays the CLPR ID.

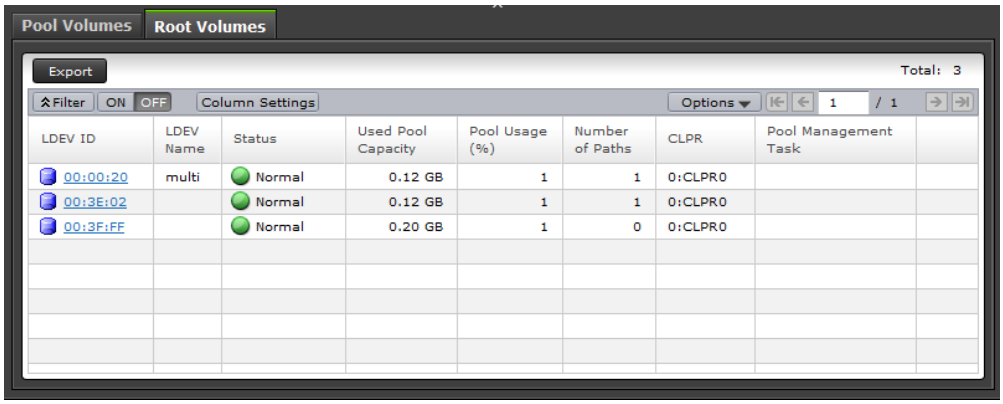
Item	Description
Full Allocation	Displays the status of the setting for the full allocation in a pool associated with the V-VOL. • Enable: Pages are reserved. • Disable: Pages are not reserved.
Tiering Policy	Displays the tiering policy name and ID. • All(0): The policy of which all tiers in the pool are used. • Level1(1) - Level5(5): One of the policy from Level1 to Level5 is set to V-VOL. • Level6(6) - Level31(31): The tiering policy of the user definition is set to V-VOL. From Level 6 (6) to Level 31 (31), the names of tiering policies can be changed. If these names have changed, the new names appear. • - (hyphen): V-VOL is not the Dynamic Tieringor active flash V-VOL.
New Page Assignment Tier	Displays the new page assignment tier. • High: High is set to V-VOL. • Middle: Middle is set to V-VOL. • Low: Low is set to V-VOL. • - (hyphen): V-VOL is not the Dynamic Tiering or active flash V-VOL.
Tier Relocation	Displays whether tier relocation is set to enabled or disabled. If the Dynamic Tieringor active flash V-VOL is not used, a hyphen (-) is displayed.
Relocation Priority	Displays the relocation priority. • Prioritized: The priority is set to V-VOL. • Blank: The priority is not set to V-VOL. • - (hyphen): V-VOL is not the Dynamic Tiering or active flash V-VOL or the tier relocation function is disabled.
Pool Management Task	Displays the pool management task being performed to the pool. • Waiting for Rebalance: The rebalance process is being waited. • Rebalancing: The rebalance process is being performed. • Waiting for Relocation: The tier relocation process is being waited. • Relocating: The tier relocation process is being performed. • Waiting for Shrink: The pool shrinking process is being waited. • Shrinking: The pool shrinking process is being performed. • Blank:The pool management task is not being performed to the pool.
V-VOL Management Task	Displays the V-VOL management task being performed to V-VOL. • Reclaiming Zero Pages: The zero page reclaiming processing is being performed. • Waiting for Zero Page Reclaiming: The zero page reclaiming processing is being waited. • Blank: The V-VOL management task is not being performed to V-VOL.
Attribute	Displays the attribute of the LDEV. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • - (hyphen): Volume in which the attribute is not defined.
Access Attribute[1]	Displays the access attribute of the LDEV.

Item	Description
T10 PI[1]	Displays the LDEV's T10 PI attribute information (Enabled or Disabled).
Data Direct Mapped LDEV[1]	Displays LDEV ID of pool-VOL in the pool with data direct mapping enabled. If the link of LDEV ID is clicked, the LDEV Properties window appears. A hyphen (-) appears if the data direct mapping attribute is disabled.
Resource Group Name (ID)	Displays the resource group names and IDs of the LDEV. The ID is provided in parentheses.
Virtual Storage Machine[1]	Information about the virtual storage machine. • Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank. • Attribute[1]: Virtual LDEV attribute. If the attribute is not set for the LDEV, this column is blank.
Create LDEVs	Displays the **Create LDEV** window.
Add LUN Paths	Displays the **Add LUN Paths** window.
Expand V-VOLs	Displays the **Expand V-VOLs** window.
Format LDEVs[2]	Displays the **Format LDEVs** window.
Delete LDEVs[2]	Displays the **Delete LDEVs** window.
Shred LDEVs[2]	Displays the **Shred LDEVs** window.
Delete LUN Paths[2]	Displays the **Delete LUN Paths** window.
Block LDEVs[2]	Displays the **Block LDEVs** window.
Restore LDEVs[2]	Displays the **Restore LDEVs** window.
Edit LDEVs[2]	Displays the **Edit LDEVs** window.
Reclaim Zero Pages[2]	Displays the **Reclaim Zero Pages** window.
Stop Reclaiming Zero Pages[2]	Displays the **Stop Reclaiming Zero Pages** window.
View Tier Properties[2]	Displays the **View Tier Properties** window. This window can open only for a pool for which Dynamic Tieringis enabled.
Edit Command Devices[2]	Opens the **Edit Command Devices** window.
Assign MP Unit[2]	Opens the **Assign MP Unit** window.
Delete UUIDs[2]	Opens the **Delete UUIDs** window.
Interrupt LDEV Task [2]	Select Shred to display the **Interrupt Shredding Task** window.
Force Delete Pairs[2]	• TC Pairs: Opens the Force Delete Pairs (TC Pairs) window. For details see the *Hitachi TrueCopy® User Guide* .

Item	Description
	• UR Pairs: Opens the Force Delete Pairs (UR Pairs) window. For details see the *Hitachi Universal Replicator User Guide* . • GAD Pairs: Opens the Force Delete Pairs (GAD Pairs) window. For details see the *Global-Active Device User Guide*.
Force Delete Pairs (TC Pairs)[3]	Opens the Force Delete Pairs (TC Pairs) window. For details see the *Hitachi TrueCopy® User Guide*.
Force Delete Pairs (UR Pairs)[3]	Opens the Force Delete Pairs (UR Pairs) window. For details see the *Hitachi Universal Replicator User Guide*.
Force Delete Pairs (GAD Pairs)[3]	Opens the Force Delete Pairs (GAD Pairs) window. For details see the *Global-Active Device User Guide*.
View ALUs / SLUs[3]	Displays the ALUs / SLUs window.
Export[3]	Displays the window for outputting table information.
Notes: **1.** Does not appear by default. To display this item, change the Column Settings of the table option. **2.** Available when you click More Actions. **3.** Available when you click More Actions > more.	

Root Volumes tab

If you select a Thin Image pool, this tab is displayed.



Item	Description
LDEV ID	Displays the combination of the LDKC, CU, and LDEV. Clicking LDEV ID opens the **LDEV Properties** window.
LDEV Name	Displays the LDEV name.
Status	• Normal: Normal status. • Blocked: Host cannot access a blocked volume. • Warning: Problem occurs in the volume.

Item	Description
	• Formatting: Volume is being formatted. • Preparing Quick Format: Volume is being prepared for quick formatting. • Quick Formatting: Volume is being quick-formatted. • Correction Access: Access attribute is being corrected. • Copying: Data in the volume is being copied. • Read Only: Data cannot be written to a read-only volume. • Shredding: Volume is being shredded. • - (hyphen): Any status other than the above.
Used Pool Capacity	Displays the used pool capacity.
Pool Usage(%)	Displays the pool usage level.
Number of Paths	Displays the number of alternate paths.
CLPR	Displays the CLPR. Displays in *ID*:*CLPR* form.
Pool Management Task	Displays the pool management task being performed to the pool. • Waiting for Rebalance: The rebalance process is being waited. • Rebalancing: The rebalance process is being performed. • Waiting for Relocation: The tier relocation process is being waited. • Relocating: The tier relocation process is being performed. • Waiting for Shrink: The pool shrinking process is being waited. • Shrinking: The pool shrinking process is being performed. • Blank:The pool management task is not being performed to the pool.
Encryption[1]	Displays the information about parity group encryption. • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the pool-VOL which is enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the pool-VOL which is enabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data

Item	Description
	encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume. This item is not displayed when using Virtual Storage Platform G200.
Virtual Storage Machine[1]	Information about the virtual storage machine. • Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.
Export	Displays the window for outputting table information.

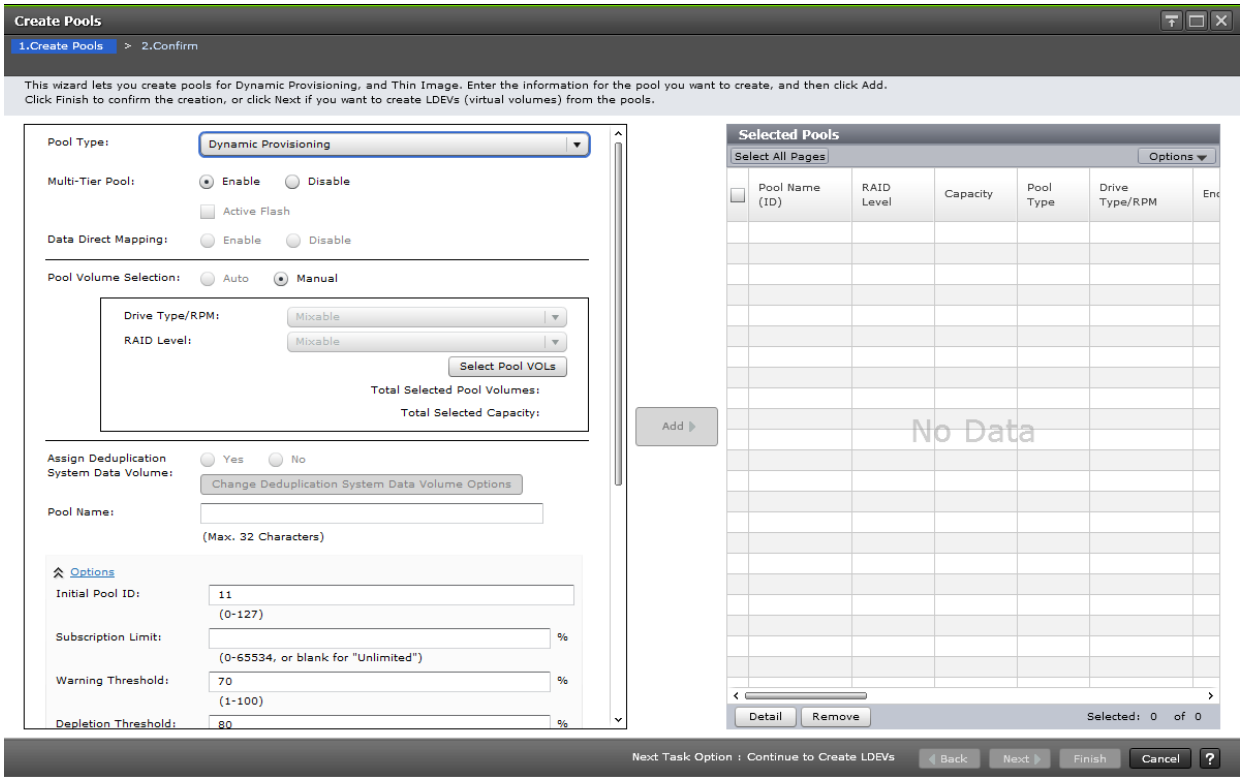
Notes:
1. Does not appear by default. To display this item, change the Column Settings of the table option.
2. Available when you click More Actions.

Create Pools wizard

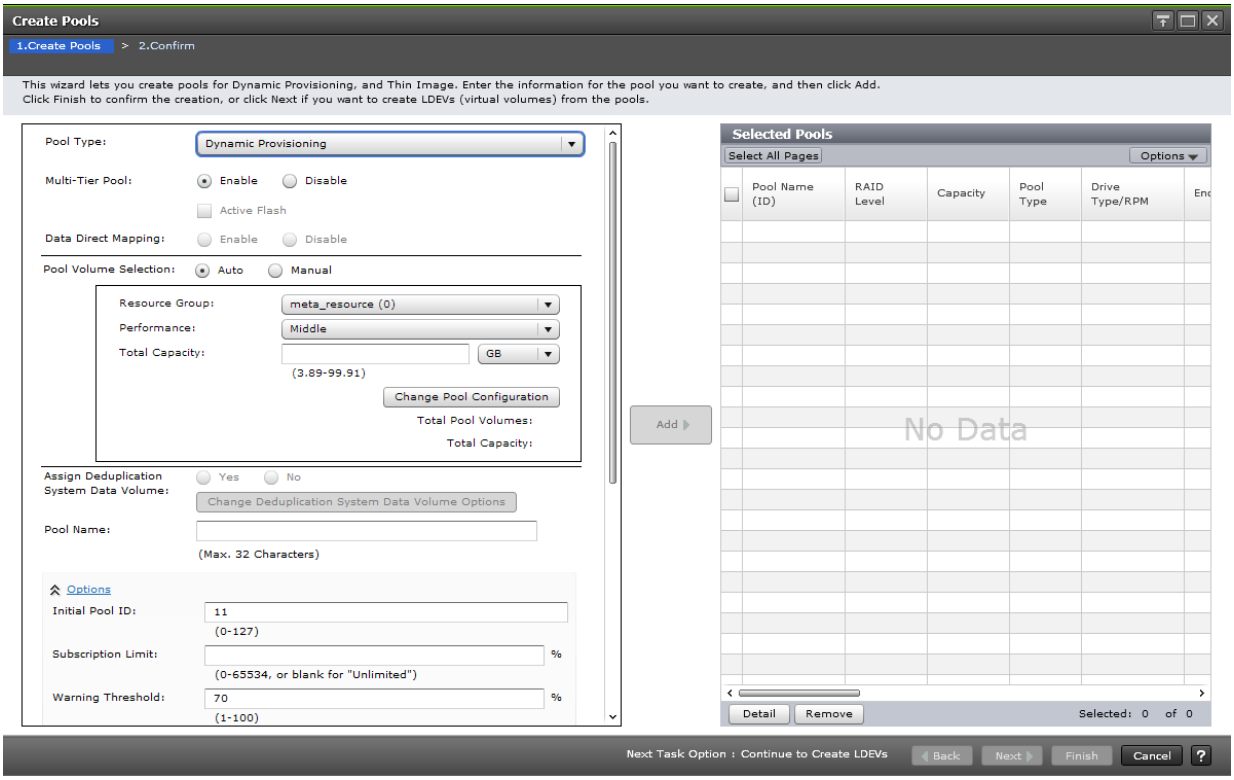
Create Pools window

Use this window to create new pools for Dynamic Provisioning and Thin Image.

When selecting pool-VOL manually



When selecting pool-VOL automatically



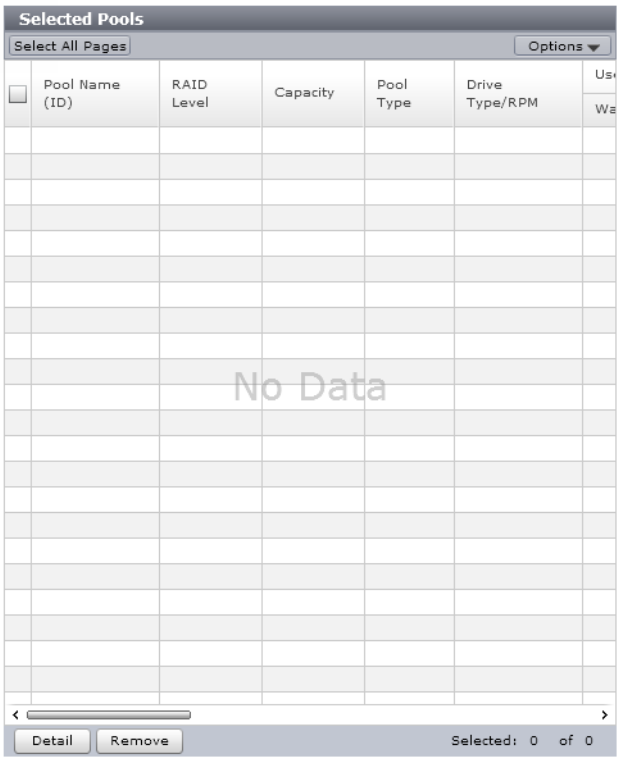
Item	Description
*Pool Type	Select the pool type. For Thin Image, select Thin Image. For the following software, select Dynamic Provisioning. • Dynamic Provisioning • Dynamic Tiering • active flash
*Multi-Tier Pool	If Dynamic Tiering is enabled, Auto or Manual for performance monitoring and tier relocation is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Active Flash	When the following conditions are satisfied, this check box can be selected: • Multi-Tier Pool is enabled. • Pool volumes whose drive type is SSD are installed. If this check box is selected, active flash can be used.
Data Direct Mapping	Select Enable or Disable for the data direct mapping attribute. This item can be selected if following are specified: • Pool Type: Dynamic Provisioning • Multi-Tier Pool: Disable
*Pool Volume Selection	Select the mode of the pool-VOL setting from Auto or Manual. If Enable is selected in Data Direct Mapping, Manual is selected automatically.
*Drive Type/RPM	Select the data drive type and RPM of the pool-VOL. When the volume is created by Dynamic Provisioning, Dynamic Tiering, or active flash, `Mixable` appears. When the volume is the external volume, Drive Type displays External Storage. This item is displayed when you select Manual as your Pool Volume Selection.
*RAID Level	Select the RAID level of the pool-VOL. This item is displayed when you select Manual as your Pool Volume Selection. `Mixable` appears in the case of Dynamic Provisioning, Dynamic Tiering, or active flash. A hyphen (-) appears when External Storage is selected in the Drive Type/RPM list.
*Select Pool VOLs	Opens the **Select Pool VOLs** window. Selecting a pool-VOL is mandatory. This item is displayed when you select Manual as your Pool Volume Selection.
Total Selected Pool Volumes	Displays the total number of the selected pool-VOLs. This item is displayed when you select Manual as your Pool Volume Selection.
Total Selected Capacity	Displays the total capacity of the selected pool-VOLs. This item is displayed when you select Manual as your Pool Volume Selection.
Resource Group	This item is displayed when you select Auto as your Pool Volume Selection. Select the resource group name of the pool.
Performance	This item is displayed when you select Auto as your Pool Volume Selection. Select the performance of the pool.
Total Capacity	This item is displayed when you select Auto as your Pool Volume Selection.

Item	Description
	Specify the total capacity of the pool.
Change Pool Configuration	This item is displayed when you select Auto as your Pool Volume Selection. Opens the **Change Pool Configuration Pattern** window. You can change the pool configuration that is automatically selected. For details, see Change Pool Configuration Pattern window on page 636.
Total Pool Volumes	This item is displayed when you select Auto as your Pool Volume Selection. Displays the total number of pool-VOLs.
Total Capacity	This item is displayed when you select Auto as your Pool Volume Selection. Displays the capacity of the pool created by the selected pool configuration.
Assign Deduplication System Data Volume (Open systems)	Select Yes or No to enable or disable the deduplication setting. Deduplication cannot be enabled if any of the following conditions exists: • The license for the capacity saving function is not installed. • The System Type is Mainframe. • Data Direct Mapping is enabled. • Multi-Tier Pool is enabled. • Pool volumes are not selected. • There are not enough available LDEV IDs. • There are not enough available cache management devices. Change Deduplication System Data Volume Options: Opens the Change Deduplication System Data Volume Options window.
*Pool Name	Set the pool name. You can enter up to 32 case-sensitive and alphanumeric characters.
Initial Pool ID	The smallest available number is entered in the text box as a default. No number appears in the text box if no available pool ID exists. If you specify the pool ID which is used already, the minimum pool ID after that the specified pool ID is automatically set.
Subscription Limit	Set the subscription limit of the pool from 0 to 65534 (%). If this is blank, the subscription is set to unlimited. When creating a Thin Image pool, this setting is not necessary.
Warning Threshold	Set the threshold between 1 and 100%. The default value is 70%. For Thin Image: Set the threshold between 20% and 95%. The default value is 80%. If Enable is selected in Data Direct Mapping, 100% is specified automatically.
Depletion Threshold	Set the threshold between 1% and 100%. The default value is 80%. When creating a Thin Image pool, this setting is not necessary. If Enable is selected in Data Direct Mapping, 100% is specified automatically.

Item	Description
Protect V-VOLs when I/O fails to Blocked Pool VOL	You can set this item if the following conditions are satisfied: • Dynamic Provisioning is selected in Pool Type. • Data Retention Utility is installed. Select Yes or No in the protect function for DP-VOL. If this function is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests, and, at the same time, the access attribute of the DP-VOL is changed to the Protect attribute.
Protect V-VOLs when I/O fails to Full Pool	You can set this item if the following conditions are satisfied: • Dynamic Provisioning is selected in Pool Type. • Data Retention Utility is installed. Select Yes or No in the protect function for DP-VOL. If this function is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests, and, at the same time, the access attribute of the DP-VOL is changed to the Protect attribute.
Tier Management	Select Auto or Manual of performance monitoring and tier relocation. • Cycle Time Select the cycle of performance monitoring and tier relocation. • Monitoring Period When 24 Hours is selected in the Cycle Time list, specify the time zone from 00:00 to 23:59 (default value), in which performance monitoring is to be performed. Take one or more hours between the starting time and the ending time. If you specify the starting time later than the ending time, the performance monitoring continues until the time when you specify as the ending time on the next day. This function can be set when the multi-tier pool is enabled.
Monitoring Mode	Specifies the monitoring mode, If you perform the tier relocation weighted to the past period monitoring result, select Continuous Mode. If you perform the tier relocation on the specified cycle, select Period Mode. You can specify this function when the multi-tier pool feature is enabled.
Relocation speed	Specifies the page relocation speed. You can set the speed to: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). The default is 3(Standard). If the speed specified is slower than 3(Standard), the data drive load is low when tier relocation is performed.
Buffer Space for New page assignment	You can set this function when the multi-tier pool feature is enabled. Tier 1: Enter an integer value from 0 to 50 as the percentage (%) to set for tier 1. A default value depends on the data drive type of pool-VOL in tier 1. The default value of SSD is 0%. The default value other than SSD is 8%. Tier 2: Enter an integer value from 0 to 50 as the percentage (%) to set for tier 2. A default value depends on the data drive type of pool-VOL in tier 2. Tier 3: Enter an integer value from 0 to 50 as the percentage (%) to set for tier 3. A default value depends on the data drive type of pool-VOL in tier 3.

Item	Description
Buffer Space for Tier relocation	You can set this function when the multi-tier pool feature is enabled. Tier 1: Enter an integer value from 2 to 40 as the percentage (%) to set for tier 1. A default value is 2%. Tier 2: Enter an integer value from 2 to 40 as the percentage (%) to set for tier 2. A default value is 2%. Tier 3: Enter an integer value from 2 to 40 as the percentage (%) to set for tier 3. A default value is 2%.
Add	When you click Add, the configured information is added to the right side of the Selected Pools table.
*Items with asterisks require configuration.	

Selected Pools table



Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays RAID level of the pool. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the total capacity of the created pool.

Item	Description
	For open systems, the displayed capacity is approximately 4.1 GB (capacity of the management area) less than the total capacity of the selected pool volumes. As for a pool comprised of pool volumes assigned to accelerated compression-enabled parity groups, the writable capacity might be smaller than the displayed capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM. If multiple drive types or RPMs exist in a pool, this field indicates Mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.

Encryption	Encryption: The encryption information of the pool.
	• Enabled: Pool which is created by pool-VOLs whose encryption settings are enabled.
	• Disable: Pool which is created by pool-VOLs whose encryption settings are disabled.
	• Mixed: This status is displayed when two or more of the following are specified as pool-VOLs:
	  ○ Volume encryption setting is enabled.
	  ○ Volume encryption setting is disabled.
	  ○ External volume
	
	Caution: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled.
	• Hyphen(-): Pool which is created by external volumes.

User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Subscription Limit (%)	Displays subscription limit of the pool. For Thin Image pool, a hyphen (-) is displayed.
Protect V-VOLs when I/O fails to Blocked Pool VOL	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of following: • Data Retention Utility is not installed.

Item	Description
	• Pool type is the type other than DP or DT.
Protect V-VOLs when I/O fails to Full Pool	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of following: • Data Retention Utility is not installed. • Pool type is the type other than DP or DT.
Number of Pool VOLs	Displays the number of pool-VOLs.
Tier Management	If Dynamic Tiering is enabled, Auto or Manual for performance monitoring and tier relocation is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Cycle Time	Displays the cycle of performance monitoring and tier relocation. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Period	Displays the time zone of performance monitoring when 24 Hours is selected as the Cycle Time. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Mode	If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed.
Relocation speed	Displays the page relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Buffer Space for New page assignment (%)	Displays the information of the buffer space for new page assignment to each tier. Tier 1: If you make the Dynamic Tiering function available, the buffer space for new page assignment to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for new page assignment to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed. Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for new page assignment to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Buffer Space for Tier relocation (%)	Displays the information of the buffer space for tier relocation to each tier. Tier 1: If you make the Dynamic Tiering function available, the buffer space for tier relocation to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for tier relocation to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed.

Item	Description
	Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for tier relocation to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Deduplication (Open systems)	If the pool type is DP, this item displays Available or Not Available for the deduplication setting. If the pool type is other than DP, a hyphen (-) is displayed.
Detail	Displays the **Pool Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.
Remove	Deletes the pool selected in the **Selected Pools** window. Displays the error window when a row is not selected.

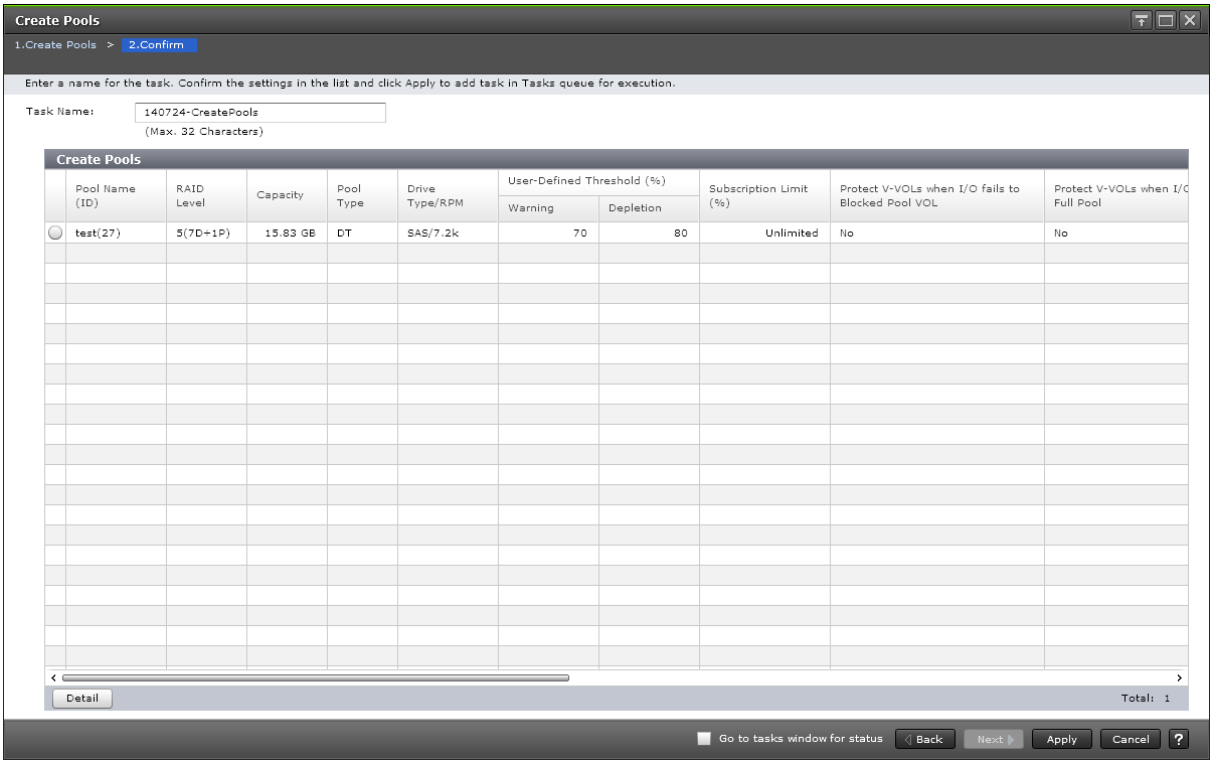
Next Task Option

Click Next to go to the task setting window.

Create Pools confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, and then click Help.



Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity. (Open systems) For a pool containing pool volumes assigned by accelerated compression-enabled parity groups, the writable capacity may be smaller than the displayed capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
Encryption	Encryption: The encryption information of the pool.

Item	Description
	• Enabled: Pool which is created by pool-VOLs whose encryption settings are enabled. • Disable: Pool which is created by pool-VOLs whose encryption settings are disabled. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • Hyphen(-): Pool is created by external volumes. This item is not displayed when using Virtual Storage Platform G200.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Subscription Limit (%)	Displays the subscription limit. For Thin Image pool, a hyphen (-) is displayed.
Protect V-VOLs when I/O fails to Blocked Pool VOL	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen is displayed if the pool corresponds with one of the following: • Data Retention Utility is not installed.
Protect V-VOLs when I/O fails to Full Pool	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. At the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen is displayed under these conditions: • Data Retention Utility is not installed.
Number of Pool VOLs	Displays the number of pool-VOLs.
Tier Management	If Dynamic Tiering is enabled, Auto or Manual for performance monitoring and tier relocation is displayed. If Dynamic Tieringis disabled, a hyphen (-) is displayed.
Cycle Time	Displays the cycle of performance monitoring and tier relocation. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Period	Displays the time zone of performance monitoring when 24 Hours is selected as the Cycle Time. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Mode	If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed.

Item	Description
Relocation speed	Displays the page relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). If Dynamic Tierings disabled, a hyphen (-) is displayed.
Buffer Space for New page assignment (%)	Displays the information of the buffer space for new page assignment to each tier. Tier 1: If you make the Dynamic Tiering function available, the buffer space for new page assignment to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for new page assignment to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed. Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for new page assignment to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Buffer Space for Tier relocation (%)	Displays the information of the buffer space for tier relocation to each tier. Tier 1: If you make the Dynamic Tiering function available, the buffer space for tier relocation to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for tier relocation to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed. Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for tier relocation to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Deduplication (Open systems)	If the pool type is DP, this item displays Available or Not Available for the deduplication setting. If the pool type is other than DP, a hyphen (-) is displayed.
Detail	Displays the **Pool Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.

Selected deduplication system data volumes

This table is displayed only when a deduplication system data volume is selected.

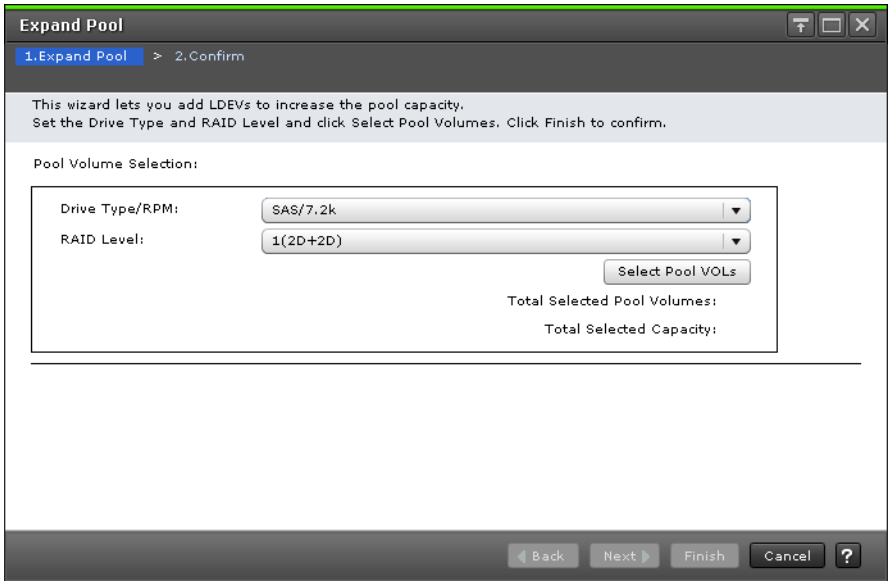
Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.

Item	Description
Pool Name (ID)	Displays the pool name, and the pool ID is displayed in parentheses.
Capacity	Displays the LDEV capacity.
Provisioning Type	Displays the type of the LDEV.
SSID	Displays the SSID of the LDEV.
Resource Group Name (ID)	Displays the resource group names, and the IDs of the resource groups are displayed in parentheses.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has LDEV.

Expand Pool wizard

Expand Pool window

Use this window to add LDEVs to a pool to expand the pool to increase pool capacity.

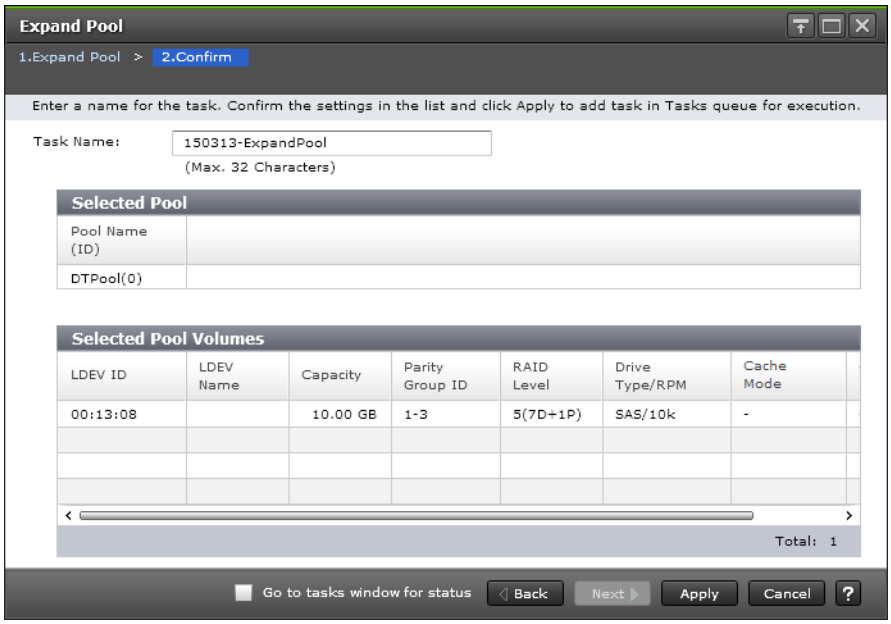


Item	Description
Drive Type/RPM	The Drive Type/RPM of the selected pool or Mixable is displayed. When the volume is the external volume, Drive Type displays External Storage.
RAID Level	Set the RAID level of the selected pool. If the level is not set, Mixable appears. If External Storage is selected in the Drive Type/RPM field, a hyphen (-) is displayed.
Select Pool VOLs	Opens the **Select Pool VOLs** window.
Total Selected Pool Volumes	Total number of the pool-VOLs selected for this pool.

Item	Description
Total Selected Capacity	Total capacity of the pool-VOLs selected for this pool.

Expand Pool confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Pool table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.

Selected Pool Volumes table

Item	Description
LDEV ID	Displays LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Capacity	Displays the pool-VOL capacity.
Parity Group ID	Displays the parity group ID.
RAID Level	Displays RAID level. If a pool-VOL is an external volume, a hyphen (-) is displayed.
Drive Type/RPM	Displays the data drive type and RPM. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.

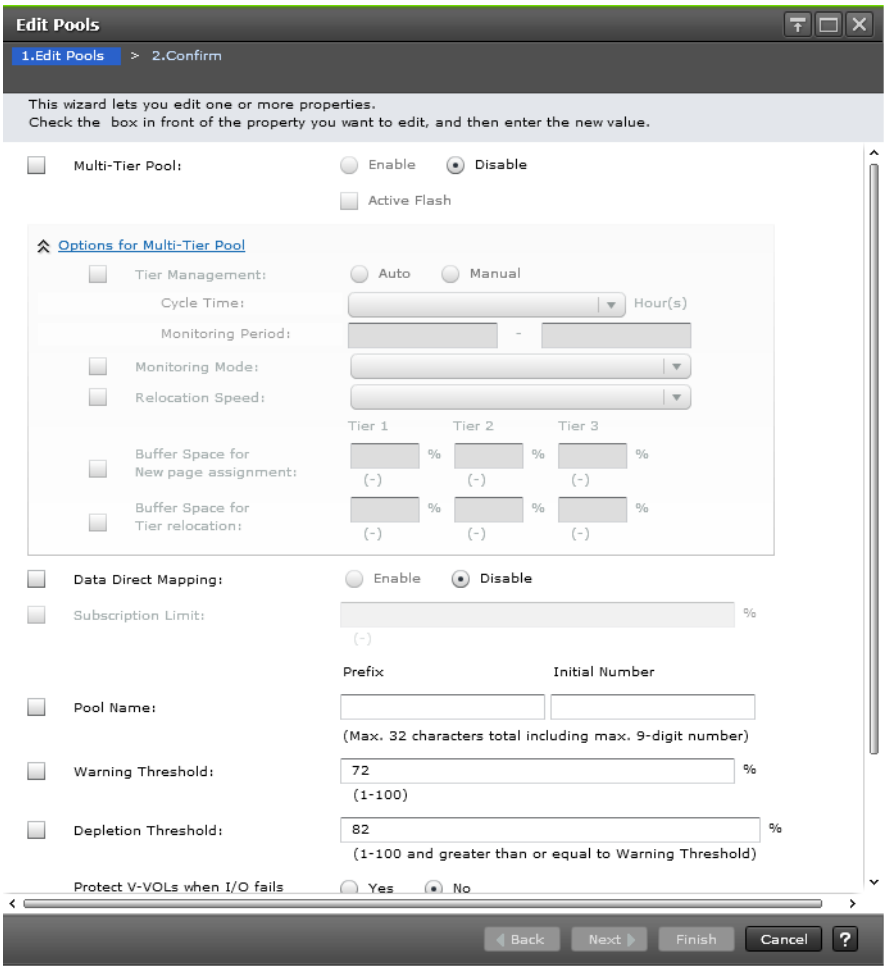
Item	Description
Cache Mode	For an external volume, this item is displayed as enabled or disabled. If the LDEV is not an external volume, a hyphen (-) is displayed.
Attribute	Attribute of the volume indicating how the LDEV is being used. • Data Direct Mapping: LDEV with the data direct mapping attribute. • Deduplication System Data Volume: LDEV used to manage data deduplication. • - (hyphen): Volume for which the attribute is not defined.
Accelerated Compression	Displays information about the accelerated compression of the parity group that is created of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. - (hyphen): The parity group with the accelerated compression is not supported.

Edit Pools wizard

Edit Pools window

Caution:

- In one pool, if you need to perform two or more operations to edit several items, wait until the first task has been applied before performing the next task. If the next task is performed while the first task is being applied, the first task is canceled and the next task is applied to the storage system.
- If you modified pool parameters by using Command Control Interface and then use Device Manager - Storage Navigator, click File > Refresh All to display the latest pool information before performing the next operation by using Device Manager - Storage Navigator. If you use Device Manager - Storage Navigator without refreshing the windows, the information updated by Command Control Interface might not yet be displayed on the Device Manager - Storage Navigator windows, so if you perform an operation the result might be different from what you expect.



Item	Description
Multi-Tier Pool	Select the check box, then Enable or Disable when using or not using Dynamic Tiering. In Thin Image, you cannot change the setting of this function.
Active Flash	Select the check box if you are using active flash. If pool volumes whose drive type is SSD are installed, this check box can be selected. In Thin Image, you cannot change the setting of this function.
Options for Multi-Tier Pool	Specifies the performance monitoring, tier relocation, edit buffer space for new page assignment, and buffer space for tier relocation if Multi-Tier Pool is set to Enable. In Thin Image, you cannot change the setting of this function. Select the Tier Management check box, and then set the tier management, the cycle time, and the monitoring period. • Tier Management: Select Auto or Manual. • Cycle Time: When selecting Auto in the Tier Management option, select the cycle of performance monitoring and tier relocation from the Cycle Time list.

Item	Description
	• Monitoring Period: When selecting 24 Hours in the Cycle Time list, specify the time of starting and ending of performance monitoring in 00:00 to 23:59 (default value). Take one or more hours between the starting time and the ending time. If you specify the starting time later than the ending time, the performance monitoring continues until the time when you specify as the ending time on the next day. Select the Monitoring Mode check box, and then set the monitoring mode. Monitoring Mode: Specify the monitoring mode. If you perform the tier relocation weighted to the past period monitoring result, select Continuous Mode. If you perform the tier relocation on the specified cycle, select Period Mode. Select the Relocation Speed check box. Then set the tier relocation speed. Relocation Speed: Specify the page relocation speed when tier relocation is performed. You can set the speed to: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). Select the Buffer Space for New page assignment check box, and then set the buffer space for new page assignment. Buffer Space for New page assignment: Enter an integer value from 0 to 50 as the percentage (%) to set for tier 1, tier 2, and tier 3. If there is no tier, you cannot set this item. Select the Buffer Space for Tier relocation check box, and then set the buffer space for tier relocation. Buffer Space for Tier relocation: Enter an integer value from 2 to 40 as the percentage (%) to set for tier 1, tier 2, and tier 3. If the check box is not selected, you cannot set this item. You must set all items if you change the pool setting from Dynamic Provisioning to Dynamic Tieringor active flash. If the check box is selected, you cannot collapse the Options for Multi-Tier Pool field.
Data Direct Mapping	Select the check box, then select Enable or Disable for the data direct mapping attribute. This item can be enabled if the pool type is Dynamic Provisioning and the multi tier function is disabled. However, depending on the selected pool, the Enable or Disable cannot be selected. See following: • Case both of Enable and Disable are inactive if one of following is satisfied: ○ Multi-Tier Pool is set to Enable. ○ Thin Image pool is selected. ○ Dynamic Provisioning for Mainframe pool is selected. ○ Dynamic Tiering for Mainframe pool is selected. • Case of Enable is inactive: In the selected pool, DP-VOL which is not related to LDEV of the data direct mapping, is created. • Case of Disable is inactive: In the selected pool, LDEV of the data direct mapping exists.

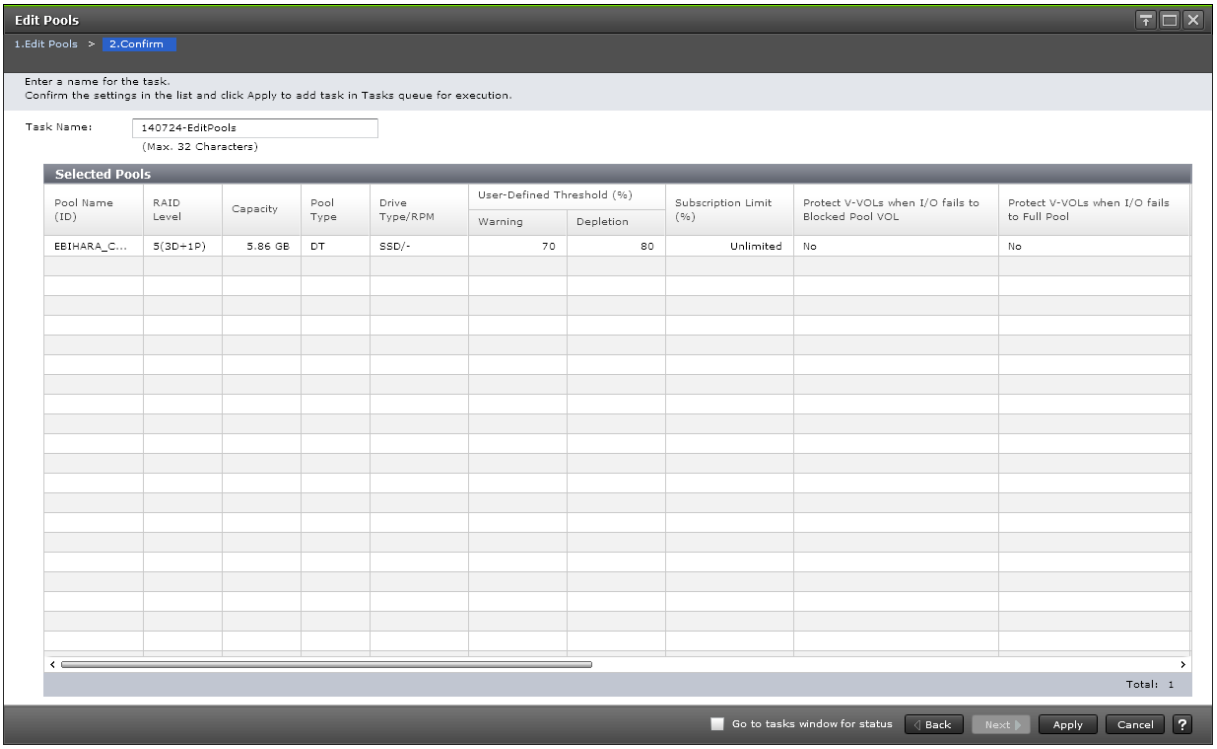
Item	Description
Subscription Limit	Select the Subscription Limit check box, and then enter the subscription limit (%). In Thin Image, you cannot change the setting of this function. • If this field is blank, the subscription is set to be unlimited. • Use blank or a value in the following range: (Total V-VOL capacity including the control information / pool capacity) * 100(%) +1 to 65534(%) • When the current subscription setting is unlimited and the value calculated by the following formula exceeds 65534, you cannot configure the subscription limit. ((Total V-VOL capacity including the control information / pool capacity) * 100) • If the check box is not selected, the subscription limit is disabled.
Pool Name	Select the Pool Name check box, and then enter the pool name. • Prefix: Enter the alphanumeric characters, which are fixed characters of the head of the pool name. The characters are case-sensitive. • Initial Number: Enter the initial number following the prefix name, which can be entered up to 9 digits.* • You can enter up to the 32 characters including the initial number. The initial number must be 9 or less digits. *When a pool is selected, the pool name appears in the Prefix text box by default. When multiple pools are selected, the initial number from the set number to the maximum number of the digit number is automatically set. Example: • When 1 is set in the Initial Number field, number 1 to 9 is automatically given to the pool name. • When 08 is set in the Initial Number field, number 08 to 99 is automatically given to the pool name. • When 098 is set in the Initial Number field, number 098 to 999 is automatically given to the pool name.
Warning Threshold	Select the check box, and then enter a threshold. The minimum threshold is the sum of the mapped capacity rates, reserved capacity rates, and one percent (1%). The maximum threshold is 100%. For Thin Image, you cannot change the setting of this function: Check Warning Threshold and enter a threshold. You cannot set this item if the result of the following calculation exceeds 95: (*used-pool-capacity*/*pool-capacity*) * 100 (%)
Depletion Threshold	Select the check box, and then enter a threshold. The minimum threshold is the sum of the mapped capacity rates, reserved capacity rates, and one percent (1%). The maximum threshold is 100%. If you change the Thin Image pool, you cannot set this item.
Protect V-VOLs when I/O fails to Blocked Pool VOL	Select the check box, and then select Yes or No in the protect function for DP-VOL. If this function is enabled, when the pool-VOL

Item	Description
	is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. However, if Data Retention Utility is not installed, this check box goes inactive.
Protect V-VOLs when I/O fails to Full Pool	Select the check box, and then select Yes or No in the protect function for DP-VOL. If this function is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. However, if Data Retention Utility is not installed, this check box goes inactive.
Assign Deduplication System Data Volume (Open systems)	Select Yes or No to enable or disable the deduplication setting. Deduplication cannot be enabled if any of the following conditions exists: • The license for the capacity saving function is not installed. • The System Type is Mainframe. • Data Direct Mapping is enabled. • Multi-Tier Pool is enabled. • There are not enough available LDEV IDs. • There are not enough available cache management devices. Deduplication cannot be disabled if the setting for Deduplication is being disabled.

Caution: If you want to change multiple parameters for a pool two or more times, wait until the current task finishes, and then change the next settings. If you attempt to change settings before the current task finishes, only the settings in the next task will be applied, so the result might be different from what you expected.

Edit Pools confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPMs. If multiple drive types or RPMs exist in a pool, this field indicates Mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Subscription Limit (%)	Displays the subscription limit.

Item	Description
	For Thin Image pool, a hyphen (-) is displayed.
Protect V-VOLs when I/O fails to Blocked Pool VOL	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool-VOL is blocked, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of the following: • Data Retention Utility is not installed. • Pool type is other than DP or DT.
Protect V-VOLs when I/O fails to Full Pool	Displays whether the protect function for DP-VOL is being enabled or disabled. If the setting is enabled, when the pool usage reaches the full size, DP-VOL is protected from reading and writing requests. And at the same instant, the access attribute of the DP-VOL is changed to the Protect attribute. A hyphen appears if the pool corresponds with one of the following: • Data Retention Utility is not installed. • Pool type is other than DP or DT.
Number of Pool VOLs	Displays the number of pool-VOLs.
Tier Management	If Dynamic Tiering is enabled, Auto or Manual for performance monitoring and tier relocation is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Cycle Time	Displays the cycle of performance monitoring and tier relocation. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Period	Displays the time zone of performance monitoring when 24 Hours is selected as the Cycle Time. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Mode	If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed.
Relocation speed	Displays the page relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Buffer Space for New page assignment (%)	Displays the information of the buffer space for new page assignment to each tier. Tier 1: If you make the Dynamic Tiering function available, the buffer space for new page assignment to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for new page assignment to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed. Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for new page assignment to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Buffer Space for Tier relocation (%)	Displays the information of the buffer space for tier relocation to each tier.

Item	Description
	Tier 1: If you make the Dynamic Tiering function available, the buffer space for tier relocation to tier 1 is displayed. If you make the Dynamic Tiering function unavailable, a hyphen (-) is displayed. Tier 2: If you make the Dynamic Tiering function available, and tier 2 exists, the buffer space for tier relocation to tier 2 is displayed. If you make the Dynamic Tiering function unavailable, or tier 2 does not exist, a hyphen (-) is displayed. Tier 3: If you make the Dynamic Tiering function available, and tier 3 exists, the buffer space for tier relocation to tier 3 is displayed. If you make the Dynamic Tiering function unavailable, or tier 3 does not exist, a hyphen (-) is displayed.
Deduplication	If the pool type is DP, this item displays Available or Not Available for the deduplication setting. If the pool type other than DP, a hyphen (-) is displayed.

Added Deduplication System Data Volumes

This table is displayed only when Deduplication System Data volumes are being added.

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name, and the pool ID is displayed in parentheses.
Capacity	Displays the LDEV capacity.
Provisioning Type	Displays the type of the LDEV.
SSID	Displays the SSID of the LDEV.
Resource Group Name (ID)	Displays the resource group names, and the IDs of the resource groups are displayed in parentheses.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has LDEV.

Removed Deduplication System Data Volumes

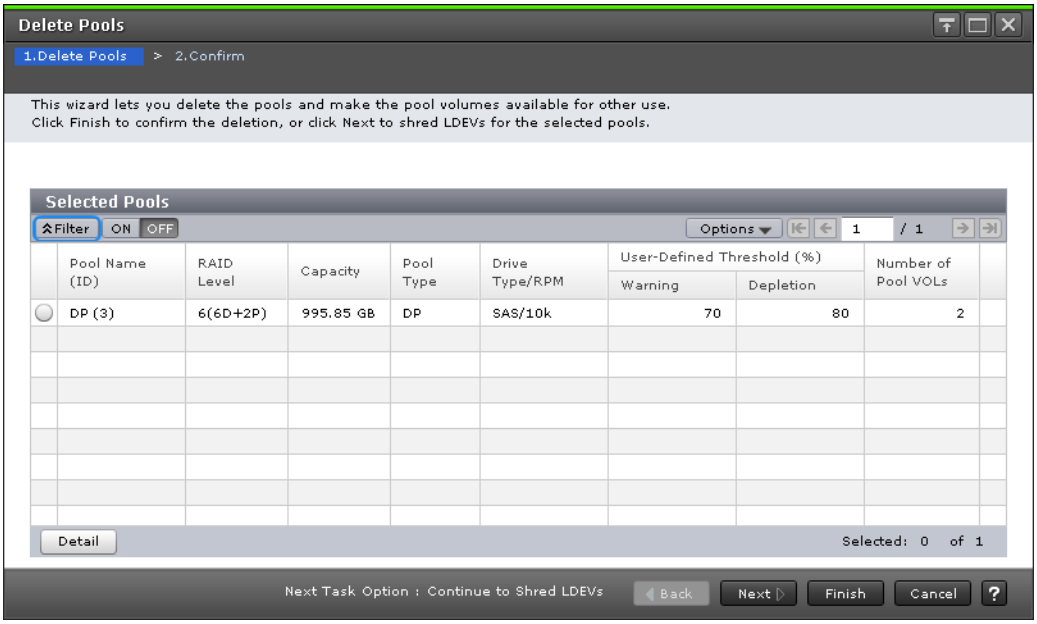
This table is displayed only when Deduplication System Data volumes are being removed.

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.

Item	Description
Pool Name (ID)	Displays the pool name, and the pool ID is displayed in parentheses.
Capacity	Displays the LDEV capacity.
Provisioning Type	Displays the type of the LDEV.
SSID	Displays the SSID of the LDEV.
Resource Group Name (ID)	Displays the resource group names, and the IDs of the resource groups are displayed in parentheses.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has LDEV.

Delete Pools wizard

Delete Pools window



Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed.

Item	Description
	For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM of the pool. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Number of Pool VOLs	Displays the number of pool-VOLs.
Detail	Displays the **Pool Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.

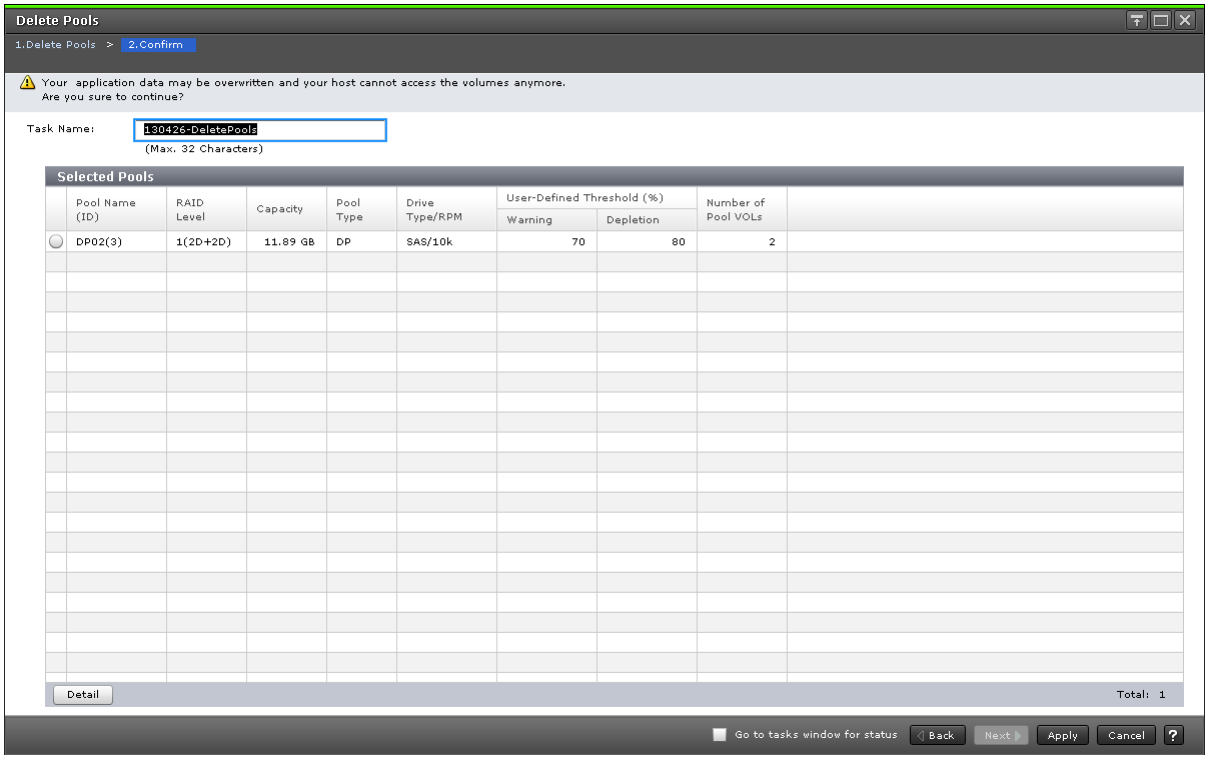
Next Task Option

Click Next to go to the task setting window.

Delete Pools confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, and then click **Help**.



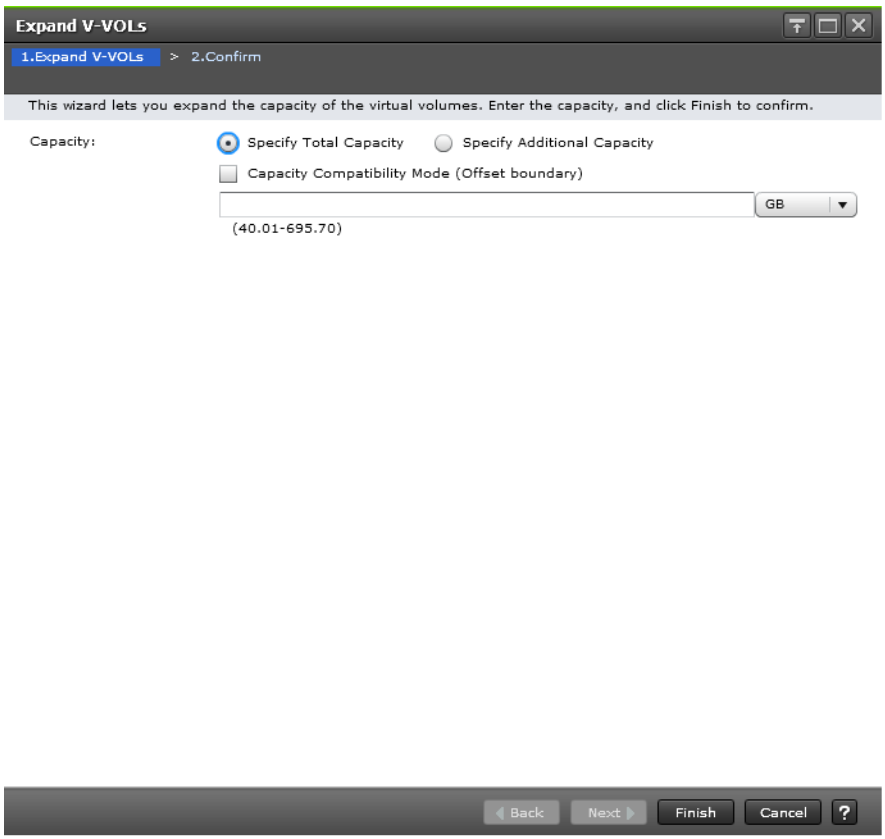
Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed.

Item	Description
	For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Number of Pool VOLs	Displays the number of pool-VOLs.
Detail	Displays the **Pool Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.

Expand V-VOLs wizard

Expand V-VOLs window

Use this wizard to expand the V-VOLs to the defined final capacity of the virtual volumes.

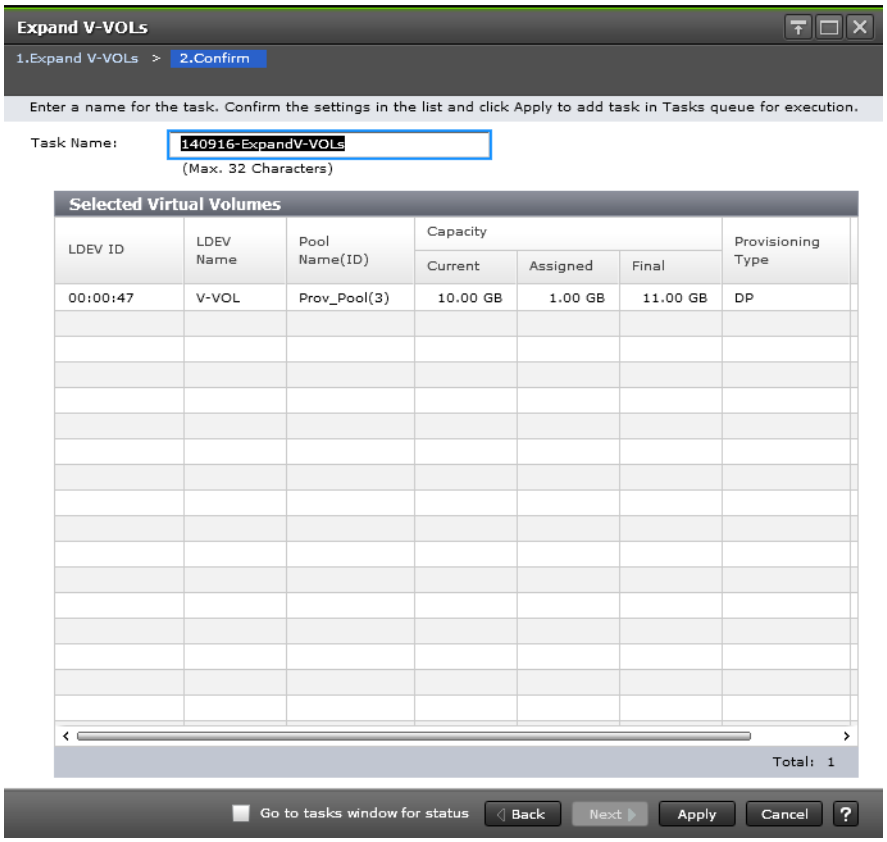


Item	Description
Specify total capacity	Select this check box when you specify the total capacity of V-VOL.
Specify additional capacity	Select this check box when you specify the additional capacity of V-VOL.
Capacity Compatibility Mode (Offset boundary)	Select this check box if you want to offset the specified LDEV capacity by boundary.

Item	Description
Text Box	Specify the V-VOL (LDEV) capacity within the range of values indicated below the text box.

Expand V-VOLs confirmation window

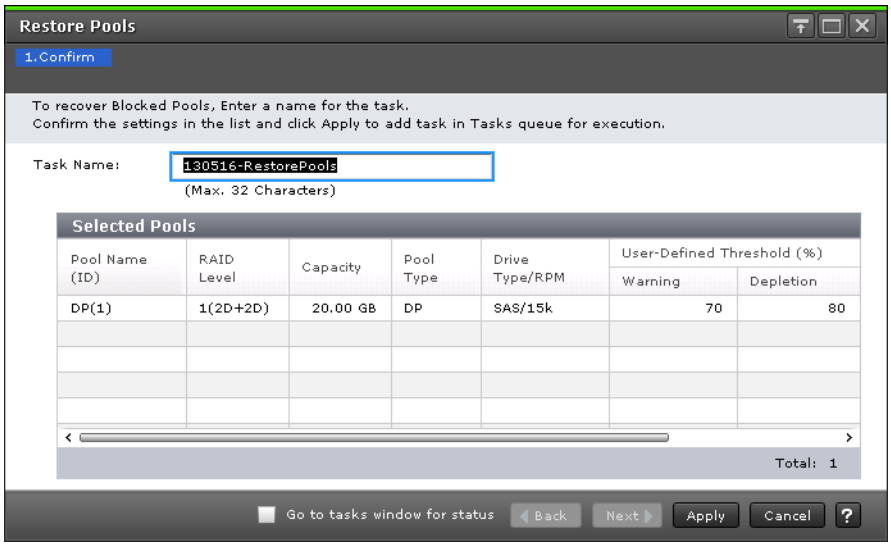
Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name and pool ID.
Capacity	Displays the capacity of the LDEV. • Current: Displays the capacity before expanding the volume. • Assigned: Displays the capacity that is derived by the current value subtracted from the final value. The value might not be exact because the size is displayed with two decimal places. • Final: Displays the capacity after expanding the volume.
Provisioning Type	Displays the LDEV type. In this case, DP is displayed.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device of CCI.

Item	Description
	• (Open systems) Deduplication System Data: Deduplication system data volume • - (hyphen): Volume in which the attribute is not defined.
Full Allocation	Displays the status of the setting for the full allocation in a pool associated with the V-VOL. • Enable: Full allocation of all DP-VOL pages is performed. • Disable: Full allocation of all DP-VOL pages is not performed.

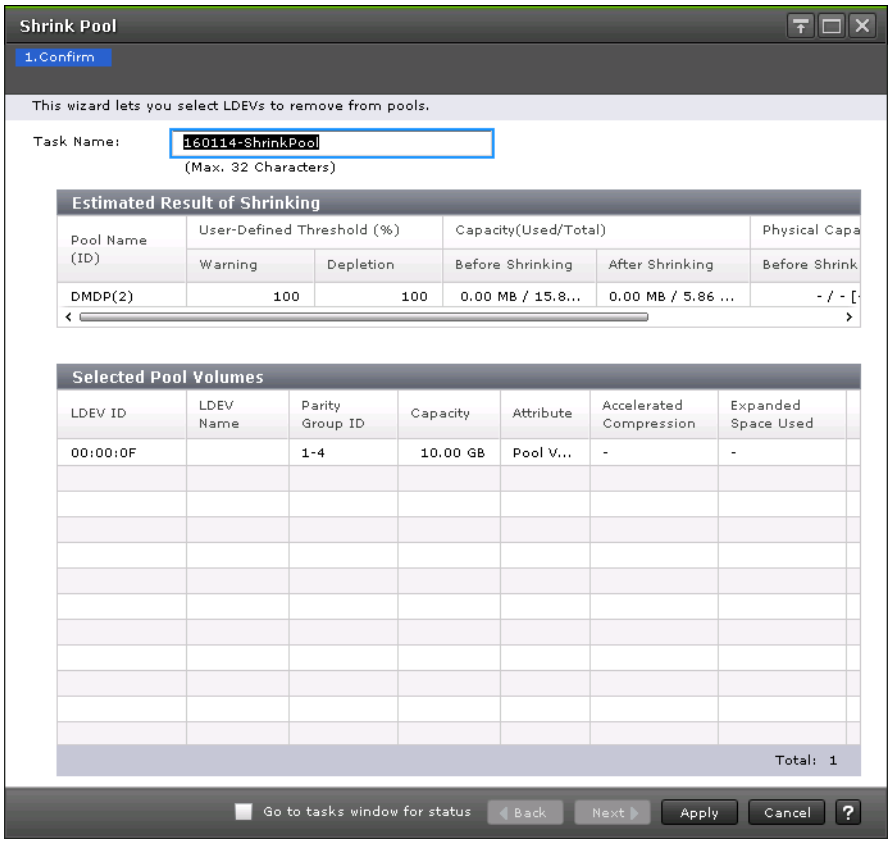
Restore Pools window



Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity. If the pool is blocked and pool-VOLs that belong to the pool cannot be identified, 0 is displayed.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.

Item	Description
Drive Type/RPM	Displays the data drive type and RPM. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Number of Pool VOLs	Displays the number of pool-VOLs. If the pool is blocked and pool-VOLs that belong to the pool cannot be identified, 0 is displayed.

Shrink Pool window



Estimated Result of Shrinking table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.

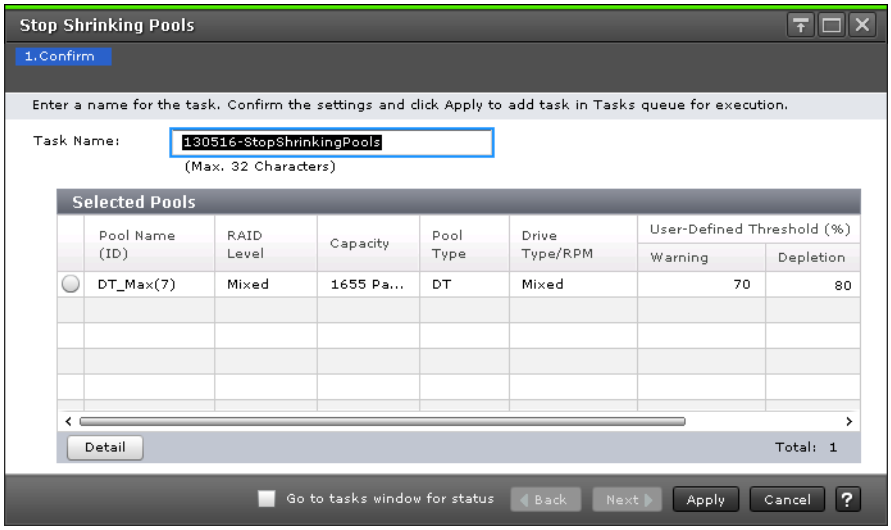
Item	Description
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Capacity(Used/Total)	Displays the capacity before and after shrinking. As for the pool comprised of pool volumes assigned by the accelerated compression-enabled parity groups, the writable capacity may be smaller than the displayed capacity. • Before Shrinking: Displays the sum of the mapped capacity and the reserved page capacity, the total capacity before shrinking the pool, and the pool usage rates. • After Shrinking: Displays the sum of the mapped capacity and the reserved page capacity, the total capacity after shrinking the pool, and the pool usage rates.
Physical Capacity (Used/Total)	Displays the capacity before and after shrinking. • Before Shrinking: For the pool of containing the pool-VOL which supports the accelerated compression, this item displays the total capacity, the used capacity, and the usage percentages. The capacity is the capacity reserved for writing data in the pool. If the accelerated compression is not supported, a hyphen (-) appears. • After Shrinking: For the pool comprised of pool volumes supporting accelerated compression, this item displays the total capacity, the used capacity, and the usage percentages. The capacity is the capacity reserved for writing data in the pool. If the accelerated compression is not supported, a hyphen (-) appears.

Selected Pool Volumes table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Parity Group ID	Displays the parity group ID.
Capacity	Displays the pool-VOL capacity.
Attribute	Attribute of the volume indicating how the LDEV is being used. Pool VOL: LDEV with pool-VOL Data Direct Mapping: LDEV with data direct mapping attribute. Hyphen (-): Volume in which the attribute is not defined.
Accelerated Compression	Displays the information about the accelerated compression of the parity group comprised of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled.

Item	Description
	Hyphen (-): The parity group with accelerated compression is not supported.
Expanded Space Used	Displays the information that LDEV is allocated on the expanded area or the physical area. If the accelerated compression is enabled, LDEVs are initially allocated on the physical area, then LDEVs are allocated on the expanded area. This item displays whether the area of which LDEV is allocated is the expanded area or the physical area. Yes: LDEV is allocated in the expanded area. No: LDEV is allocated in the physical area.

Stop Shrinking Pools window

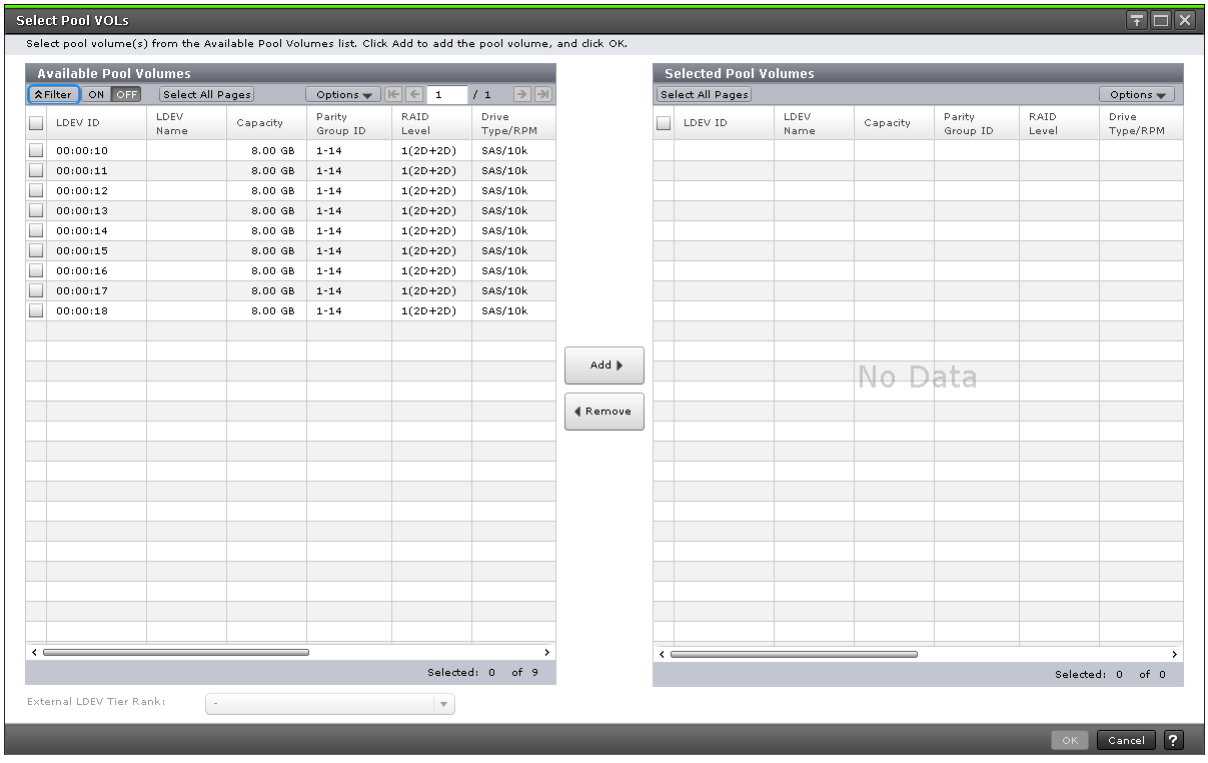


Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Capacity	Displays the pool capacity.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed.

Item	Description
	For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Drive Type/RPM	Displays the data drive type and RPM. If multiple drive types or RPMs exist in a pool, this field indicates that drive types or RPMs are mixed. When the volume is the external volume, Drive Type displays External Storage and the value of the external LDEV tier rank.
User-Defined Threshold (%)	Displays the pool threshold. • Warning: Warning threshold is displayed. • Depletion: Depletion threshold is displayed. For a Thin Image pool, a hyphen (-) is displayed for Depletion.
Number of Pool VOLs	Displays the number of pool-VOLs.
Detail	Displays the **Pool Properties** window when a row is selected, and shows the error window when a row is not selected or multiple rows are selected.

Select Pool VOLs window

Use this window to add pool-VOLs to a pool. Only the LDEVs assigned to the logged-on user are available.



Available Pool Volumes table

Only the LDEVs assigned to the user are displayed.

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Capacity	Displays the pool-VOL capacity.
Parity Group ID	Displays the parity group ID.
RAID Level	Displays the RAID level. If an LDEV is an external volume, a hyphen (-) is displayed.
Drive Type/RPM	Displays the data drive type and RPM. When the volume is the external volume, Drive Type displays External Storage.
Provisioning Type	Displays the type of the LDEV. Basic: Internal volume. External: External volume.
Attribute	Attribute of the volume indicating how the LDEV is being used. Data Direct Mapping: LDEV of the data direct mapping attribute. - (hyphen): Volume in which the attribute is not defined.
Cache Mode	For the external volume, the item is displayed as enabled or disabled. If the LDEV is not an external volume, a hyphen (-) is displayed.
Encryption	Displays the information about parity group encryption. • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the pool-VOL which is enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the pool-VOL which is enabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume. This item is not displayed when using Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group comprised of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled.

Item	Description
	- (hyphen): The parity group with accelerated compression is not supported.
Resource Group Name (ID)	Displays the resource group names and IDs of the LDEV. The ID is provided in parentheses.

External LDEV Tier Rank

Specify the tier rank of the external volume. If there is no external volume in the Available Pool Volumes table or Selected Pool Volumes table, you cannot select this option.

Add

When you select a row in the Available Pool Volumes table and click Add, the selected pool-VOL is added to the Selected Pool Volumes table.

Note: Up to 1,024 volumes can be added including the volumes already in the pool. When adding a volume to the pool for which Multi-Tier Pool is enabled, note the following:

For a pool, you can add volumes whose Drive Type/RPM settings are the same and whose RAID Levels are different. For example, you can add the following volumes to the same pool:

- Volume whose Drive Type/RPM is SAS/15K and whose RAID Level is 5 (3D +1P)
- Volume whose Drive Type/RPM is SAS/15K and whose RAID Level is 5 (7D +1P)

Note: For details about adding LDEVs carved from the accelerated compression-enabled parity groups, Guidelines for pools when accelerated compression is enabled on page 417.

Remove

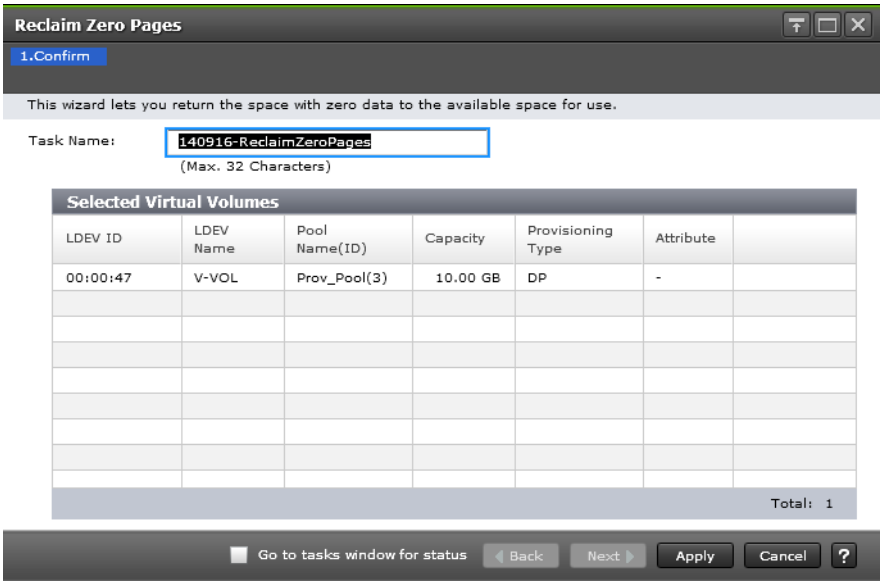
When you select a row in Selected Pool Volumes table and click Remove, the selected pool-VOL is removed from the Selected Pool Volumes table.

Selected Pool Volumes table

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Capacity	Displays the pool-VOL capacity.
Parity Group ID	Displays the parity group ID.

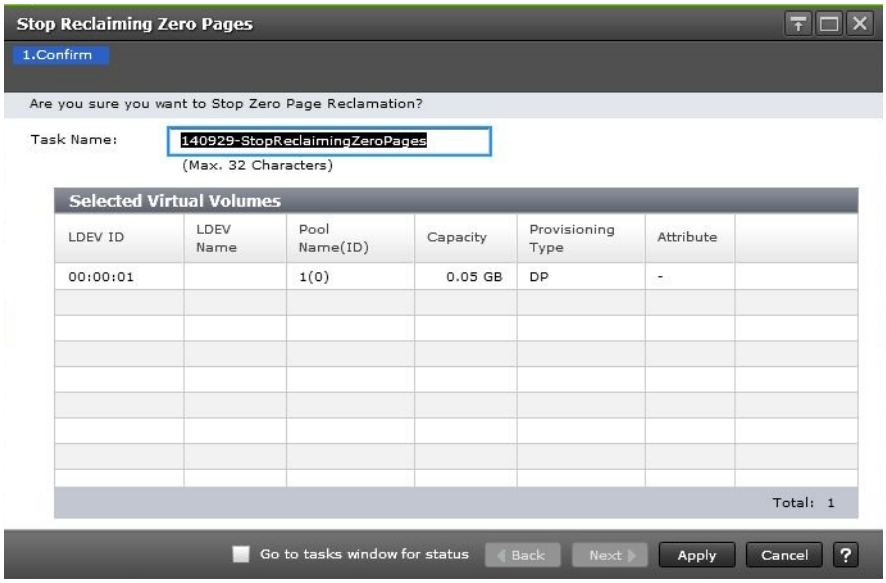
Item	Description
RAID Level	Displays the RAID level. If an LDEV is an external volume, a hyphen (-) is displayed.
Drive Type/RPM	Displays the data drive type and RPM. When the volume is the external volume, Drive Type displays External Storage.
External LDEV Tier Rank	Displays the tier rank of the external volume. If the volume is not an external volume, a hyphen(-) is displayed.
Provisioning Type	Displays the type of the LDEV. Basic: Internal volume. External: External volume.
Attribute	Attribute of the volume indicating how the LDEV is being used. Data Direct Mapping: LDEV of the data direct mapping attribute. - (hyphen): Volume in which the attribute is not defined.
Cache Mode	For the external volume, this item is displayed as enabled or disabled. If the LDEV is not an external volume, a hyphen (-) is displayed.
Encryption	Displays the information about parity group encryption. • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the pool-VOL which is enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the pool-VOL which is enabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume. This item is not displayed when using Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group comprised of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. - (hyphen): The parity group with accelerated compression is not supported.
Resource Group Name (ID)	Displays the resource group names and IDs of the LDEV. The ID is provided in parentheses.

Reclaim Zero Pages window



Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name and pool ID.
Capacity	Displays the capacity.
Provisioning Type	Displays the LDEV type. In this case, DP is displayed.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device of CCI. • Deduplication System Data: Deduplication System Data volume • - (hyphen): Volume in which the attribute is not defined.

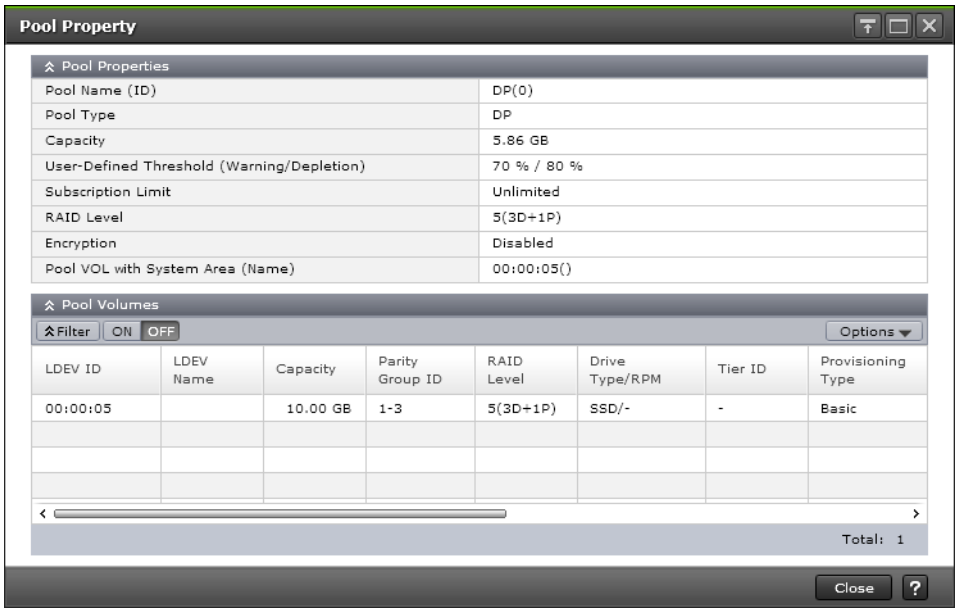
Stop Reclaiming Zero Pages window



Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name and pool ID.
Capacity	Displays the capacity.
Provisioning Type	Displays the LDEV type. In this case, DP is displayed.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device of CCI. • Deduplication System Data: Deduplication System Data volume • - (hyphen): Volume in which the attribute is not defined.

Pool Property window

Use this window to view and change pool properties. Only the LDEVs assigned to the logged-on user are available.



Pool Properties table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed. For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Capacity	Displays the pool capacity. As for the pool comprised of pool volumes assigned by the accelerated compression-enabled parity groups, the writable capacity may be smaller than the displayed capacity.
User-Defined Threshold (Warning/Depletion)	Displays the user-defined threshold (Warning/Depletion).
Subscription Limit	Displays the subscription limit. For a Thin Image pool, a hyphen (-) is displayed for Current or Limit.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, this field indicates that RAID levels are mixed. If all pool-VOLs are external volumes, a hyphen (-) is displayed.
Encryption	Displays the encryption information of the pool: • Enable: Pool comprised of pool volumes with encryption settings are enabled.

Item	Description
	• Disable: Pool comprised of pool volumes with encryption settings are disabled. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): The pool is created by external volumes, or the pool is being blocked. This item is not displayed when using Virtual Storage Platform G200.
Pool VOL with System Area (Name)	Displays LDEV ID and LDEV name of the pool-VOL which includes the system area. If you open this window from the Selected Pools table in the **Create Pool** window, a hyphen(-) is displayed.

Pool Volumes table

Only the LDEVs assigned to the user are displayed.

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Capacity	Displays the pool volumes capacity. If you open this window from the Selected Pools table in the **Create Pool** window, the LDEV capacity selected in the **Select Pool VOLs** window is displayed.
Parity Group ID	Displays the parity group ID.
RAID Level	Displays the RAID level. If a pool-VOL is an external volume, a hyphen (-) is displayed.
Drive Type/RPM	Displays the tier ID. A hyphen (-) is displayed when selecting the pool for Dynamic Provisioning, or Thin Image.
Tier ID	Displays the tier ID. A hyphen (-) is displayed when you select a Dynamic Provisioning or Thin Image pool.
Provisioning Type	Displays the type of the LDEV. Basic: Internal volume. External: External volume.
Attribute	Attribute of the volume indicating how the LDEV is being used. Pool VOL: LDEV of the pool-VOL Data Direct Mapping: LDEV with the data direct mapping attribute enabled. - (hyphen): Volume in which the attribute is not defined.

Item	Description
Cache Mode	For the external volume, this item is displayed as enabled or disabled. If the LDEV is not an external volume, a hyphen (-) is displayed.
Encryption	Displays the information about parity group encryption: • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the pool-VOL which is enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the pool-VOL which is enabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume. This item is not displayed when using Virtual Storage Platform G200.
Accelerated Compression	Displays information about the accelerated compression of the parity group comprised of LDEVs. Enabled: The accelerated compression of the parity group is enabled. Disabled: The accelerated compression of the parity group is disabled. - (hyphen): The parity group with accelerated compression is not supported.
Resource Group Name (ID)	Displays the resource group names and IDs of the LDEV. The ID is provided in parentheses.

Deduplication System Data Volumes

This table is displayed only when Deduplication System Data volumes are set.

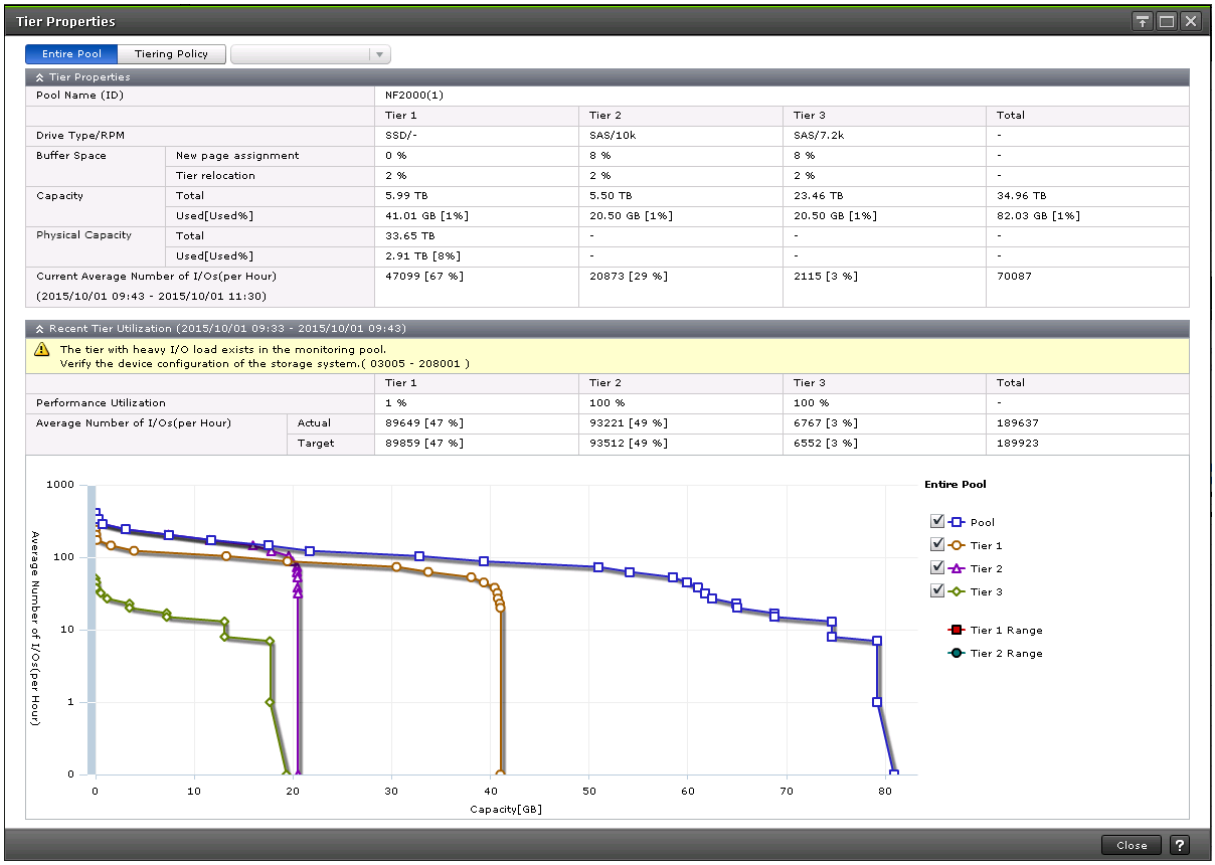
Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name, and the pool ID is displayed in parentheses.
Capacity	Displays the LDEV capacity.
Provisioning Type	Displays the type of the LDEV.
SSID	Displays the SSID of the LDEV.

Item	Description
Resource Group Name (ID)	Displays the resource group names, and the IDs of the resource groups are displayed in parentheses.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has LDEV.

Tier Properties window

This window displays tier properties and a performance graph.

When the pool name (pool ID) appears in the graph banner, you are looking a pool information. When the LDEV name (LDEV ID) appears in the graph banner, you are looking at V-VOL information.



For pools

The following tables list the Tier Properties information.

When selecting Entire Pool or Tiering Policy

Item	Description
Entire Pool or Tiering Policy	Select the following resource to display the performance graph. • Entire Pool: Displays the performance graph of the entire pool. • Tiering Policy: Displays the performance graph of the tiering policy.
All(0), and from Level1(1) to Level31(31)	Select the Tiering Policy. The performance graph that corresponds to the selected tiering policy appears. From Level 6 (6) to Level 31 (31), the names of tiering policies can be changed. If these names have changed, the new names appear.

Tier Properties table

Item	Description
Pool Name (ID)	Displays the pool name and ID.
Tier name	Displays the tier names: Tier1, Tier2, Tier3, and Total. Each column displays information about the tier.
Drive Type/RPM	Displays the data drive type and RPM of tier. If multiple types exist in a tier, Mixed is displayed. For an external volume, Drive Type displays External Storage with the value of the external LDEV tier rank.
Buffer Space	Displays the following buffer spaces. • New page assignment: Buffer spaces for new page assignment. • Tier relocation: Buffer spaces for tier relocation.
Capacity	Displays the capacity of the pool and each tier. • Total: displays the total capacity of each tier and a pool. As for the pool comprised of pool volumes assigned by the accelerated compression-enabled parity groups, the writable capacity may be smaller than the displayed capacity. • Used [Used%]: Displays the percentage of the used capacity for the pool and each tier. The field is updated asynchronously with the Recent Tier Utilization table and when the View Tier Properties window is opened. The Used Capacity of each tier can differ from the sum of the used capacities of all tiers. Tiering Policy: tiering policy name: Displays the used capacity size and percentage related to the tiering-policy of the pool and each tier. This item displays when you make a Tiering Policy selection. • Used (Pre Processed Data): Displays the data capacity before the reduction provided by the capacity saving function.
Physical Capacity	This item appears when Entire Pool is selected. In the tier 1 of containing the pool-VOL supporting accelerated compression, the capacity which is assured of the writing of data appears. Hyphens are displayed in Tier 2 column, Tier 3 column, and Total column. • Total: Displays the total capacity of tier 1. • Used [Used%]: Displays the used capacity and percentage of the tier 1.

Item	Description
Total Capacity	Displays the total capacity of each tier and total capacity of the pool.
Used Capacity (Used %)	Displays the percentage of the used capacity for the pool and each tier. The field is updated asynchronously with the Recent Tier Utilization table and when the **View Tier Properties** window is opened. The Used Capacity of each tier can differ from the sum of the used capacities of all tiers.
Tiering Policy: tiering policy name	Displays the used capacity size and percentage related to the tiering-policy of the pool and each tier. This item displays when you make a Tiering Policy selection.
Current Average Number of I/O(per Hour)	Displays the actual monitored average I/Os and percentages of each tier and entire pool for the period from the creating of the pool to the current state. This item appears when selecting of Entire Pool. In addition, the number of I/Os is initialized in cases of following, and then I/Os are counted again: • When monitoring information collection is completed. • When the number of tiers in a pool changes. • When a tier location of the pool VOL changes by adding a pool VOL. • When multi tier pools are enabled after being invalid. • When the fixed monitoring information is calculated again. For details about cases that the fixed monitoring information is calculated again, see Tier relocation rules, restrictions, and guidelines on page 171.

Recent Tier Utilization (monitoring period) table

Item	Description
Header area	If an error occurs, a message appears.
Tier name	Displays the tier names: Tier1, Tier2, Tier3, and Total. Each column displays information about the tier.
Performance Utilization	Displays the percentage of progress in performance utilization processing.
Average Number of I/Os (per Hour)	Displays the average number of I/Os in a pool and each tier. Actual: Displays the actual monitored average I/Os and percentages for each tier and a pool on an hourly basis.* This item appears when selecting the Entire Pool option. Target: Displays the target average I/Os and percentages for each tier and a pool after the tier determination calculation.* This item appears when selecting the Entire Pool option. Tiering Policy: tiering policy name: Displays the average number of I/Os for the pool and each tier that are related to the tiering-policy. This item displays when you make a Tiering Policy selection.*
* This field is updated when performance monitoring information is collected, asynchronously with Used Capacity (Used %). If ? is displayed, take the actions displayed in the header area of the Recent Tier Utilization table. If an error message and countermeasure are not shown in the header	

Item	Description
area of the Recent Tier Utilization table, refresh the window. If ? continues to be displayed, call customer support.	

Performance Graph

Item	Description
Performance graph	Displays the performance graph of the entire pool or tiering policy.
Pool	If Entire Pool and the period mode of the monitoring mode are specified, this item appears. When this check box is selected, the performance graph appears. The vertical scale of the performance graph indicates the average number of I/Os on an hourly basis. The horizontal scale of the performance graph indicates the capacity. If there is no monitor data, this item does not appear.
Pool(Weighted average)	If Entire Pool and the continuous mode of the monitoring mode are specified, this item appears. When this check box is selected, the performance graph appears. The vertical scale indicates the average number of I/Os on an hourly basis. The number of I/Os is a weighted, averaged with the monitoring data from the past cycle weighted against the monitoring data from the current cycle. The horizontal scale indicates the capacity. If there is no monitor data, this item does not appear.
Policy	If Tiering Policy and the period mode of the monitoring mode are specified, this item appears. When the check box is selected, the performance graph appears. The vertical scale of the performance graph indicates the average number of I/Os on an hourly basis. The horizontal scale of the performance graph indicates the capacity. If there is no monitor data, this item does not appear.
Policy(Weighted average)	If Tiering Policy and the continuous mode of the monitoring mode are specified, this item appears. When the check box is selected, the performance graph appears. The vertical scale of the performance graph indicates the average number of I/Os on an hourly basis. The horizontal scale of the performance graph indicates the capacity. If there is no monitor data, this item does not appear.
Tier1	Displays the performance graph of tier1. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity. If there is no monitor data in tier1, this item does not appear.
Tier2	Displays the performance graph of tier2. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity. If there is no monitor data in tier2, this item does not appear.
Tier3	Displays the performance graph of tier3. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity.

Item	Description
	If there is no monitor data in tier3, this item does not appear.
Tier1 range	Displays the range in tier1. If there is no monitor data in tier1, this item does not appear.
Tier2 range	Displays the range in tier2. If there is no monitor data in tier2, this item does not appear.

The following describes how to read the performance graph when it contains pool information.

The vertical scale of the graph indicates an average number of I/Os by each hour and the horizontal scale indicates capacity (GB) of the area where the I/Os are performed.

The two lines in the graph indicate tier 1 range and tier 2 range. They are calculated when the collection of performance monitoring has been completed (monitoring period is completed). They show the boundary of each tier.

A maximum of 127 dots is shown in the graph. The following information appears over a dot in the graph depending on where the cursor is placed.

- Capacities, average I/Os, and total I/Os appear if the cursor is placed on the dot of the Tier1, Tier2, Tier3, Pool, or the Pool(Weighted average).
- The lower value of the average I/Os appears if the cursor is placed on the dot of the Tier1 Range or the Tier2 Range.

The following table describes these items.

Item	Description
Capacities	The capacity (GB) of the area from the dot of the maximum value on the vertical scale to a specified dot. The capacity of the dot on the vertical scale is 0.00 GB.
Average I/Os	All I/Os are sorted into 127 sections. The average I/O is the representative I/O number assigned to each section, based on the definition of the storage system. By the total number of I/Os, the number of dots may be 127 or less.
Total I/Os	The total number of I/Os in the section from the dot of the maximum value on the vertical scale to a specified dot. The total I/Os is calculated using the average I/Os and capacities in the specified section. If the specified dot is on the vertical scale, the total I/Os is zero.

When no I/Os are in the lower tier with multiple tiers, the tier range line is placed at 0 on the vertical scale.

For example, if the dot is placed far from the lower limit of the tier range, the lower limit levels of the Tier 1 Range and Tier 2 Range are adjusted to improve the visibility of the performance graph. In this case, the value that is

obtained by Command Control Interface might not correspond with the value of the dot displayed in a performance graph.

For V-VOLs

The following table provides the View Tier Properties table information when LDEV information is present.

Tier Properties table when selecting a DP-VOL

Item	Description
LDEV ID	Displays the combination of the LDKC, CU, and LDEV.
LDEV name	Displays the LDEV name.
Tiering Policy	Displays the tiering policy name and ID.
New Page Assignment Tier	Displays the new page assigned tier.
Tier Relocation	Displays whether tier relocation is set to Enabled or Disabled.
Relocation Priority	Displays the relocation priority.
Tier name	Displays the tier names: Tier1, Tier2, Tier3, and Total. Each column displays information about the tier.
Drive Type/RPM	Displays the data drive type and RPM of tier. If multiple types exist in a tier, Mixed is displayed. For an external volume, Drive Type displays External Storage with the value of the external LDEV tier rank.
Pool Capacity	Displays the total capacity of each tier and total capacity of the pool.
Used Capacity (Used %)	Displays the percentage of the used capacity for the pool and each tier. The field is updated asynchronously with the Recent Tier Utilization table and when the **View Tier Properties** window is opened. The Used Capacity of each tier might differ from the sum of the used capacities of all tiers.
Current Average Number of I/O(per Hour)	Displays the actual monitored average I/Os and percentages of each tier and entire pool for the period from the creating of the DP-VOL to the current state. In addition, the number of I/Os is initialized in cases of following, and then I/Os are counted again: • When monitoring information collection is completed. • When the number of tiers in a pool changes. • When a tier location of the pool VOL changes by adding a pool VOL. • When multi tier pools are enabled after being invalid. • When the fixed monitoring information is calculated again. For details about cases that the fixed monitoring information is calculated again, see Tier relocation rules, restrictions, and guidelines on page 171.

Recent Tier Utilization (monitoring period) table

Item	Description
Header area	If a error occurs, a message appears.

Item	Description
Tier name	Displays the tier names: Tier1, Tier2, Tier3, and Total. Each column displays information about the tier.
Average Number of I/O (per Hour)	• Displays the actual monitored average I/Os and percentages of each tier and a DP-VOL on an hourly basis.* • Target: Displays the target average I/Os and percentages of each tier and a DP-VOL after the tier determination calculation.
* This field is updated when performance monitoring information is collected, asynchronously with Used Capacity (Used %). If ? is displayed, take the actions displayed in the header area of the Recent Tier Utilization table. If an error message and countermeasure are not shown in the header area of the Recent Tier Utilization table, refresh the window. If ? continues to display, call the customer support.	

Performance Graph

Item	Description
Performance graph	Displays the performance graph of the entire pool or tiering policy.
Volume	If the period mode of the monitoring mode is specified, this item appears. When this check box is selected, the performance graph appears. The vertical scale of the performance graph indicates the average number of I/Os on an hourly basis. The horizontal scale of the performance graph indicates the capacity. If there is no monitor data, this item does not appear.
Volume(Weighted average)	If the continuous mode of the monitoring mode is specified, this item appears. When this check box is selected, the performance graph appears. The vertical scale indicates the average number of I/Os on an hourly basis. The number of I/Os is a weighted, averaged with the monitoring data from the past cycle weighted against the monitoring data from the current cycle. The horizontal scale indicates the capacity. If there is no monitor data, this item does not appear.
Tier1	Displays the performance graph of tier1. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity. If there is no monitor data in tier1, this item does not appear.
Tier2	Displays the performance graph of tier2. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity. If there is no monitor data in tier2, this item does not appear.
Tier3	Displays the performance graph of tier3. The vertical scale indicates the average number of I/Os on an hourly basis. The horizontal scale indicates the capacity. If there is no monitor data in tier3, this item does not appear.
Tier1 range	Displays the range in tier1. If there is no monitor data in tier1, this item does not appear.
Tier2 range	Displays the range in tier2.

Item	Description
	If there is no monitor data in tier2, this item does not appear.

The following describes how to read the performance graph when LDEV information is presented.

The vertical scale of the graph indicates an average number of I/Os by each hour and the horizontal scale indicates a capacity, in GB, of the area where the I/Os are performed.

The two lines in the graph indicate tier 1 range and tier 2 range. These ranges are calculated when the collection of performance monitoring data is complete (monitoring period is completed). They show the boundary of each tier.

A maximum of 127 dots is shown in the graph. The following information appears over a dot in the graph depending on where the cursor is placed.

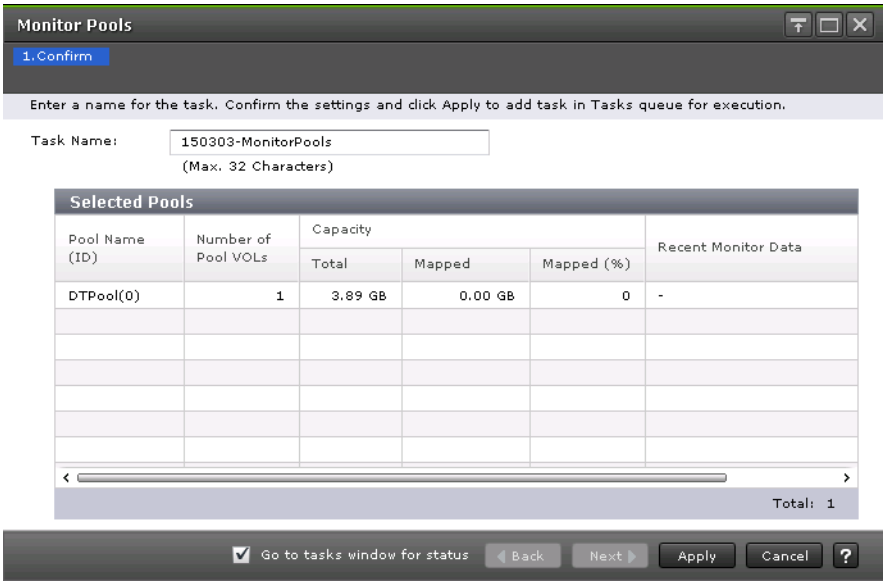
- Capacities, average I/Os, and total I/Os appear if the cursor is placed on the dot of the Tier1, Tier2, Tier3, Volume or the Volume(Weighted average).
- The lower value of the average I/Os appears if the cursor is placed on the dot of the Tier1 Range or the Tier2 Range.

The following table describes these items.

Item	Description
Capacities	The capacity (GB) of the area from the dot of the maximum value on the vertical scale to a specified dot. The capacity of the dot on the vertical scale is 0.00 GB.
Average I/Os	All I/Os are sorted into 127 sections. The average I/O is the representative I/O number assigned to each section, based on the definition of the storage system. By the total number of I/Os, the number of dots may be 127 or less.
Total I/Os	The total number of I/Os in the section from the dot of the maximum value on the vertical scale to a specified dot. The total I/Os is calculated using the average I/Os and capacities in the specified section. If the specified dot is on the vertical scale, the total I/Os is zero.

When no I/Os are in the lower tier with multiple tiers, the tier range line is placed at 0 on the vertical scale.

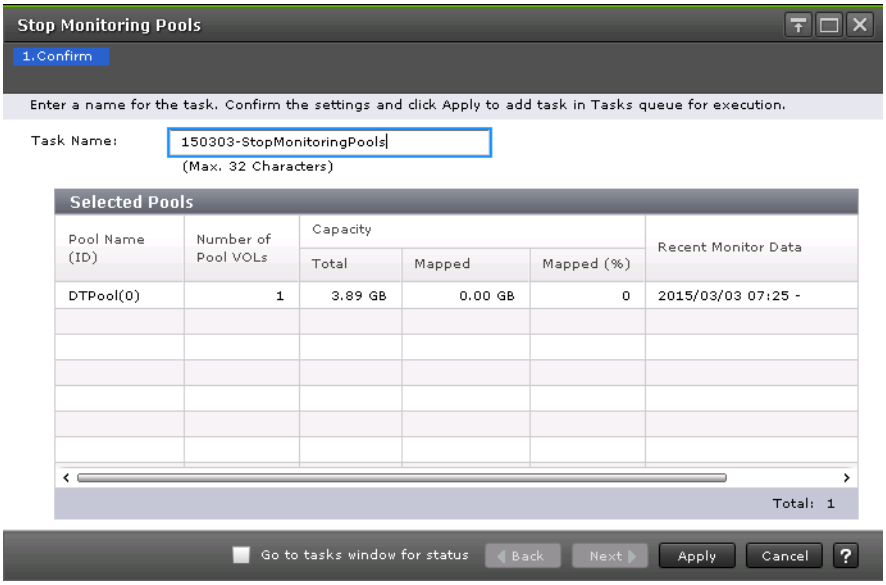
Monitor Pools window



Selected Pools table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Number of Pool VOLs	Displays the number of pool-VOLs in the selected pool.
Capacity	Displays the information about the pool capacity. • Total: Total capacity of pool. Using Option, you can select unit of capacity. ○ One block equals 512 bytes and one page equals 42 megabytes in a pool capacity of Dynamic Provisioning, Dynamic Tiering,active flash, or Thin Image. • Mapped: Page capacity of the pool in which user data and control information is stored. • Mapped (%): Percentages of the page capacity of the pool that contains user data and control information. Mapped (%) displays the value which is truncated after the decimal point of the actual value.
Recent Monitor Data	Displays the period of monitoring time as follows: *start-time-end-time* If the monitoring data is being obtained, only the starting time is displayed. If the latest monitoring data does not exist, a hyphen (-) is displayed.

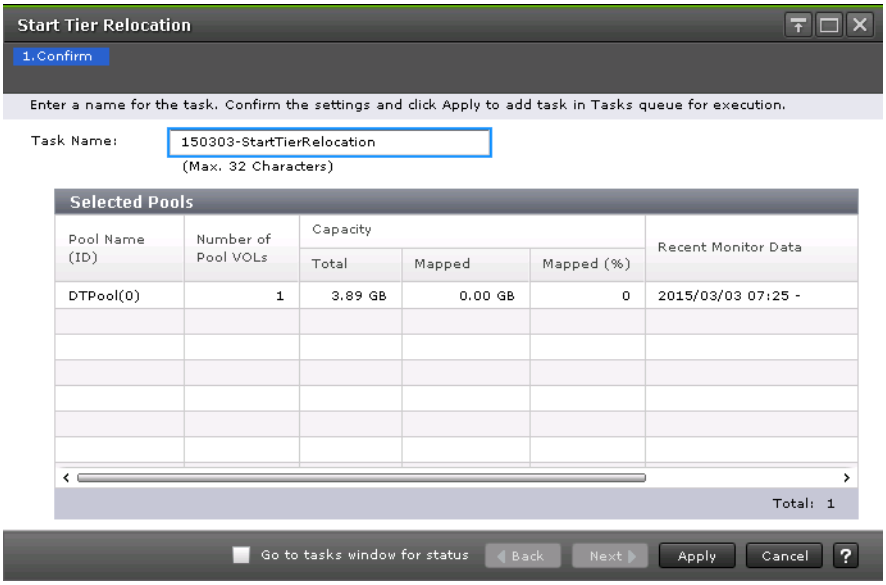
Stop Monitoring Pools window



Selected Pools table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Number of Pool VOLs	Displays the number of pool-VOLs in the selected pool.
Capacity	Displays the information about the pool capacity. • Total: Total capacity of pool. Using Option, you can select unit of capacity. ○ One block equals 512 bytes and one page equals 42 megabytes in a pool capacity of Dynamic Provisioning, Dynamic Tiering,active flash, or Thin Image. • Mapped: Page capacity of the pool in which user data and control information is stored. • Mapped (%): Percentages of the page capacity of the pool that contains user data and control information. Mapped (%) displays the value which is truncated after the decimal point of the actual value.
Recent Monitor Data	Displays the period of monitoring time as follows: *start-time-end-time* If the monitoring data is being obtained, only the starting time is displayed. If the latest monitoring data does not exist, a hyphen (-) is displayed.

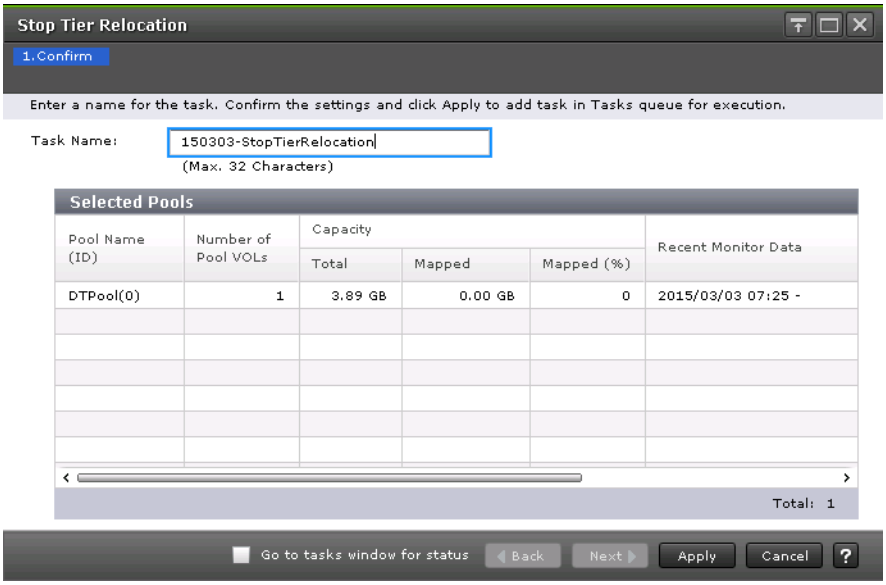
Start Tier Relocation window



Selected Pools table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Number of Pool VOLs	Displays the number of pool-VOLs in the selected pool.
Capacity	Displays the information about the pool capacity. • Total: Total capacity of pool. Using Option, you can select unit of capacity. ○ One block equals 512 bytes and one page equals 42 megabytes in a pool capacity of Dynamic Provisioning, Dynamic Tiering, active flash, or Thin Image. • Mapped: Page capacity of the pool in which user data and control information is stored. • Mapped (%): Percentages of the page capacity of the pool that contains user data and control information. Mapped (%) displays the value which is truncated after the decimal point of the actual value.
Recent Monitor Data	Displays the period of monitoring time as follows: *start-time-end-time* If the monitoring data is being obtained, only the starting time is displayed. If the latest monitoring data does not exist, a hyphen (-) is displayed.
Relocation Speed	Displays the tier relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest)

Stop Tier Relocation window

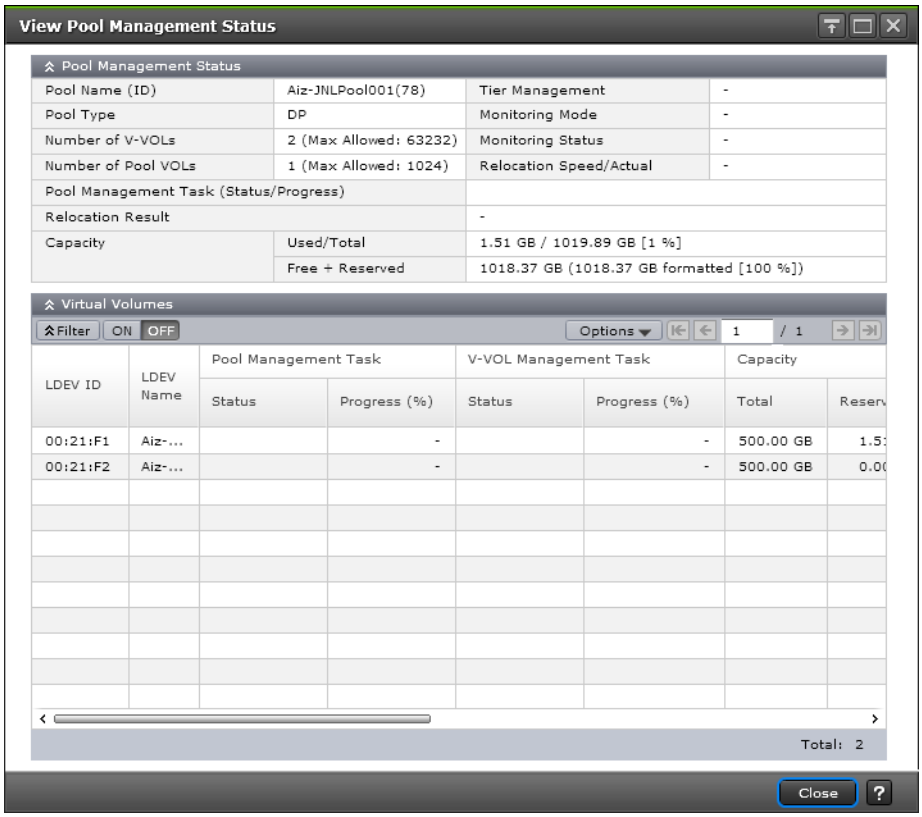


Selected Pools table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Number of Pool VOLs	Displays the number of pool-VOLs in the selected pool.
Capacity	Displays the information about the pool capacity. • Total: Total capacity of pool. Using Option, you can select unit of capacity. ○ One block equals 512 bytes and one page equals 42 megabytes in a pool capacity of Dynamic Provisioning, Dynamic Tiering, active flash, or Thin Image. • Mapped: Page capacity of the pool in which user data and control information is stored. • Mapped (%): Percentages of the page capacity of the pool that contains user data and control information. Mapped (%) displays the value which is truncated after the decimal point of the actual value.
Recent Monitor Data	Displays the period of monitoring time as follows: *start-time-end-time* If the monitoring data is being obtained, only the starting time is displayed. If the latest monitoring data does not exist, a hyphen (-) is displayed.
Relocation Progress(%)	Displays the progress percentage of the tier relocation. 0 to 99: The relocation is performed at the indicated percentage progression.

Item	Description
	100: The relocation operation is not in performed, or the relocation is complete. For details about the tier relocation, see the tier relocation log file.
Relocation Speed	Displays the tier relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest)

View Pool Management Status window



Pool Management Status table

Item	Description
Pool Name (ID)	Displays the pool name and pool ID.
Pool Type	Displays the pool type. For a Dynamic Provisioning pool, DP is displayed. For a Dynamic Tiering pool, DT is displayed. For a pool being used for active flash, DT(Active Flash) is displayed.

Item	Description
	For a pool with data direct mapping enabled, DP (data direct mapping) is displayed. For a Thin Image pool, TI is displayed.
Number of V-VOLs	Displays the number of V-VOLs associated with the pool, and the maximum number of V-VOLs that can be associated with the pool. If you select a Dynamic Provisioning, Dynamic Tiering, or active flash pool, this item appears. If the pool with the data direct mapping attribute is selected, the number of the V-VOLs is displayed, then a hyphen appears for the maximum number of V-VOLs which can associate with the pool.
Number of Root VOLs	Displays the number of root volumes of Thin Image pairs that are associated with the pool. If you select a Thin Image pool, this item appears.
Number of Pool VOLs	Displays the number of pool-VOLs set for the pool, and the maximum number of pool-VOLs that can be set for the pool.
Pool Management Task (Status/Progress)	Displays the status and progress ratio of the pool management task being performed to the pool, and average progress ratio of each V-VOL in the pool. Waiting for Rebalance: The rebalance process is being waited. Rebalancing: The rebalance process is being performed. Waiting for Relocation: The tier relocation process is being waited. Relocating: The tier relocation process is being performed. Waiting for Shrink: The pool shrinking process is being waited. Shrinking: The pool shrinking process is being performed. Blank:The pool management task is not being performed to the pool. The following values that are displayed in the Virtual Volume table or in the Root Volumes table might not correspond with the value displayed for this item. This is because the progress of the pool management task is calculated after the progress of each V-VOL displayed in the Virtual Volume table or the Root Volumes table is calculated. • Pool Management Task - Status • Pool Management Task - Progress(%) For details about the tier relocation, see the tier relocation log file.
Relocation Result	Displays the status of the tier relocation processing. In Progress: The status of Pool Management Task is Waiting for Relocation or Relocating. Completed: The tier relocation operation is not in progress, or the tier relocation is complete. Uncompleted (n% relocated): The tier relocation is suspended at the indicated percentage progression.

Item	Description
	- (hyphen): The pool is not a Dynamic Tiering pool.
Capacity	• Used/Total: Displays the used and total pool capacity. If the pool consists of multiple pool-VOLs, the sum of its capacities is displayed in the Total field. As for the pool comprised of pool volumes assigned by the accelerated compression-enabled parity groups, the writable capacity might be smaller than the displayed capacity. • Free + Reserved: Displays the sum of the free capacity and reserved capacity, and displays the formatted pool capacity. If the pool consists of multiple pool-VOLs, the sum of its capacities is displayed in the Total field.
Tier Management	If Dynamic Tiering is enabled, Auto or Manual of performance monitoring and tier relocation is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Mode	Displays the monitoring mode that is set for the pool. If the continuous mode is enabled, Continuous Mode is displayed. If the period mode is enabled, Period Mode is displayed. If Dynamic Tiering is disabled, a hyphen (-) is displayed.
Monitoring Status	Displays the status of pool monitoring. If monitoring is being performed, In Progress is displayed. A hyphen (-) is displayed other than this case.
Relocation Speed/Actual	Displays the tier relocation speed: 1(Slowest), 2(Slower), 3(Standard), 4(Faster), or 5(Fastest). Actual displays the measured value of the tier relocation capacity per second.

Virtual Volume table

If you select a Dynamic Provisioning, Dynamic Tiering, or active flash pool, this table displays.

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Management Task	• Status: Displays the pool management task being performed to the pool. ○ Waiting for Rebalance: The rebalance process is being waited. ○ Rebalancing: The rebalance process is being performed. ○ Waiting for Relocation: The tier relocation process is being waited. ○ Relocating: The tier relocation process is being performed. ○ Waiting for Shrink: The pool shrinking process is being waited. ○ Shrinking: The pool shrinking process is being performed. ○ Blank: The pool management task is not being performed to the pool. • Progress(%): Displays V-VOL progress percentage (%) of the pool management task being performed. A hyphen (-) is displayed when the pool management task is not performed.

Item	Description

V-VOL Management Task	• Status: Displays the V-VOL management task being performed to V-VOL.
	  ○ Reclaiming Zero Pages: The zero page reclaim processing that is being performed.
	  ○ Waiting for Zero Page Reclaiming: The zero page reclaim processing
	  ○ Blank: The V-VOL management task is not being performed to V-VOL.
	• Progress(%): Displays the progress percentages (%) of the V-VOL management task being performed. A hyphen (-) is displayed when the V-VOL management task is not performed.

Capacity	Displays information about the V-VOL used capacity.
	• Total: Displays the V-VOL capacity.
	• Reserved: Displays the reserved page capacity of the V-VOL.
	The displayed value of Reserved might be larger than the displayed value of Total due to following reasons:
	  ○ Reserved displays the sum of the used V-VOL capacity and the reserved page capacity that is rounded up on each page.
	  ○ The mapped capacity of V-VOL for Dynamic Provisioning includes the capacity of control information (168 MB is required per 3,145,548 MB).
	• Used: Displays the sum of the mapped capacity and the reserved page capacity.
	The displayed value of Used might be larger than the displayed value of Total due to the following reasons:
	  ○ Used displays the sum of the mapped capacity and the reserved page capacity that is rounded up on each page.
	  ○ The mapped capacity of DP-VOL includes the capacity of the control information (uses a maximum of 168 MB per 3,145,548 MB).
	  ○ DP-VOL with data direct mapping enabled includes the control information (168 MB is used per 3,145,548 MB) and the capacity for one page.
	If used capacity is referenced during I/O or copy processing by software such as ShadowImage or Universal Replicator, the used capacity displayed might be different from the actual capacity even if the full allocation is enabled on the V-VOL. This is caused by a gap between the times that information is gathered about the mapped capacity and the reserved capacity.
	• Used(%): For the entire capacity of V-VOL, this item displays percentages of the sum of the mapped capacity and the reserved capacity.

Full Allocation	Displays the status of the setting for full allocation in a pool that are associated with the V-VOL. • Enable: Pages are reserved. • Disable: Pages are not reserved.
Tiering Policy	Displays the tiering policy name and ID. • All(0): Policy in which all tiers of the pool are used. • Level1(1) - Level5(5):Policy selected from levels 1 to 5 is set to the V-VOL. • Level6(6) - Level31(31): Policy defined by the user and set to the V-VOL. From Level 6 (6) to Level 31 (31), the names of

Item	Description
	tiering policies can be changed. If these names have changed, the new names appear. • - (hyphen): V-VOL is not the V-VOL of Dynamic Tiering V-VOL.
New Page Assignment Tier	Displays the new page assigned tier. • High: High is set to V-VOL. • Middle: Middle is set to V-VOL. • Low: Low is set to V-VOL. • - (hyphen): V-VOL is not the Dynamic Tieringor active flash V-VOL.
Tier Relocation	Displays whether tier relocation is set to enable or disable. If the Dynamic Tieringor active flash V-VOL is not used, a hyphen (-) is displayed.
Relocation Priority	Displays the relocation priority. • Prioritized: The priority is set to the V-VOL. • Blank: The priority is not set to the V-VOL. • - (hyphen): V-VOL is not the Dynamic Tiering or active flash V-VOL or the tier relocation function is disabled.
Attribute	Displays the attribute of the LDEV. • TSE: TSE-VOL for Compatible FlashCopy® SE. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Deduplication System Data Volume: LDEV used to manage data deduplication. • - (hyphen): Volume in which the attribute is not defined.
Virtual Storage Machine	Information about the virtual storage machine. • Model / Serial Number: Model name and serial number of the virtual storage machine to which the LDEV belongs. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to the LDEV, this column is blank. • Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If a Virtual SSID is not set for the LDEV, this column is blank.

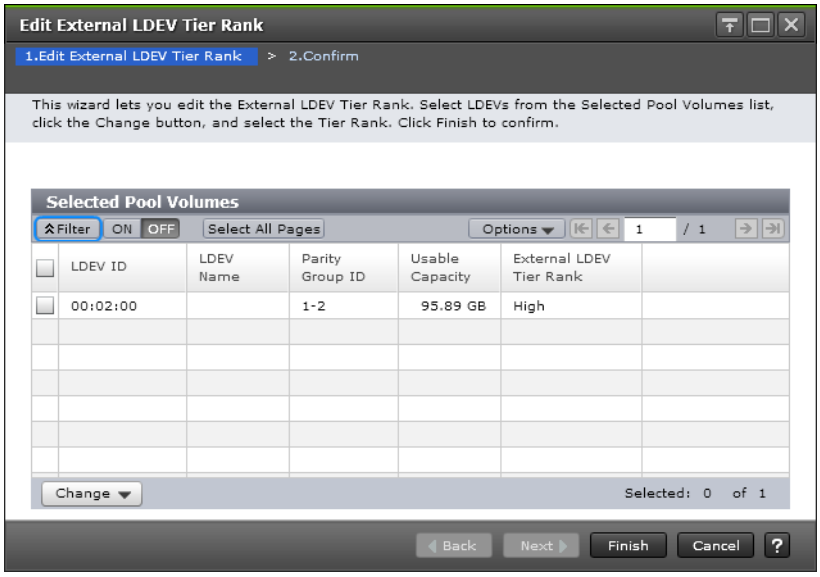
Root Volumes table

Item	Description
LDEV ID	Displays the LDEV identifier which is the combination of LDKC, CU, and LDEV.

Item	Description
LDEV Name	Displays the LDEV name.
Pool Management Task -- Status	Displays the pool management task being performed to the pool. • Waiting for Rebalance: The rebalance process is being waited. • Rebalancing: The rebalance process is being performed. • Waiting for Shrink: The pool shrinking process is being waited. • Shrinking: The pool shrinking process is being performed. • Blank: The pool management task is not being performed to the pool.
Pool Management Task -- Progress (%)	Displays a progress percentage (%) of a pool management task being performed on each primary volume. A hyphen (-) is displayed when the pool management task is not performed.
Used Pool Capacity	Displays the used pool capacity.
Pool Usage(%)	Displays the pool usage ratio.
Virtual Storage Machine	Information about the virtual storage machine. • Model / Serial Number: Model name and serial number of the virtual storage machine that has LDEV. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.

Edit External LDEV Tier Rank wizard

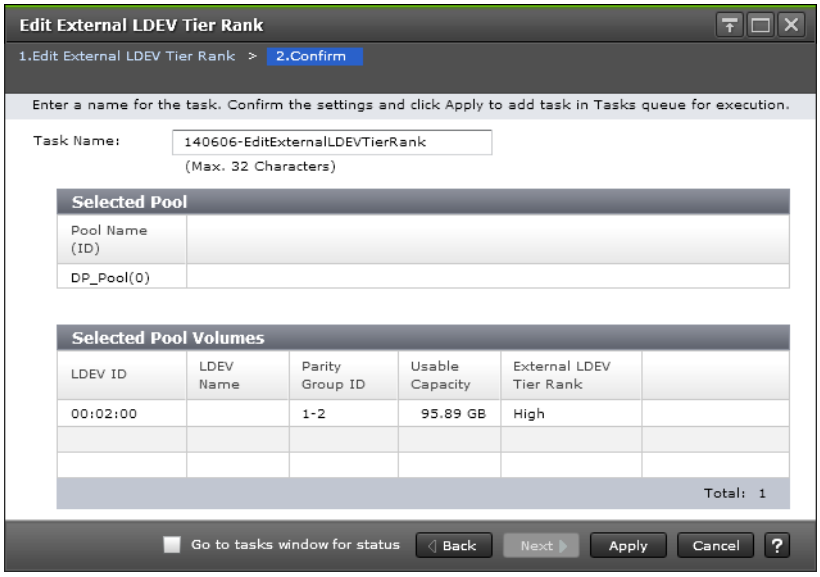
Edit External LDEV Tier Rank window



Selected Pool Volumes table

Item	Description
LDEV ID	Displays the combination of the LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Parity Group ID	Displays the parity group ID.
Usable Capacity	The usable capacity in the pool-VOL that is offset on the basis of the page appears. For the pool-VOL with system area, the displayed capacity does not include the capacity of the management area.
External LDEV Tier Rank	Displays the tier rank of the external volume.
Change	Changes the tier rank of the selected pool-VOL to High, Middle, or Low.

Edit External LDEV Tier Rank confirmation window



Selected Pool table

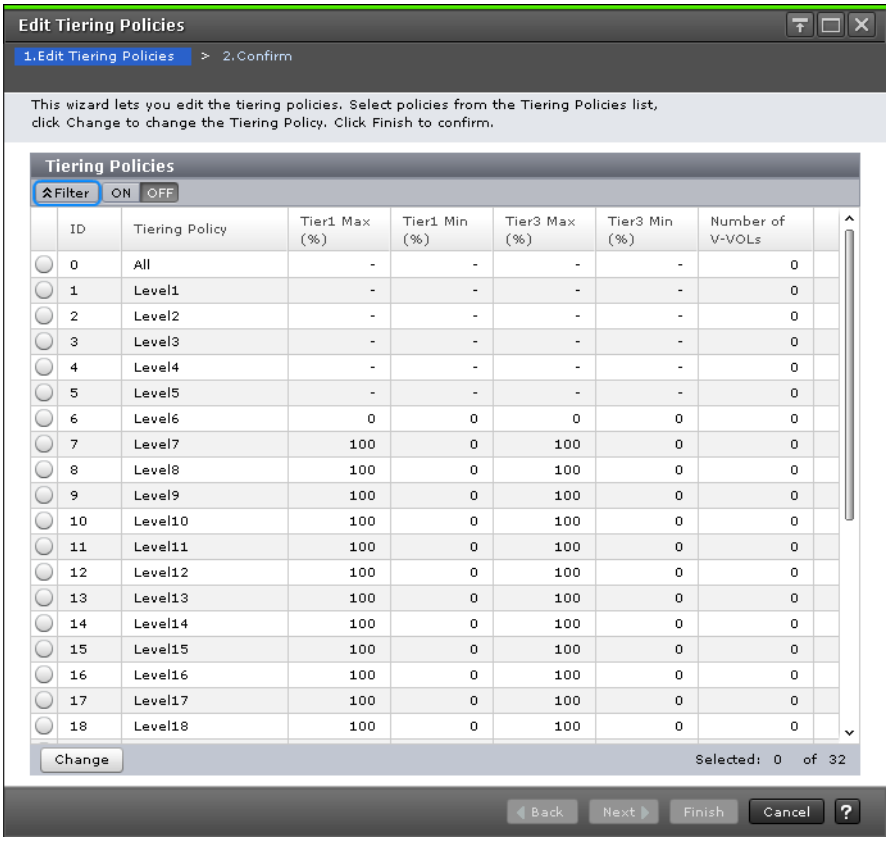
Item	Description
Pool Name (ID)	Displays the pool name and pool ID.

Selected Pool Volumes table

Item	Description
LDEV ID	Displays the combination of the LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Parity Group ID	Displays the parity group ID.
Usable Capacity	The usable capacity in the pool-VOL that is offset on the basis of the page appears. For the pool-VOL with system area, the displayed capacity does not include the capacity of the management area.
External LDEV Tier Rank	Displays the tier rank of the external volume.

Edit Tiering Policies wizard

Edit Tiering Policies window

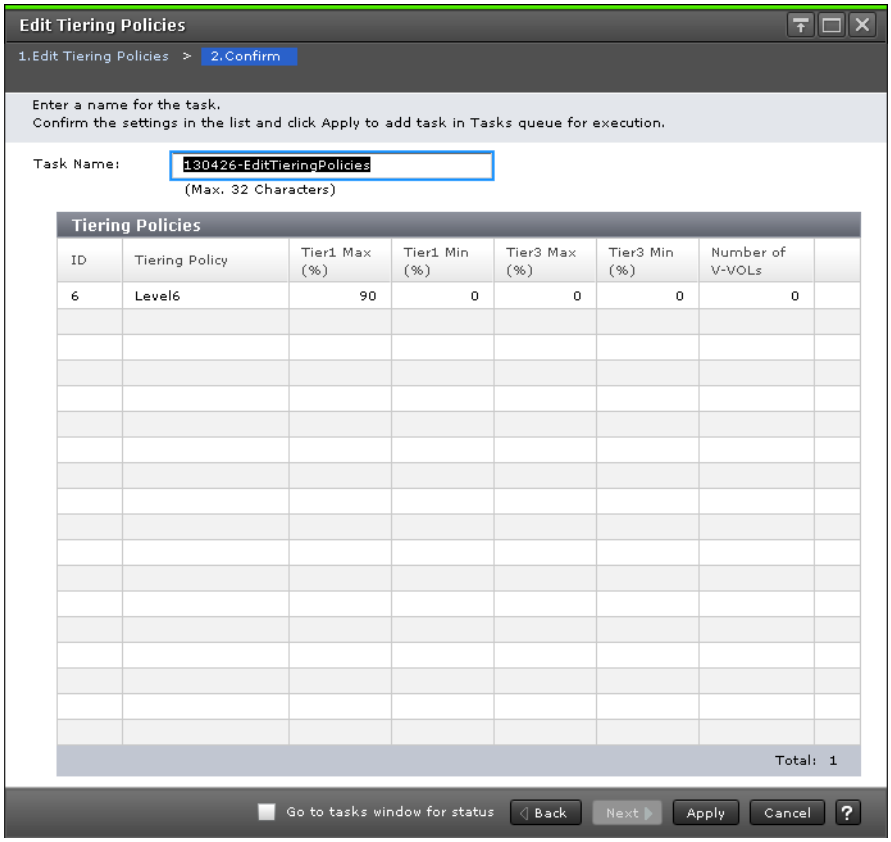


Tiering Policies table

Item	Description
ID	Displays the ID of the tiering policy.
Tiering Policy	Displays the name of the tiering policy.
Tier1 Max(%)	Displays the maximum percentage that is allocated to tier 1 in the total capacity to which tier relocation is performed. For a policy with an ID from 0 to 5, a hyphen (-) is displayed.
Tier1 Min(%)	Displays the minimum percentage that is allocated to tier 1 in the total capacity to which tier relocation is performed. For a policy whose ID is from 0 to 5, a hyphen (-) is displayed.
Tier3 Max(%)	Displays the maximum percentage that is allocated to tier 3 in the total capacity to which tier relocation is performed. For a policy with an ID from 0 to 5, a hyphen (-) is displayed.
Tier3 Min(%)	Displays the minimum percentage that is allocated to tier 3 in the total capacity to which tier relocation is performed. For a policy whose ID is from 0 to 5, a hyphen (-) is displayed.
Number of V-VOLs	Displays the number of V-VOLs to which the tiering policy is set.
Change	Displays the **Change Tiering Policy** window when you select the row and click this button.

Item	Description
	A policy with an ID is from 0 to 6 cannot be changed.

Edit Tiering Policies confirmation window

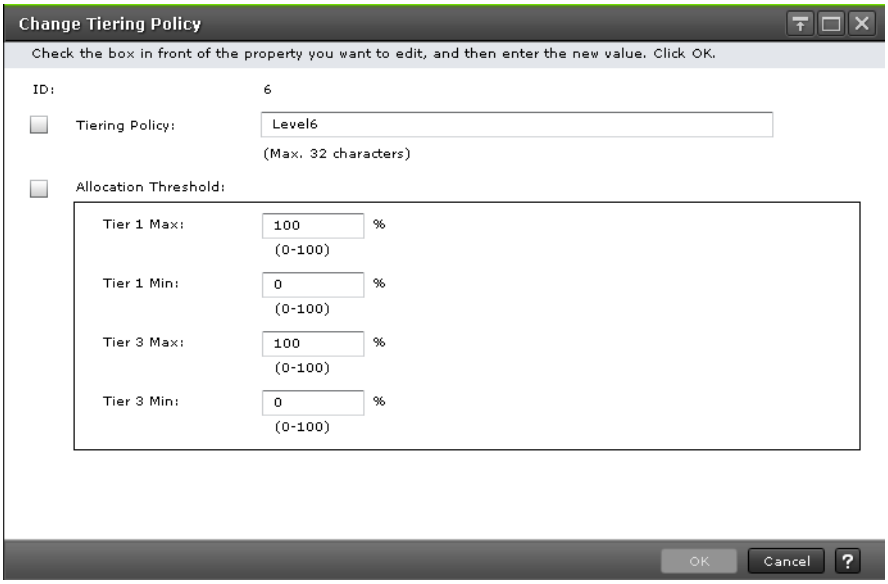


Tiering Policies table

Item	Description
ID	Displays the ID of the tiering policy.
Tiering Policy	Displays the name of the tiering policy.
Tier1 Max(%)	Displays the maximum percentage that is allocated to tier 1 in the total capacity to which tier relocation is performed. For a policy with an ID from 0 to 5, a hyphen (-) is displayed.
Tier1 Min(%)	Displays the minimum percentage that is allocated to tier 1 in the total capacity to which tier relocation is performed. For a policy whose ID is from 0 to 5, a hyphen (-) is displayed.
Tier3 Max(%)	Displays the maximum percentage that is allocated to tier 3 in the total capacity to which tier relocation is performed. For a policy with an ID from 0 to 5, a hyphen (-) is displayed.
Tier3 Min(%)	Displays the minimum percentage that is allocated to tier 3 in the total capacity to which tier relocation is performed. For a policy whose ID is from 0 to 5, a hyphen (-) is displayed.

Item	Description
Number of V-VOLs	Displays the number of V-VOLs to which the tiering policy is set.

Change Tiering Policy window

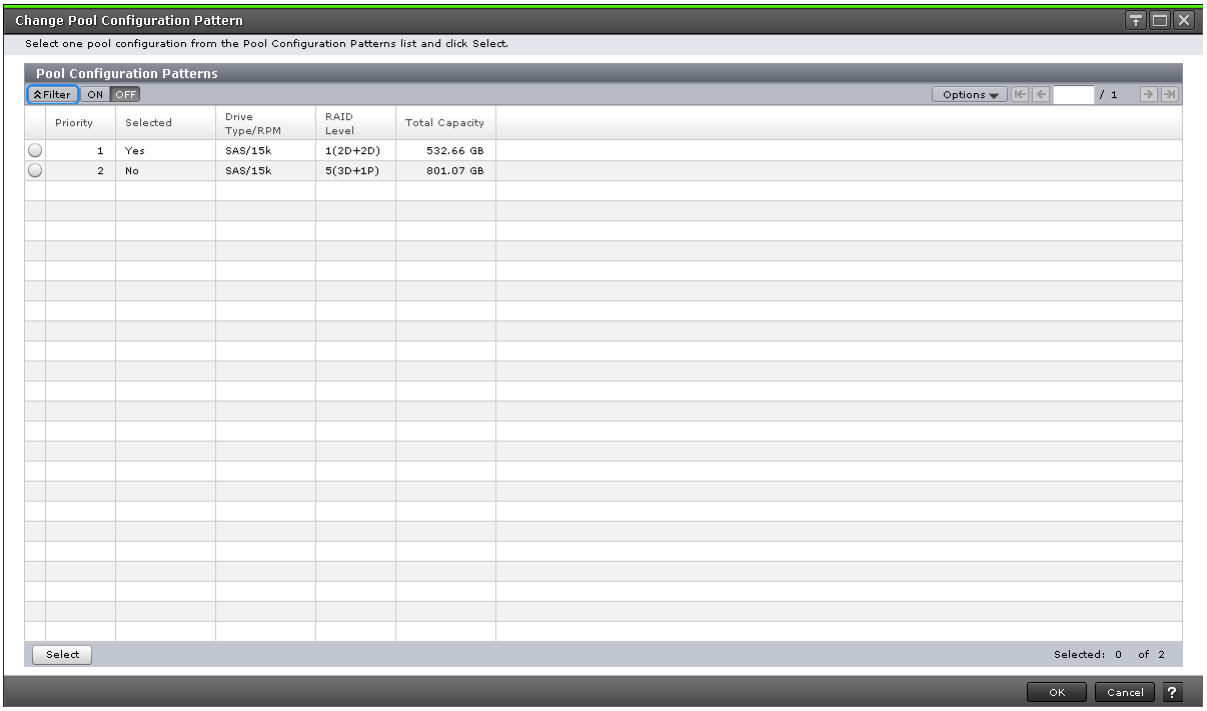


Item	Description
ID	Displays the ID of the tiering policy.
Tiering Policy	Specify the tiering policy name. You can enter up to 32 alphanumeric characters. The name is case-sensitive. The following symbols cannot be used in the name: \ / : , ; * ? " < > |
Tier1 Max(%)	Set the maximum percentage that is allocated to tier 1 in the total capacity for the tier relocation from 0 (%) to 100 (%). The setting value is needed to satisfy either one of following conditions: Equal to Tier1 Min Larger than Tier1 Min
Tier1 Min(%)	Set the minimum percentage that is allocated to tier 1 in the total capacity for the tier relocation from 0 (%) to 100 (%). The setting value is needed to satisfy either one of following conditions: Equal to Tier1 Max Smaller than Tier1 Max
Tier3 Max(%)	Set the maximum percentage that is allocated to tier 3 in the total capacity for the tier relocation from 0 (%) to 100 (%). The setting value is needed to satisfy either one of following conditions: Equal to Tier1 Min

Item	Description
	Larger than Tier1 Min
Tier3 Min(%)	Set the minimum percentage that is allocated to tier 3 in the total capacity for the tier relocation from 0 (%) to 100 (%). The setting value is needed to satisfy either one of following conditions: Equal to Tier1 Max Smaller than Tier1 Max
Note: The total of Tier1 Min and Tier3 Min must be 100(%) or less.	

Change Pool Configuration Pattern window

For Dynamic Provisioning pools



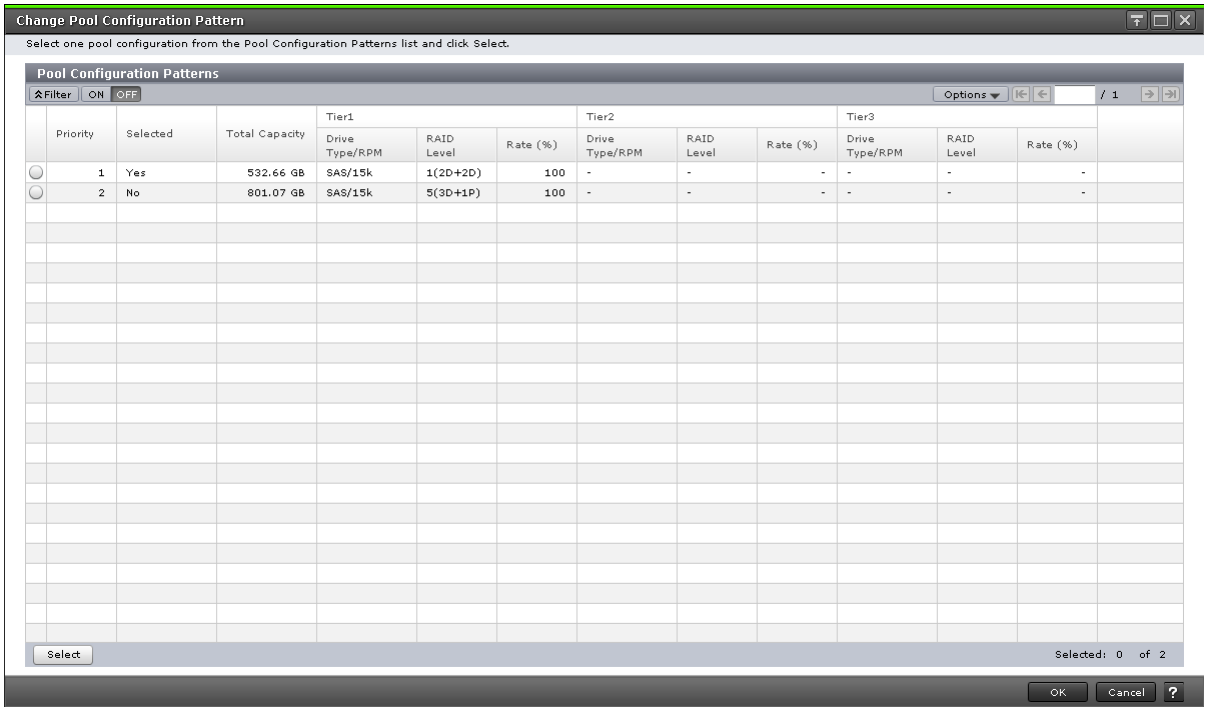
When you create a Dynamic Provisioning pool, the following table displays.

Pool Configuration Patterns table

Item	Description
Priority	Displays the priority of the pool configuration.
Selected	Displays whether the pool configuration is selected or not.
Total Capacity	Displays the total capacity of the pool.
Drive Type/RPM	Displays the data drive type and RPM of the pool.
RAID Level	Displays the RAID level of the pool.

Item	Description
Select	If the pool configuration is changed, select a row in the Pool Configuration Patterns table. Then click this button. The selected pool configuration is reflected to the pool setting.

For Dynamic Tiering pools



When you create a Dynamic Tiering pool, the following table displays.

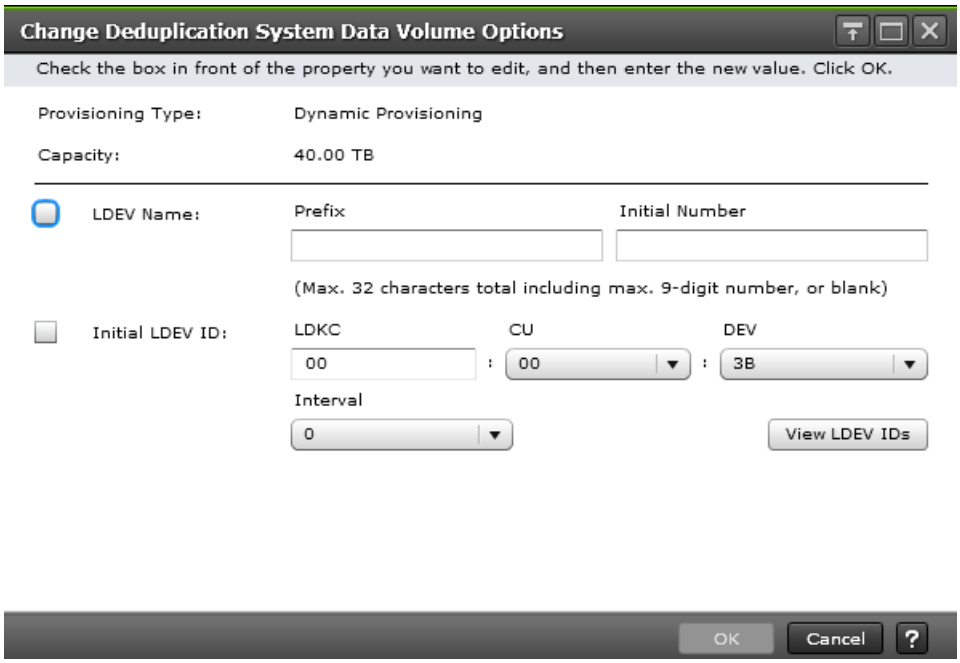
Pool Configuration Patterns table

Item	Description
Priority	Displays the priority of the pool configuration.
Selected	Displays whether the pool configuration is selected or not.
Total Capacity	Displays the total capacity of the pool
Tier 1	Displays the tier 1 information. Drive Type/RPM: Displays the data drive type and RPM of pool-VOLs. RAID Level: Displays the RAID level of pool-VOLs. Rate (%): Displays the percentage of the tier 1 against the total capacity of the pool.
Tier 2	Displays the tier 2 information. Drive Type/RPM: Displays the data drive type and RPM of pool-VOLs.

Item	Description
	RAID Level: Displays the RAID level of pool-VOLs. Rate (%): Displays the percentage of the tier 2 against the total capacity of the pool.
Tier 3	Displays the tier 3 information. Drive Type/RPM: Displays the data drive type and RPM of pool-VOLs. RAID Level: Displays the RAID level of pool-VOLs. Rate (%): Displays the percentage of the tier 3 against the total capacity of the pool.
Select	If the pool configuration is changed, select a row in the Pool Configuration Patterns table. Then click this button. The selected pool configuration is reflected to the pool setting.

Change Deduplication System Data Volume Options window

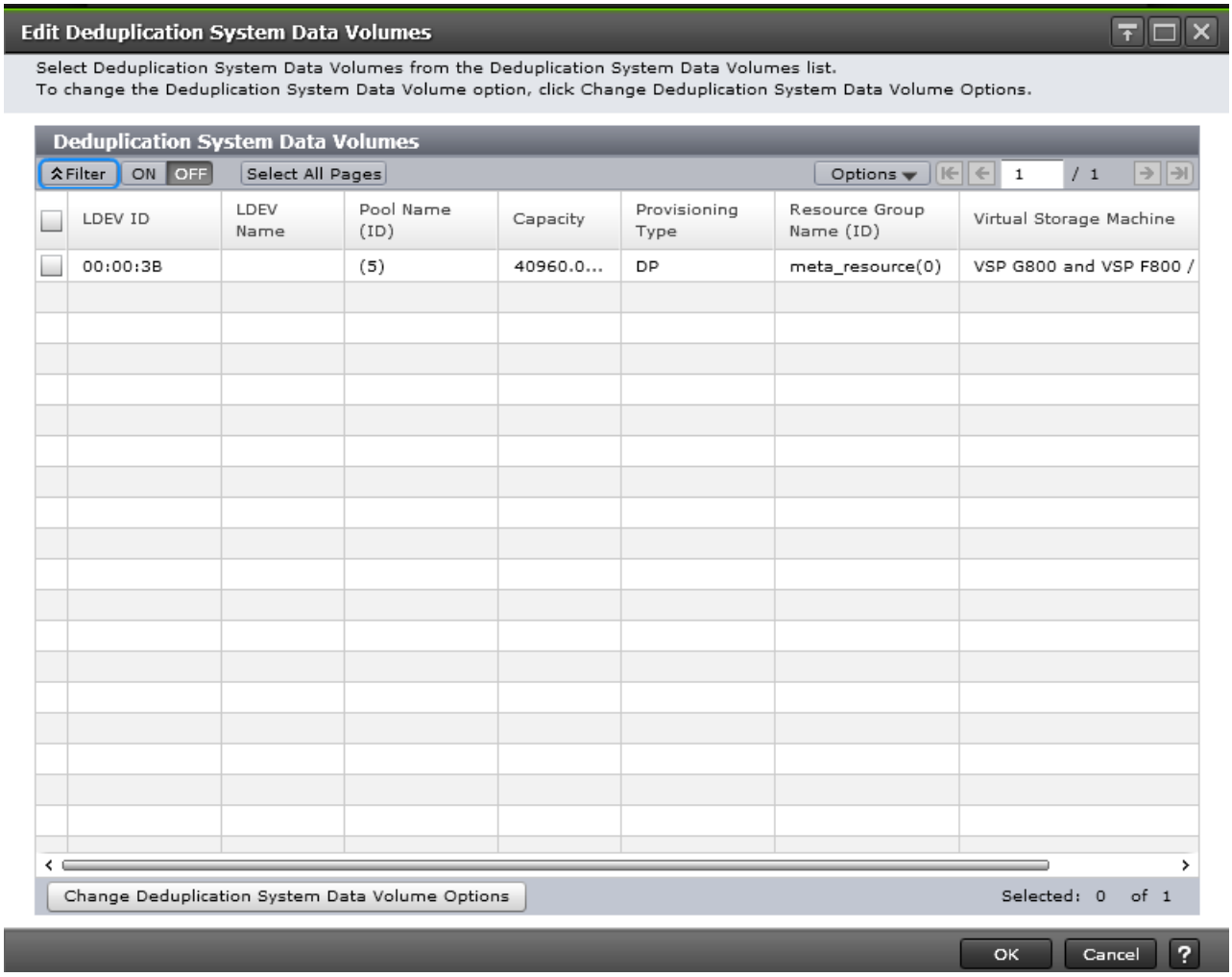
Use this window to change the options for a deduplication system data volume for a pool. To open this window, select the pool on the Pools window, click More Actions > Edit Pools to open the Edit Pools window, click Edit Deduplication System Data Volume to open the Edit Deduplication System Data Volume window, select the deduplication system data volume, and then click Change Deduplication System Data Volume Options.



Item	Description
Provisioning Type	Displays the provisioning type of the deduplication system data volume, which is Dynamic Provisioning.
Capacity	Displays 40 TB for the capacity of the deduplication system data volume.
LDEV Name	Specify the LDEV name. • Prefix: Fixed character string. • Initial Number: Initial number. Specify the initial number according to these examples. • 1: Up to 9 numbers are added (1, 2, 3 ... 9). • 08: Up to 92 numbers are added (08, 09, 10 ... 99). • 23: Up to 77 numbers are added (23, 24, 25 ... 99). • 098: Up to 902 numbers are added (098, 099, 100 ... 999).
Initial LDEV ID	Specify the LDEV identifier, which is the combination of LDKC, CU, and LDEV. Assigns the ID at a certain interval starting with the ID you specify. • LDKC: Specify the LDKC number. It is fixed to 00. • CU: Specify the CU number. • DEV: Specify the LDEV number. • Interval: Specify the interval of the assigned LDEV ID. • View LDEV IDs: Opens the View LDEV IDs window.

Edit Deduplication System Data Volume window

Use this window to edit a deduplication system data volume for a pool. To open this window, select the pool on the Pools window, click More Actions > Edit Pools to open the Edit Pools window, and then click Edit Deduplication System Data Volume.



Deduplication System Data Volume table

Item	Description
LDEV ID	Displays the LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays the LDEV name.
Pool Name (ID)	Displays the pool name, and the pool ID is displayed in parentheses.
Capacity	Displays the LDEV capacity.
Provisioning Type	Displays the type of the LDEV.
Resource Group Name (ID)	Displays the resource group names, and the IDs of the resource groups are displayed in parentheses.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has LDEV.
Change Deduplication System Data Volume Options	Opens the Change Deduplication System Data Volume Options window for the selected deduplication system data volume.

F

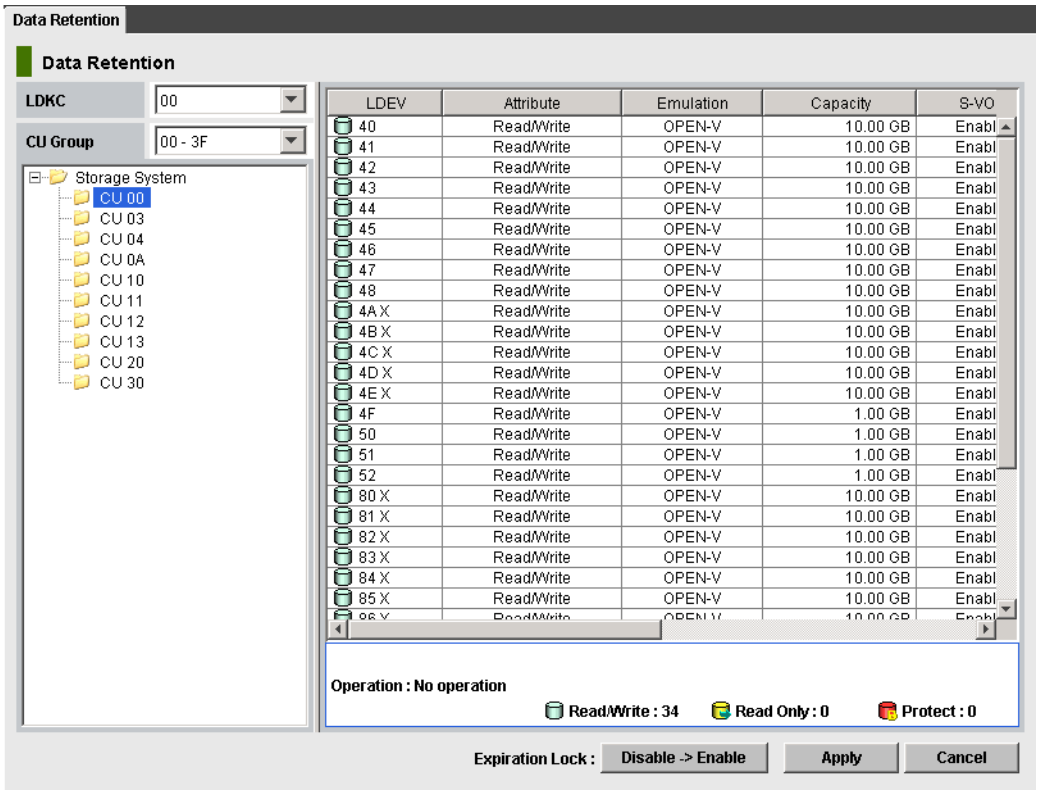
Data Retention Utility GUI reference

The Data Retention Utility windows in Hitachi Device Manager - Storage Navigator display the Data Retention Utility information for the storage system and allow you to perform Data Retention Utility operations.

For general information about the Device Manager - Storage Navigator GUI, see the *System Administrator Guide*.

Data Retention window

Use the **Data Retention** window to assign an access attribute to open-system volumes.



Summary

Item	Description
LDKC	Select the LDKC which is displayed in the tree.
CU Group	00-3F: CUs from 00 to 3F appear in the tree.
Tree	A list of CUs. Selecting a CU provides the selected CU information in the volume list on the right of the tree. This tree appears only the CUs that include volumes to which access attributes can be actually set.
Volume list	Lists information about the CU selected in the tree. See the table below for details.
Expiration Lock	Enables or disables enhanced volume protection. • Disable > Enable: Indicates the expiration lock is disabled. You can change an access attribute to read/write when the retention term is over. • Enable > Disable: Indicates the expiration lock is enabled. You cannot change an access attribute to read/write even when the retention term is over.

Item	Description
Apply	Applies settings to the storage system.
Cancel	Discards setting changes.

Volume list

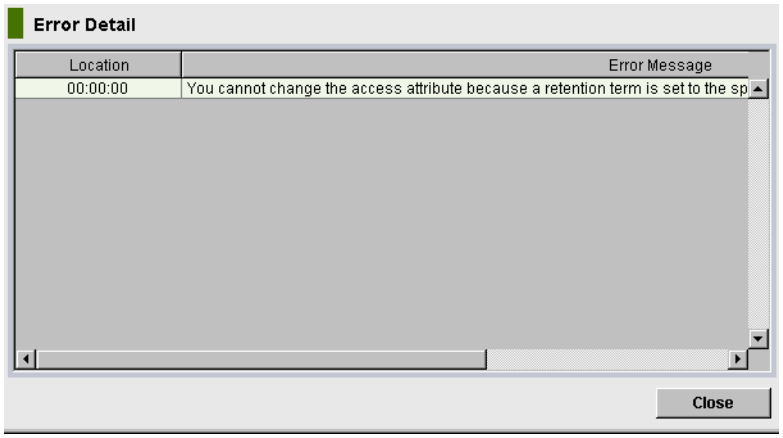
The volume list provides information about access attributes that are assigned to volumes.

Item	Description
LDEV	LDEV number. •  : Read/write •  : Read-only •  : Protect The symbol beside the LDEV number indicates: • #: an external volume • A: LDEV of the ALU attribute. • S: LDEV of the SLU attribute. • V: a virtual volume • D: Deduplication System Data volume • X: a virtual volume used for Dynamic Provisioning
Attribute	Access attribute assigned to this volume. These attributes can be assigned using the Command Control Interface. • Read/Write: Both read and writer operations are permitted on the logical volume. • Read-only: Read operations are permitted on the logical volume. • Protect: Neither read nor write operations are permitted.
Emulation	Volume emulation types.
Capacity	Capacity of each volume in GB to two decimal places.
S-VOL	Indicates whether the volume can be specified as a secondary volume (S-VOL). You can also use the CCI to specify whether each volume can be used as an S-VOL.
Reserved	Indicates the method that can be used to make LU path and command device settings. • Hyphen (-): Both CCI and Hitachi Device Manager - Storage Navigator can be used to make LU path and command device settings. • CCI: Only CCI can be used to make LU path and command device settings. Hitachi Device Manager - Storage Navigator cannot be used to do so.
Retention Term	Period (in days) when you are prohibited from changing access attribute to read/write. The retention term can be extended but cannot be shortened. During the retention term, you can change read-only to protect, or vice versa. • 500 days. Attempts to change access attribute to read/write are prohibited in the next 500 days. • Unlimited: The retention term is extended with no limits. • 0 days: You can change access attribute to read/write.

Item	Description
	Caution: In Data Retention Utility, you can increase the value for Retention Term, but cannot decrease the value.
Path	Number of LU paths.
Mode	Indicates the mode that the CCI user assigns to the volume. You cannot use Hitachi Device Manager - Storage Navigator to change modes. You must use the CCI to change modes. • Zer: Zero Read Cap mode is assigned to the volume. If the Read Capacity command (which is a SCSI command) is issued to a volume in Zero Read Cap mode, it will be reported that the capacity of the volume is zero. • Inv: Invisible mode is assigned to the volume. If the Inquiry command (which is a SCSI command) is issued to a volume in Invisible mode, it will be reported that the volume does not exist. Therefore, the hosts will be unable to recognize the volume. • Zer/Inv. Both Zero Read Cap mode and Invisible mode are assigned to the volume. • Hyphen (-): No mode is assigned by CCI to the volume.
Operation	Target of the operation or the name of the operation. When no operation is performed, No Operation appears. Also shown are the volume icons and the total number of volumes with each access attribute.

Error Detail dialog box

If an error occurs with Data Retention Utility, the **Error Detail** dialog box appears. The **Error Detail** dialog box displays error locations and error messages.



Items	Description
Location	Location where the error occurred. If an error relating to a volume occurred, the LDKC number, CU number, and LDEV number (volume number) are shown.

Items	Description
Error Message	Provides the full text of the error message. For details about the solution, see the *Hitachi Device Manager - Storage Navigator Messages*.
Close	Closes the **Error Detail** window.

Related references

- Troubleshooting Data Retention Utility on page 408

G

LUN Manager GUI reference

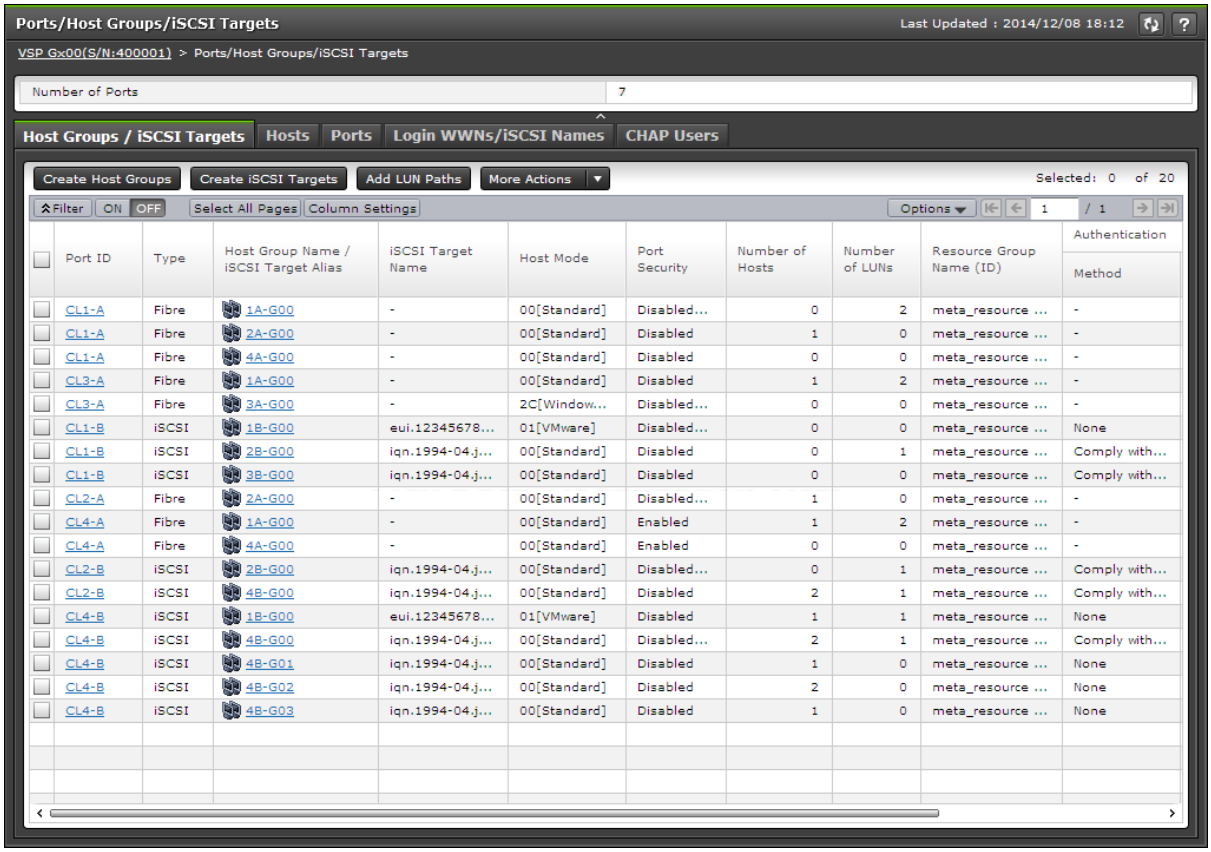
The LUN Manager windows in Hitachi Device Manager - Storage Navigator display the LUN information for the storage system and allow you to configure and manage LUNs.

For general information about the Device Manager - Storage Navigator GUI, see the *System Administrator Guide*.

- Copy LUN Paths wizard
- Remove Hosts wizard
- Edit UUIDs wizard
- Add New Host window
- Change LUN IDs window
- Delete Host Groups window
- Delete Login WWNs window
- Delete UUIDs window
- Host Group Properties window
- LUN Properties window
- Authentication window
- Edit Command Devices wizard
- Host-Reserved LUNs window
- Release Host-Reserved LUNs wizard
- View Login WWN Statuses window
- View Login iSCSI Name Statuses window
- Port Properties window
- CHAP User Properties window
- Host Properties window
- Create iSCSI Targets wizard
- Edit iSCSI Targets wizard
- Add CHAP Users wizard when selected iSCSI target

- Edit CHAP User wizard
- iSCSI Target Properties window
- Add New CHAP User window
- Delete iSCSI Targets window
- Delete Login iSCSI Names window
- Remove CHAP Users window
- Remove Target CHAP Users window
- Remove Port CHAP Users window
- Remove Hosts window
- Test Communication Statuses window
- Edit T10 PI Mode wizard

Ports/Host Groups/iSCSI Targets window



Summary

Item	Description
Number of Ports	Total number of ports.

Host Groups / iSCSI Targets tab

This tab provides information about the host groups and iSCSI targets that are assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port. Clicking a port ID opens Port/Host Groups: Host Groups and Hosts tabs.
Type	Types of ports: • Fibre: Fibre Channel ports • iSCSI: iSCSI ports.

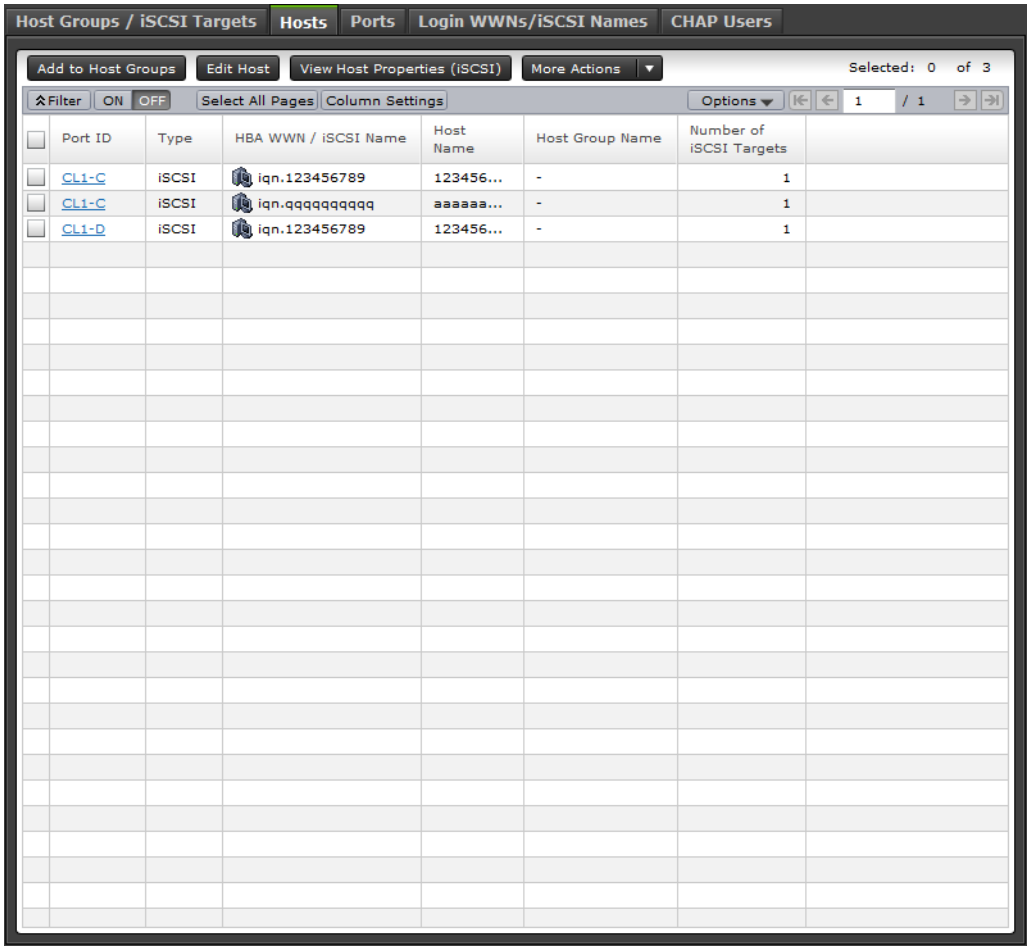
Item	Description
	• NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Host Group Name / iSCSI Target Alias	Icons and names of the host group or iSCSI target alias. Clicking a host group name or iSCSI target opens Port/Host Groups/iSCSI Targets: Hosts, LUNs, and Host Mode Options tabs.
Host Group ID / iSCSI Target ID[1]	Host group ID or iSCSI Target ID.
iSCSI Target Name	iSCSI Target name.
Host Mode	Host mode of the host group or iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Number of LUNs	Number of logical units.
Authentication	Information about the authentication. If the port is a Fibre Channel port, a hyphen appears. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Number of Users
ALUA Used	Usage condition of ALUA. Yes: ALUA is used. No: ALUA is not used.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	T10 PI attribute setting (Enabled or Disabled) on the port.
Resource Group Name (ID)	Resource group name and identifier of the host groups.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine that has the port.
Create Host Groups	Opens the **Create Host Groups** window.
Create iSCSI Targets	Opens the **Create iSCSI Targets** window.
Add LUN Paths	Opens the **Add LUN Paths** window.
Add Hosts[2]	Opens the **Add Hosts** window.
Delete Host Groups[2]	Opens the **Delete Host Groups** window.
Delete iSCSI Targets[2]	Opens the **Delete iSCSI Targets** window.
Edit Host Groups[2]	Opens the **Edit Host Groups** window.

Item	Description
Edit iSCSI Targets[2]	Opens the **Edit iSCSI Targets** window.
Create Alternative LUN Paths[2]	Opens the **Create Alternative LUN Paths** window.
Add CHAP Users[2]	Opens the **Add CHAP Users** window.
Edit Asymmetric Access States[2]	Opens the **Edit Asymmetric Access States** window. For details, see Global-Active Device User Guide.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:

1. Does not appear by default. To display this item, change the **Column Settings** of the table option.
2. Available when you click More Actions.

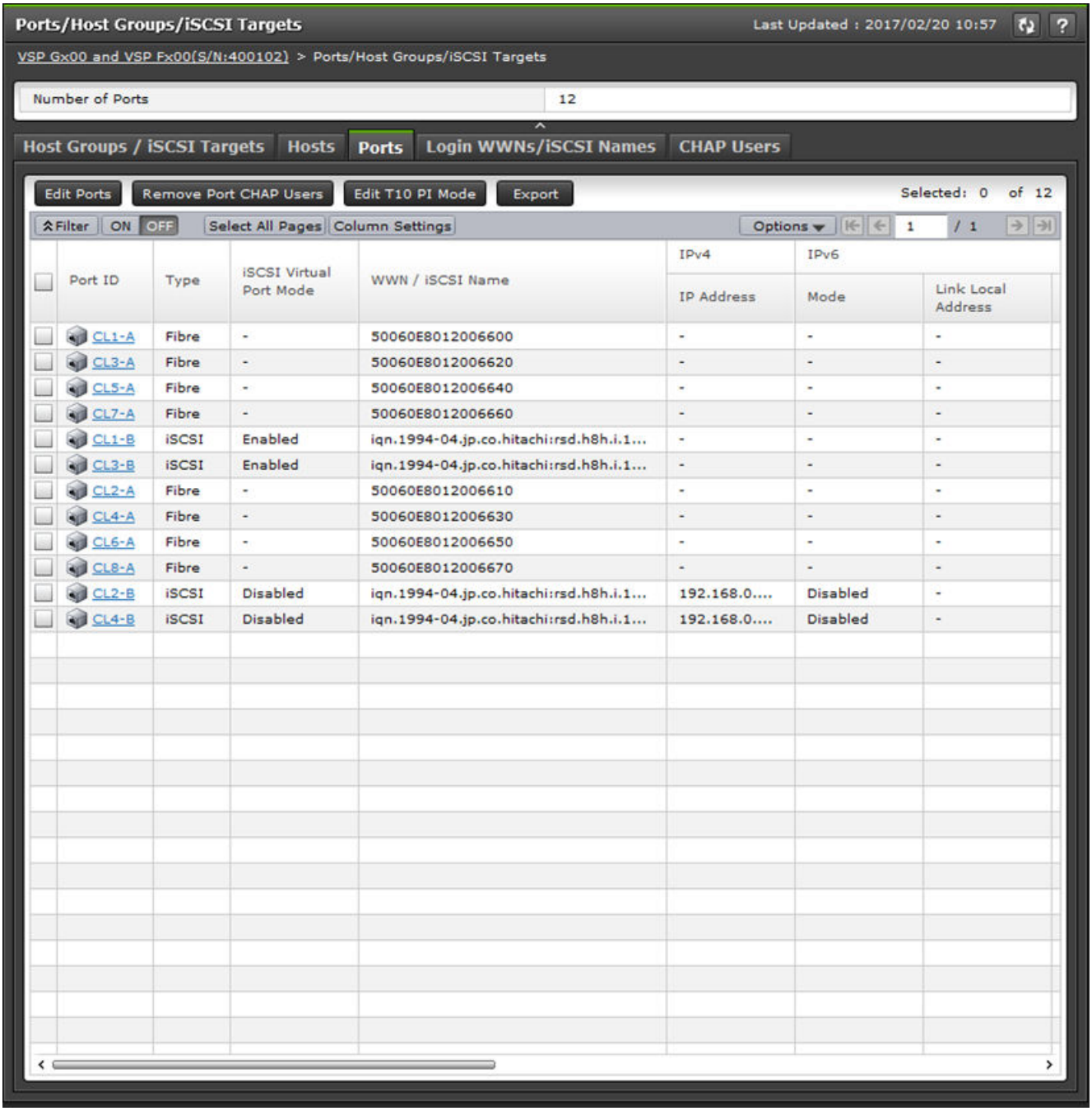
Hosts tab



This tab provides information about the HBA WWNs that are registered to the host groups or iSCSI targets assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port. Clicking a port ID opens Port/Host Groups: Host Groups and Hosts tabs.
Type	Types of ports: • Fibre: Fibre Channel ports • iSCSI: iSCSI ports • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
HBA WWN / iSCSI name	HBA WWNs/ iSCSI names and their icons.
Host Name	Name of hosts.
Host Group Name	Name of the host group.
Number of iSCSI Targets	Number of iSCSI targets.
Add to Host Groups	Opens the **Add to Host Groups** window.
Edit Host	Opens the **Edit Host** window.
View Host Properties (iSCSI)	Opens the **Host Properties** window.
Remove Hosts (Fibre)[1]	Opens the **Remove Hosts** window.
Remove Hosts (iSCSI)[1]	Opens the **Remove Hosts** window.
Export[1]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
Notes: **1.** Available when you click More Actions.	

Ports tab



This tab provides information about the ports assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port. Clicking a port ID opens Port/Host Groups: Host Groups and Hosts tabs.
Type	Types of ports: • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports.

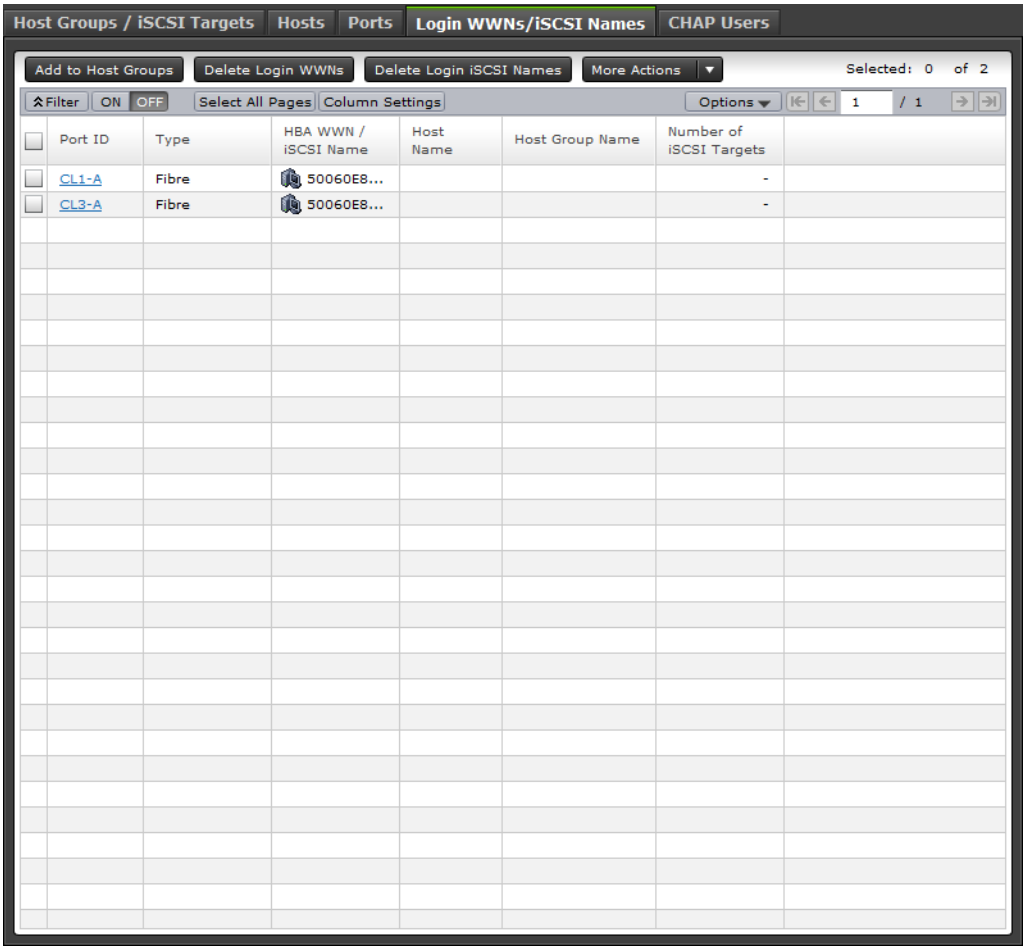
Item	Description
	• NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Adapter Type	Adapter type of the port.
iSCSI Virtual Port Mode	Information about the setting of the iSCSI virtual port mode: • Enabled: The iSCSI virtual port mode is enabled for the port. • Disabled: The iSCSI virtual port mode is disabled for the port. • - (hyphen): The port does not support the iSCSI virtual port mode.
WWN / iSCSI Name	WWN or iSCSI initiator name of the port.
IPv4	Information about the setting for IPv4: • IP Address: IP address for the port. • Subnet Mask*: Subnet mask for the port. • Default Gateway*: Default gateway for the port. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
IPv6	Information about the setting for IPv6: • Mode: IPv6 setting (Enabled or Disabled) for the port. • Link Local Address: Link local address for the port. • Global Address: Global address for the port. • Global Address 2*: Global address for the port. • Subnet Prefix*: Subnet prefix for the port address. • Assigned Default Gateway*: Assigned default gateway address for the port. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
Speed	Data transfer speed for the selected Fibre Channel port in Gbps (gigabit per second). Valid speeds are 1, 2, 4, 8, 10, 16, or 32 Gbps. If Auto is set for the port speed, Auto (1, 2, 4, 8, 10, 16, or 32 Gbps) is displayed. The value enclosed in parentheses is defined by the storage system. A hyphen (-) appears in the parentheses when the connection is not in the linkup status.
Security	LUN security setting (Enabled or Disabled) on the port.
SFP Data Transfer Rate[1]	SFP data transfer rate. A hyphen (-) is displayed for iSCSI ports.
Address (Loop ID)	Address of the port.
Fabric	Indicates whether a fabric switch is used.
Connection Type	Topology of the port.
TCP Port Number[1]	TCP port number. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Ethernet MTU Size(Byte)	MTU size on Ethernet. • MTU: Specified MTU size • Linked MTU: Present MTU size for the data transfer • - (hyphen): The iSCSI virtual port mode is enabled for the port.
MAC Address[1]	MAC address.

Item	Description
Keep Alive Timer(sec.)[1]	Keep alive timer setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Selective ACK[1]	Selective ACK setting (Enabled or Disabled) for the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Delayed ACK[1]	Delayed ACK setting (Enabled or Disabled) for the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Maximum Window Size (KB)[1]	Maximum window size setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
iSNS Server[1]	Information about the iSNS server. • Mode: iSNS server setting (Enabled or Disabled) for the port. • IP Address: IP address of the iSNS server. • TCP Port Number: TCP port number of the iSNS server.
VLAN[1]	Information about VLAN. • Tagging Mode: Tagging mode setting (Enabled or Disabled) for the port. • ID: VLAN identifier. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
Authentication	Information about authentication. • CHAP User Name: CHAP user name of the port. • Used: Shows whether the CHAP authentication is using the CHAP user. If Yes appears, the CHAP user is used. If No appears, the CHAP user is not used.
T10 PI Mode	T10 PI attribute setting (Enabled or Disabled) on the port. If the T10 PI mode is not supported, a hyphen (-) is displayed.
Resource Group Name (ID)	Resource group names and IDS of the ports.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine that has the port.
Edit Ports	Opens the **Edit Ports** window.
Remove Port CHAP User	Opens the **Remove Port CHAP User** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:

1. This item does not appear by default. To display this item, change the **Column Settings** of the table option.

Login WWNs / iSCSI Names tab

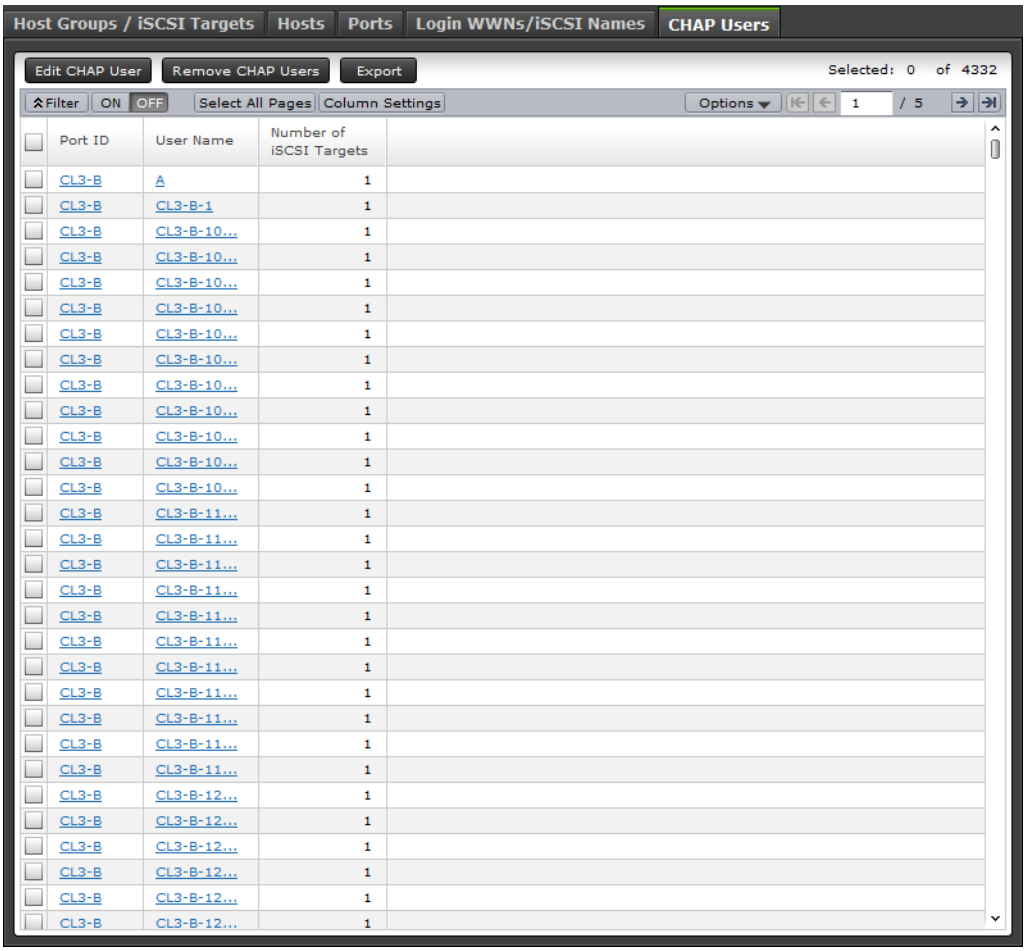


Item	Description
Port ID	Identifier of the port. Clicking a port ID opens Port/Host Groups: Host Groups and Hosts tabs.
Type	Types of ports: • Fibre: Fibre Channel ports. • iSCSI: iSCSI ports.
HBA WWN / iSCSI Name	HBA WWNs / iSCSI Names and their icons.
Host Name	Name of the host.
Host Group Name	Name of the host group.
Number of iSCSI Targets	Number of iSCSI targets.
Add to Host Groups	Opens the **Add to Host Groups** window.
Delete Login WWNs	Opens the **Delete Login WWNs** window.
Delete Login iSCSI Names	Opens the **Delete Login iSCSI Names** window.
View Login WWN Statuses[1]	Opens the **View Login WWN Statuses** window.
View Login iSCSI Name Statuses [1]	Opens the **View Login iSCSI Name Statuses** window.

Item	Description
Export[1]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:
1. Available when you click More Actions.

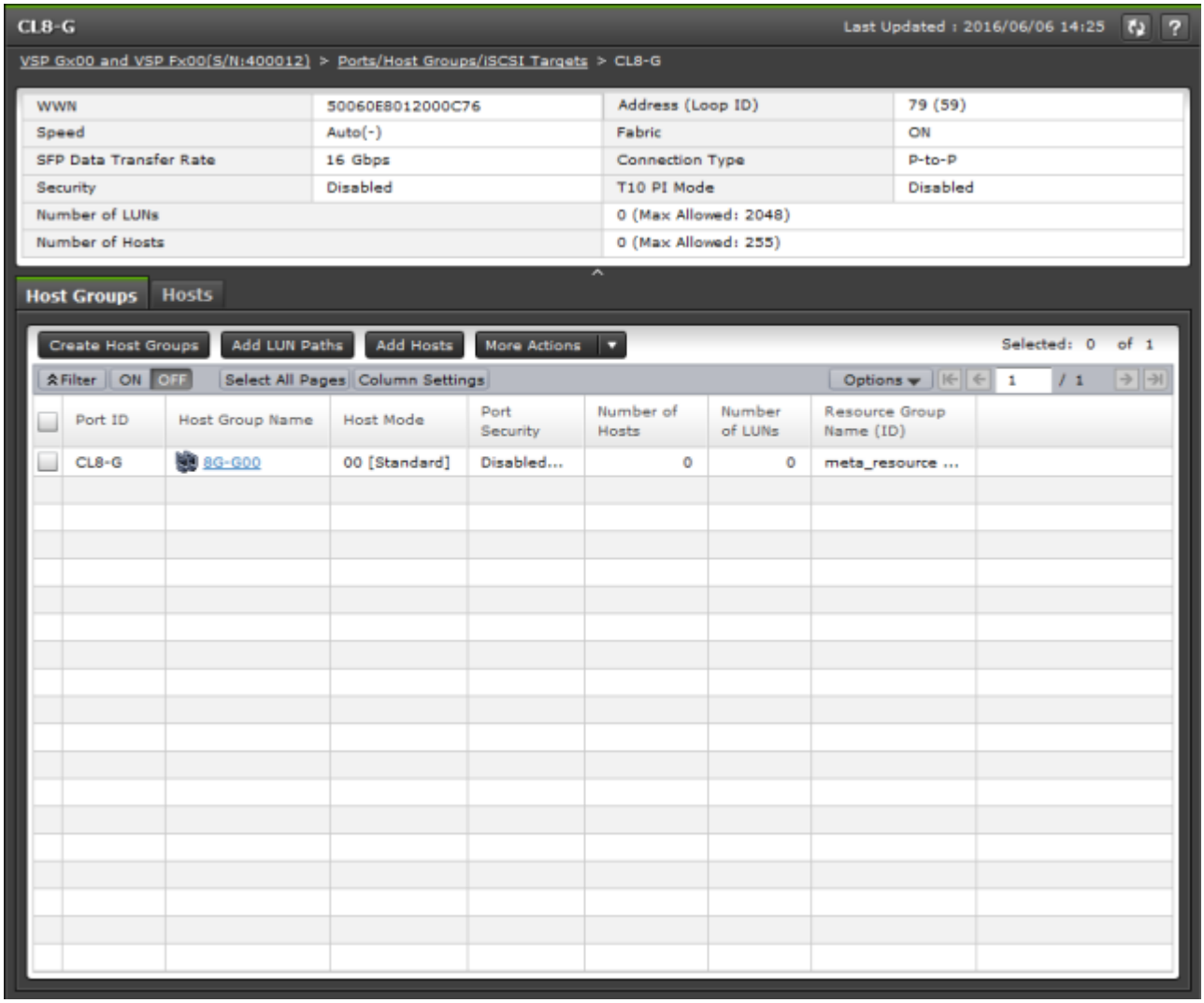
CHAP Users tab



Item	Description
Port ID	Identifier of the port. Clicking a port ID opens Port/iSCSI Targets: iSCSI Targets, Hosts and CHAP Users tabs.
User Name	User name. Clicking a user name opens the **CHAP User Properties** window.
Number of iSCSI Targets	Number of iSCSI Targets
Edit CHAP User	Opens the **Edit CHAP User** window.
Remove CHAP Users	Opens the **Remove CHAP Users** window.

Item	Description
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Port/Host Groups: Host Groups and Hosts tabs (Fibre Channel)



Summary

Item	Description
WWN	WWN of the port.

Item	Description
Speed	Data transfer speed for the selected Fibre Channel port in the unit of Gbps (Gigabit per second). Valid speeds are 2, 4, 8, 10, 16, or 32 Gbps. If Auto is set for the port speed, Auto (2, 4, 8, 10, 16, or 32 Gbps) is displayed. The value enclosed in parentheses is defined by the storage system. A hyphen (-) is displayed in the parentheses when the connection is not in the linkup status.
SFP Data Transfer Rate	SFP data transfer rate. A hyphen (-) is displayed for iSCSI ports.
Security	LUN security setting (Enabled or Disabled) on the port.
Address (Loop ID)	Address of the selected port.
Fabric	Indicates whether a fabric switch is used.
Connection Type	Topology of the selected port.
Number of LUNs	Total number of logical units set to the relevant port, and the maximum number of logical units that can be registered to the port.
Number of Hosts	Total number of hosts set to the relevant port, and the maximum number of hosts that can be registered to the port.
Number of Host Groups	Total number of host groups set to the relevant port, and the maximum number of host groups that can be registered to the port.

Host Groups tab

This tab provides information about the host groups assigned to the logged-on user.

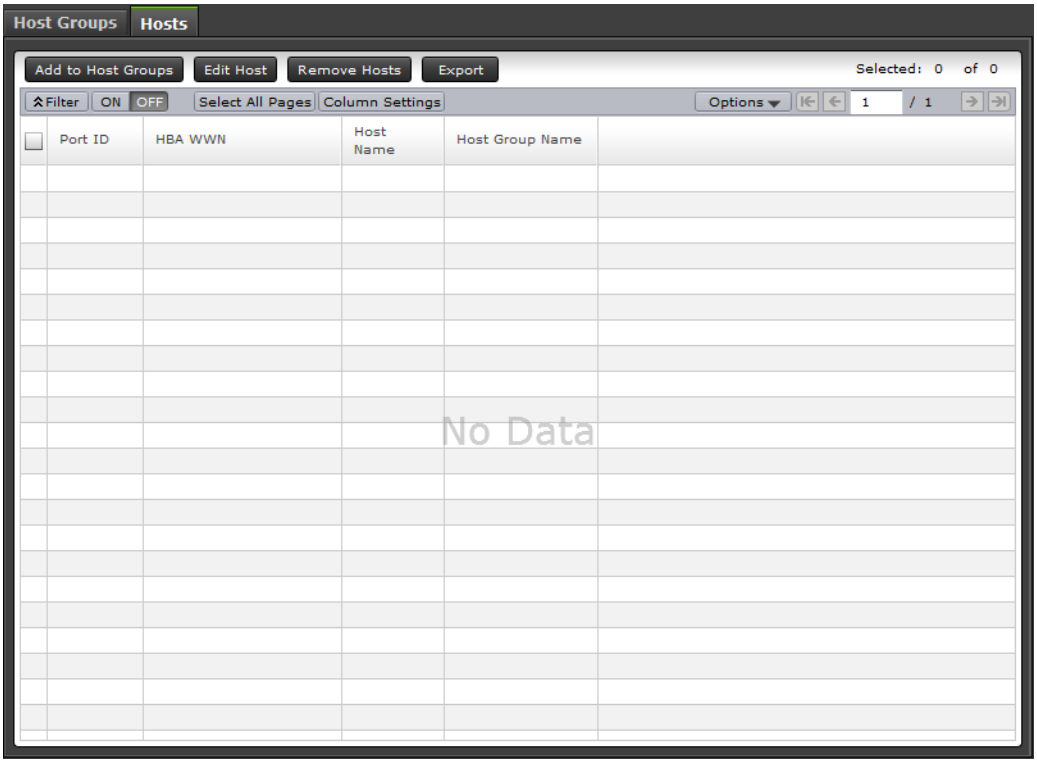
Item	Description
Port ID	Identifier of the port.
Host Group Name	Icons and names of host groups. Clicking a host group name opens Port/Host Groups: Hosts, LUNs, and Host Mode Options tabs.
Host Group ID[1]	Host group ID
Host Mode	Host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts in the host group.
Number of LUNs	Number of logical units in the host group.
ALUA Used [1]	Usage condition of ALUA. Yes: ALUA is used. No: ALUA is not used.
Asymmetric Access States[1]	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port.

Item	Description
	Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
Resource Group Name (ID)	Resource group name and identifier of the host group.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine that has the port.
Create Host Groups	Opens the **Create Host Groups** window.
Add LUN Paths	Opens the **Add LUN Paths** window.
Add Hosts	Opens the **Add Hosts** window.
Delete Host Groups[2]	Opens the **Delete Host Groups** window.
Edit Host Groups[2]	Opens the **Edit Host Groups** window.
Create Alternative LUN Paths[2]	Opens the **Create Alternative LUN Paths** window.
Edit Asymmetric Access States[2]	Opens the **Edit Asymmetric Access States** window. For details see Global-Active Device User Guide.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:

1. Does not appear by default. To display this item, change the **Column Settings** of the table option.
2. Available when you click More Actions.

Hosts tab



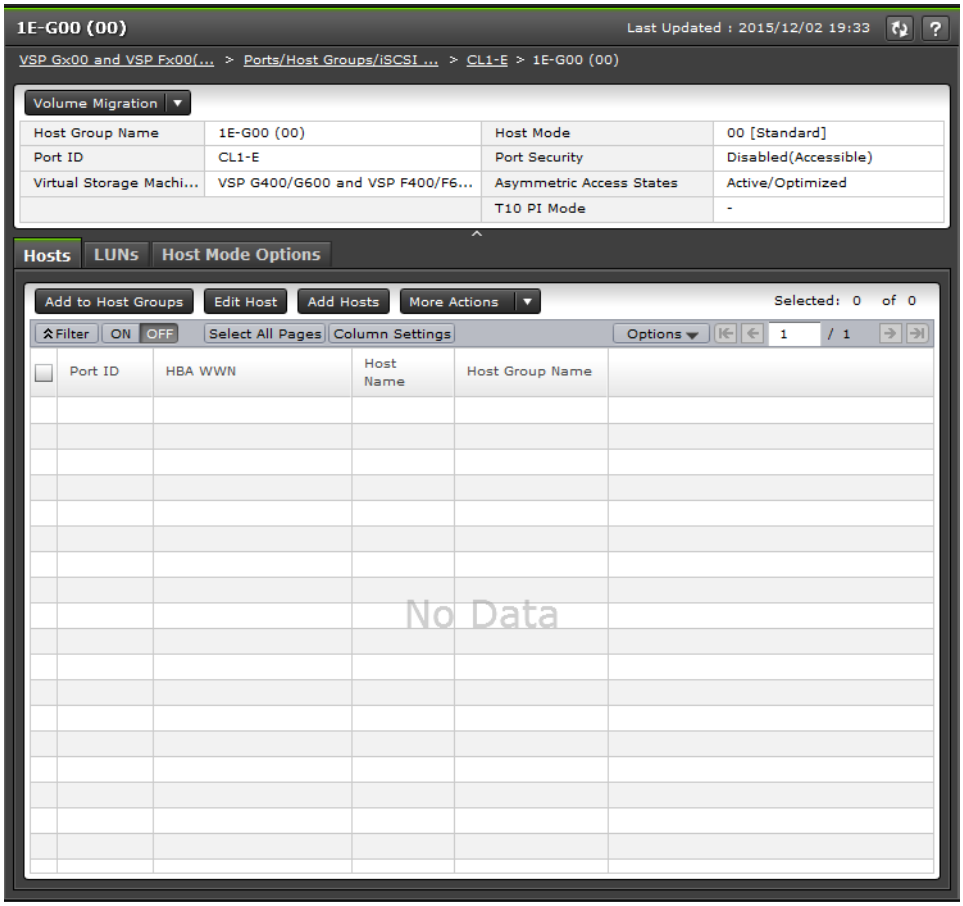
This tab provides information about the HBA WWNs that are registered to the host groups assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port.
HBA WWN	HBA WWNs and their icons.
Host Name	Name of the host.
Host Group Name	Name of the host group.
Add to Host Groups	Opens the **Add to Host Groups** window.
Edit Host	Opens the **Edit Host** window.
Remove Hosts	Opens the **Remove Hosts** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Ports / Host Groups / iSCSI Targets: Hosts, LUNs, Host Mode Options, and CHAP Users tabs

Fibre Channel

The **Ports/Host Groups/iSCSI Targets** window displays the following information on the Hosts, LUNs, and Host Mode Options tabs when a Fibre Channel port is selected.



Summary

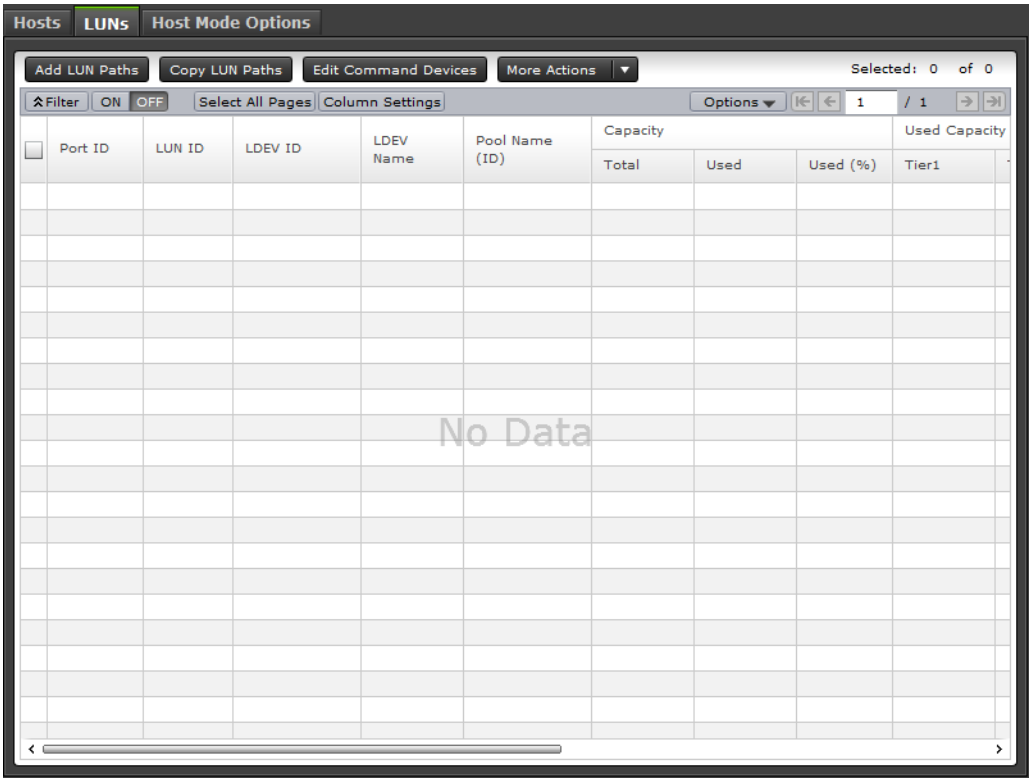
Item	Description
Volume Migration	• View Migration Plans: Opens the **View Migration Plans** window. • View Histories: Opens the **View Histories** window.
Host Group Name	Name of the host group.
Port ID	Identifier of the port.
Host Mode	Host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has a host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	T10 PI attribute setting (Enabled or Disabled) on the port.

Hosts tab

Item	Description
Port ID	Identifier of the port.
HBA WWN	HBA WWNs and their icons.
Host Name	Name of the host.
Host Group Name	Name of the host group.
Add to Host Groups	Opens the **Add to Host Groups** window.
Add Hosts	Opens the **Add Hosts** window
Edit Host	Opens the **Edit Host** window.
Remove Hosts[1]	Opens the **Remove Hosts** window.
Export[1]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Note:
1. Available when you click More Actions.

LUNs tab



This tab provides information about the LU paths that correspond to the LDEV assigned to the logged-in user.

Item	Description
Port ID	Identifier of the port.
LUN ID	Icons and identifiers of the logical unit. Clicking a LUN ID opens the **LUN Properties** window.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV. Clicking an LDEV ID takes you to the **LDEV Properties** window.
LDEV Name	Name of each LDEV.
Pool Name (ID)	Displays the pool name and pool ID. If the logical volume is not the volume other than V-VOL, a hyphen (-) is displayed.

Capacity	• Total: Displays the logical volume capacity.
	• Reserved: Displays the reserved capacity of the V-VOL.
	The displayed value of Reserved might be larger than the displayed value of Total due to following reasons:
	  • Reserved displays the reserved capacity that is rounded up on each page.
	
	  • The mapped capacity of V-VOL for Dynamic Provisioning includes the capacity of control information (168 MB is required per 3,145,548 MB).
	If used capacity is referenced during I/O or copy processing by software such as ShadowImage or Universal Replicator, the used capacity displayed might be different from the actual capacity even if the full allocation is enabled on the V-VOL. This is caused by a gap between the times that information is gathered about the mapped capacity and the reserved capacity.
	
	• Used: Displays the sum of the mapped capacity and the reserved capacity.
	The Used value displayed might be larger than the Total value displayed of due to following reasons:
	  • Used displays the sum of the mapped capacity and the reserved capacity that is rounded up on each page.
	  • The mapped capacity of DP-VOL includes the capacity of the control information (Requires a maximum of 168 MB per 3,145,548 MB).
	  • DP-VOL with data direct mapping enabled includes the control information (168 MB is required per 3,145,548 MB) and the capacity for one page.
	• Used(%): For the entire capacity of V-VOL, this item displays percentages of the sum of the mapped capacity and the reserved capacity. If the logical volume is not the volume other than V-VOL, a hyphen (-) is displayed.

Used Capacity	• Tier1: Displays the used capacity of tier 1. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or active flash, a hyphen (-) is displayed. • Tier2: Displays the used capacity of tier 2. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or active flash, or if tier 2 does not exist, a hyphen (-) is displayed. • Tier3: Displays the used capacity of tier 3. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or active flash, or if tier 3 does not exist, a hyphen (-) is displayed.

Item	Description
	The reserved capacity is not included in the used capacity for each tier of the V-VOL. Therefore, the Used value in the Capacity column may not correspond with the Used Capacity value.
Capacity Saving	Capacity saving setting of the LDEV: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used.
Capacity Saving Status	Status of the capacity saving function: • Enabling: The format for enabling the capacity saving function is being performed. • Rehydrating: The format for disabling the capacity saving function is being performed. • Deleting Volume: The deletion of DP-VOL whose capacity saving function is Enabled is being performed. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured. • - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data[1]	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Provisioning Type	Displays the type for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
CLPR	Cache logical partition number, displayed as *ID*:*CLPR*.
Full Allocation	Displays the status of the full allocation setting in a pool that is associated with the V-VOL. • Enable: Pages are reserved. • Disable: Pages are not reserved.
Tiering Policy	Displays the tiering policy name and ID. • All(0): Policy specified when all tiers in the pool are used. • Level1(1) to Level31(31): Policies selected from Level1 to Level31 are set to the V-VOL. From Level 6 (6) to Level 31 (31), the names of tiering policies can be changed. If these names have changed, the new names appear. • - (hyphen): The logical volume is not the Dynamic Tiering or active flash V-VOL.

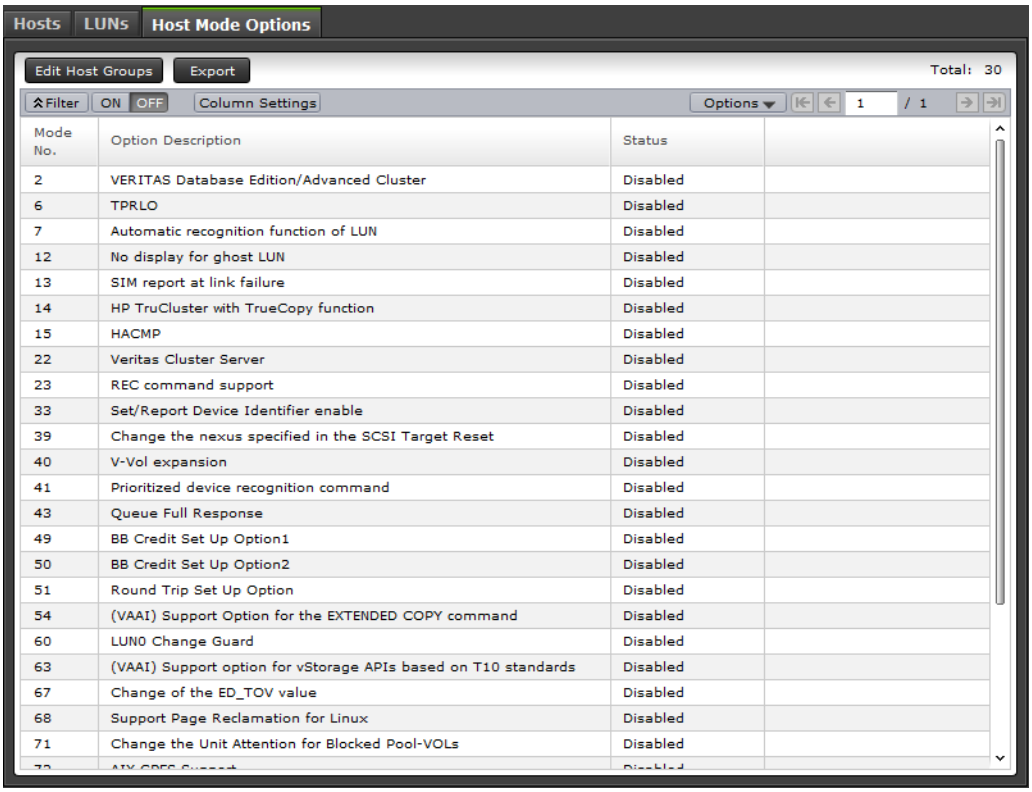
Item	Description
New Page Assignment Tier	Displays the new page assignment tier of the tiering policy. - (hyphen): The logical volume is not the Dynamic Tiering or active flash V-VOL.
Tier Relocation	Displays whether tier relocation is set to Enable or Disable. If the logical volume is not to the V-VOL of Dynamic Tiering or active flash, a hyphen (-) is displayed.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • - (hyphen): Volume for which the attribute is not defined.
Access Attribute[1]	Displays the access attribute of the LDEV.
Encryption[1]	Displays the information about parity group encryption. • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting. • Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume or migration volume. As for DP-VOL of Dynamic Provisioning , the pool-VOL in the pool of which DP-VOL belongs is an external volume, or the pool of which DP-VOL belongs is being blocked. This item is not displayed when using Virtual Storage Platform G200.
Number of Paths	Displays the total number of relevant paths and alternative paths.
ALUA Mode	Information about the ALUA mode. Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.
T10 PI[1]	Displays the LDEV's T10 PI attribute setting (Enabled or Disabled).

Item	Description
Data Direct Mapped LDEV	Displays the LDEV ID of the pool-VOL in the pool with data direct mapping enabled. Click the LDEV ID to open the **LDEV Properties** window. A hyphen (-) is displayed if the data direct mapping attribute is disabled.
Virtual Storage Machine[1]	Information about the virtual storage machine. • Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank. • Attribute[1]: Virtual LDEV attribute. If the attribute is not set for the LDEV, this column is blank.
Add LUN Paths	Opens the **Add LUN Paths** window.
Copy LUN Paths	Opens the **Copy LUN Path** window.
Edit Command Devices	Opens the **Edit Command Devices** window.
View Host-Reserved LUNs[2]	Displays the **Host-Reserved LUNs** window.
Delete LUN Paths[2]	Opens the **Delete LUN Paths** window.
Edit UUIDs[2]	Opens the **Edit UUIDs** window.
Delete UUIDs	Opens the **Delete UUIDs** window.
Create LDEVs	Opens the **Create LDEVs** window.
Edit LDEVs	Opens the **Edit LDEVs** window.
Format LDEVs	Opens the **Format LDEVs** window.
Shred LDEVs	Opens the **Shred LDEVs** window. For details, see *Hitachi Volume Shredder User Guide*.
Block LDEVs	Opens the **Block LDEVs** window.
Restore LDEVs	Opens the **Restore LDEVs** window.
Assign MP Blade	Opens the **Assign MP Blade** window.
Reclaim Zero Pages	Opens the **Reclaim Zero Pages** window.
Stop Reclaiming Zero Pages	Opens the **Stop Reclaiming Zero Pages** window.
Expand V-VOLs	Opens the **Expand V-VOL** window.
View Tier Properties	Opens the **View Tier Properties** window.
Migrate Volumes	Opens the **Migrate Volumes** window.
Force Delete Pairs	• TC Pairs: Opens the Force Delete Pairs (TC Pairs) window. For details see the *Hitachi TrueCopy® User Guide*. • UR Pairs: Opens the Force Delete Pairs (UR Pairs) window. For details see the *Hitachi Universal Replicator User Guide*.

Item	Description
	• GAD Pairs: Opens the Force Delete Pairs (GAD Pairs) window. For details see the *Global-Active Device User Guide*.
View ALUs / SLUs	Open the **ALUs / SLUs** window.
Unbind SLUs	Opens the **Unbind SLUs** window.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:
1. Does not appear by default. To display this item, change the Column Settings of the table option.
2. Available when you click More Actions.

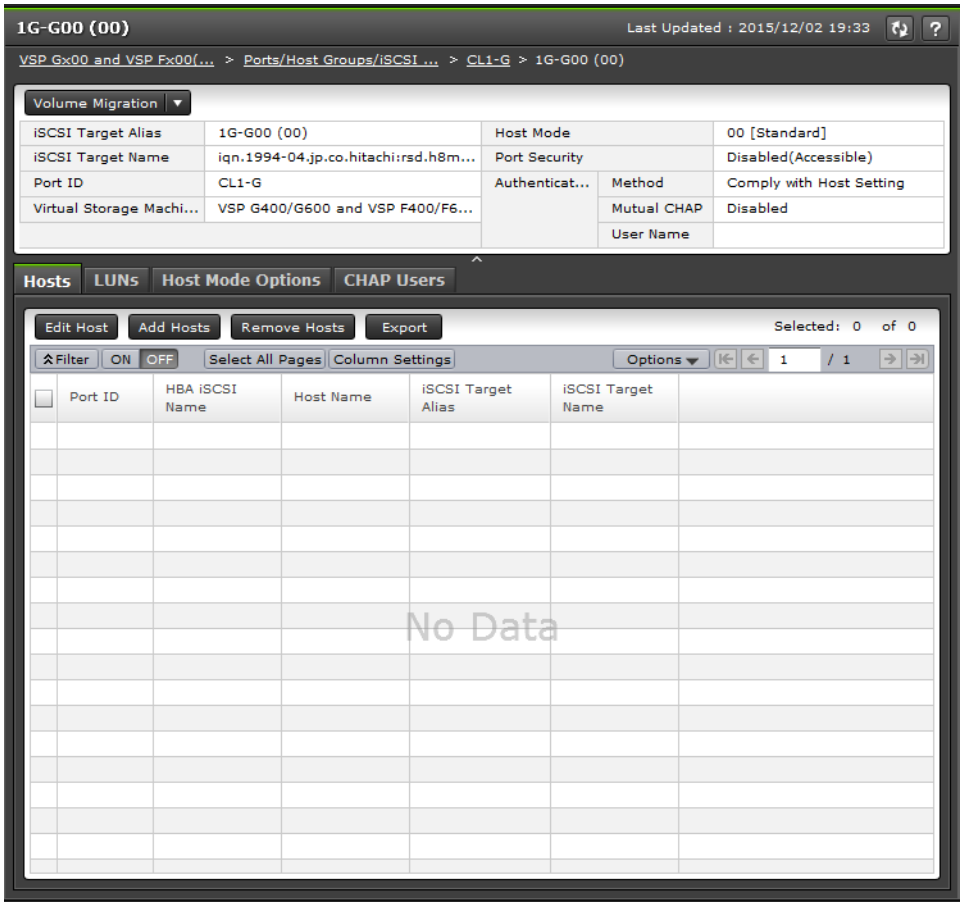
Host Mode Options tab



Item	Description
Mode No.	Number of the host mode option.
Option Description	Description of the host mode option.
Status	Setting (enable or disable) of the host mode option.
Edit Host Groups	Opens the **Edit Host Group** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

iSCSI

The **Ports/Host Groups/iSCSI Targets** window displays the following information on the Hosts, LUNs, Host Mode Options, and CHAP Users tabs when an iSCSI port is selected.



Summary

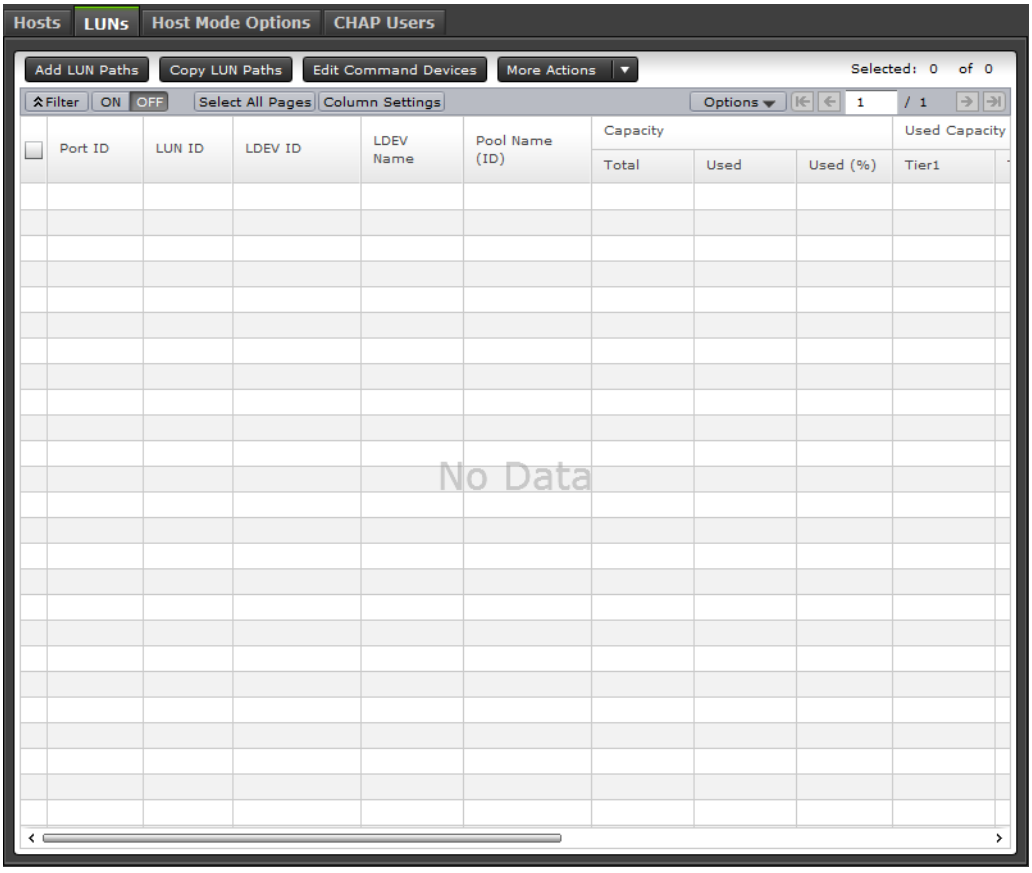
Item	Description
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Port ID	Identifier of the port.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the port.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled. • User name

Host tab

This tab provides information about the iSCSI Names that are registered to the iSCSI targets assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Names and their icons
Host Name	Name of hosts.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Edit Host	Opens the **Edit Host** window.
Add Hosts	Opens the **Add Hosts** window.
Remove Hosts	Opens the **Remove Hosts** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

LUNs tab



This tab provides information about the LU paths that correspond to the LDEV assigned to the logged-in user.

Item	Description
Port ID	Identifier of the port.
LUN ID	Icons and identifiers of the logical unit. Click a LUN ID to open the **LUN Properties** window.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV. Click an LDEV ID to open the **LDEV Properties** window.
LDEV Name	Name of each LDEV.
Pool Name (ID)	Displays the pool name and pool ID. If the logical volume is not the volume other than V-VOL, a hyphen (-) is displayed.

Capacity	• Total: Displays the logical volume capacity.
	• Reserved: Displays the reserved capacity of the V-VOL.
	The displayed value of Reserved might be larger than the displayed value of Total due to following reasons:
	  • Reserved displays the reserved capacity that is rounded up on each page.
	
	  • The mapped capacity of V-VOL for Dynamic Provisioning includes the capacity of control information (168 MB is required per 3,145,548 MB).
	If used capacity is referenced during I/O or copy processing by software such as ShadowImage or Universal Replicator, the used capacity displayed might be different from the actual capacity even if the full allocation is enabled on the V-VOL. This is caused by a gap between the times that information is gathered about the mapped capacity and the reserved capacity.
	• Used: Displays the sum of the mapped capacity and the reserved capacity.
	The Used value displayed might be larger than the Total value displayed of due to following reasons:
	  • Used displays the sum of the mapped capacity and the reserved capacity that is rounded up on each page.
	
	  • The mapped capacity of DP-VOL includes the capacity of the control information (Requires a maximum of 168 MB per 3,145,548 MB).
	
	  • DP-VOL with data direct mapping enabled includes the control information (168 MB is required per 3,145,548 MB) and the capacity for one page.
	• Used(%): For the entire capacity of V-VOL, this item displays percentages of the sum of the mapped capacity and the reserved capacity. If the logical volume is not the volume other than V-VOL, a hyphen (-) is displayed.

Used Capacity	• Tier1: Displays the used capacity of tier 1. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or active flash, a hyphen (-) is displayed. • Tier2: Displays the used capacity of tier 2. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or active flash, or if tier 2 does not exist, a hyphen (-) is displayed. • Tier3: Displays the used capacity of tier 3. If the logical volume is not the volume other than V-VOL for Dynamic Tiering or

Item	Description
	active flash, or if tier 3 does not exist, a hyphen (-) is displayed. The reserved capacity is not included in the used capacity for each tier of the V-VOL. Therefore, the Used value in the Capacity column may not correspond with the Used Capacity value.
Capacity Saving	Capacity saving setting of the LDEV: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used.
Capacity Saving Status	Status of the capacity saving function: • Enabling: The format for enabling the capacity saving function is being performed. • Rehydrating: The format for disabling the capacity saving function is being performed. • Deleting Volume: The deletion of DP-VOL whose capacity saving function is Enabled is being performed. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured. • - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data[1]	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Provisioning Type	Displays the type for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
CLPR	Cache logical partition number, displayed as *ID*:*CLPR*.
Full Allocation	Displays the status of the full allocation setting in a pool that is associated with the V-VOL. • Enable: Pages are reserved. • Disable: Pages are not reserved.
Tiering Policy	Displays the tiering policy name and ID. • All(0): Policy specified when all tiers in the pool are used. • Level1(1) to Level31(31): Policies selected from Level1 to Level31 are set to the V-VOL.

Item	Description
	• - (hyphen): The logical volume is not the Dynamic Tiering or active flash V-VOL.
New Page Assignment Tier	Displays the new page assignment tier of the tiering policy. - (hyphen): The logical volume is not the Dynamic Tiering or active flash V-VOL.
Tier Relocation	Displays whether tier relocation is set to Enable or Disable. If the logical volume is not to the V-VOL of Dynamic Tiering or active flash, a hyphen (-) is displayed.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • - (hyphen): Volume in which the attribute is not defined.
Access Attribute[1]	Displays the access attribute of the LDEV.

Encryption[1]	Displays the information about parity group encryption.
	• Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated with the pool whose pool-VOLs are enabled of the encryption setting.
	• Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting.
	• Mixed: This status is displayed when two or more of the following are specified as pool-VOLs:
	  ○ Volume encryption setting is enabled.
	  ○ Volume encryption setting is disabled.
	  ○ External volume
	
	Caution: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled.
	• - (hyphen): External volume or migration volume. As for DP-VOL of Dynamic Provisioning , the pool-VOL in the pool of which DP-VOL belongs is an external volume, or the pool of which DP-VOL belongs is being blocked.
	
	This item is not displayed when using Virtual Storage Platform G200.

Number of Paths	Displays the total number of relevant paths and alternative paths.
ALUA Mode	Information about the ALUA mode. Enabled: The LDEV can be used in ALUA. Disabled: The LDEV cannot be used in ALUA.
Data Direct Mapped LDEV	Displays LDEV ID of pool-VOL in the pool with data direct mapping enabled. Click the LDEV ID to open the **LDEV Properties** window. A hyphen (-) is displayed if the data direct mapping attribute is disabled.
Virtual Storage Machine[1]	Information about the virtual storage machine.

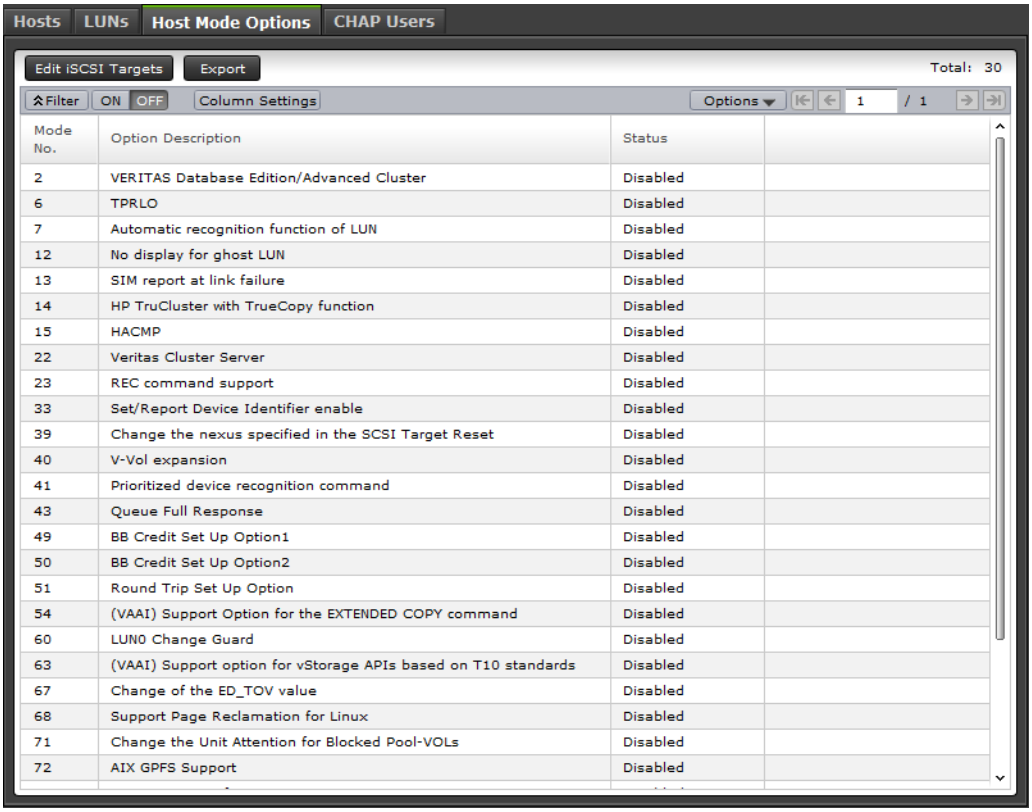
Item	Description
	• Model / Serial Number[1]: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID[1]: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name[1]: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID[1]: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank. • Attribute[1]: Virtual LDEV attribute. If the attribute is not set for the LDEV, this column is blank.
Add LUN Paths	Opens the **Add LUN Paths** window.
Copy LUN Paths	Opens the **Copy LUN Path** window.
Edit Command Devices	Opens the **Edit Command Devices** window.
View Host-Reserved LUNs[2]	Displays the **Host-Reserved LUNs** window.
Delete LUN Paths[2]	Opens the **Delete LUN Paths** window.
Edit UUIDs[2]	Opens the **Edit UUIDs** window.
Delete UUIDs [2]	Opens the **Delete UUIDs** window.
Create LDEVs[2]	Opens the **Create LDEVs** window.
Edit LDEVs[2]	Opens the **Edit LDEVs** window.
Format LDEVs[2]	Opens the **Format LDEVs** window.
Shred LDEVs [2]	Opens the **Shred LDEVs** window. For details, see *Hitachi Volume Shredder User Guide*.
Block LDEVs[2]	Opens the **Block LDEVs** window.
Restore LDEVs[2]	Opens the **Restore LDEVs** window.
Assign MP Blade[2]	Opens the **Assign MP Blade** window.
Reclaim Zero Pages[2]	Opens the **Reclaim Zero Pages** window.
Stop Reclaiming Zero Pages[2]	Opens the **Stop Reclaiming Zero Pages** window.
Expand V-VOLs[2]	Opens the **Expand V-VOL** window.
View Tier Properties[2]	Opens the **View Tier Properties** window.
Migrate Volumes[2]	Opens the **Migrate Volumes** window.
Interrupt LDEV Task[2]	**Select Shred and the Interrupt Shredding Task** window is displayed.
Force Delete Pairs[2]	• TC Pairs: Opens the Force Delete Pairs (TC Pairs) window. For details see the *Hitachi TrueCopy® User Guide*. • UR Pairs: Opens the Force Delete Pairs (UR Pairs) window. For details see the *Hitachi Universal Replicator User Guide*. • GAD Pairs: Opens the Force Delete Pairs (GAD Pairs) window. For details see the *Global-Active Device User Guide*.
View ALUs / SLUs [2]	Open the **ALUs / SLUs** window.
Unbind SLUs[2]	Opens the **Unbind SLUs** window.

Item	Description
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Notes:

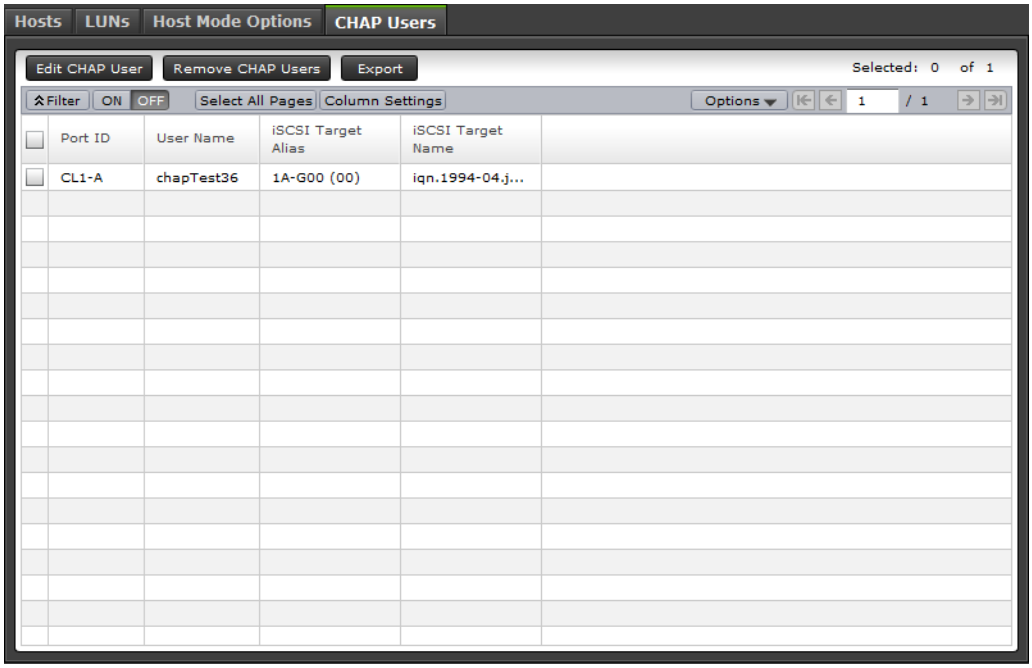
1. Does not appear by default. To display this item, change the Column Settings of the table option.
2. Available when you click More Actions.

Host Mode Options tab



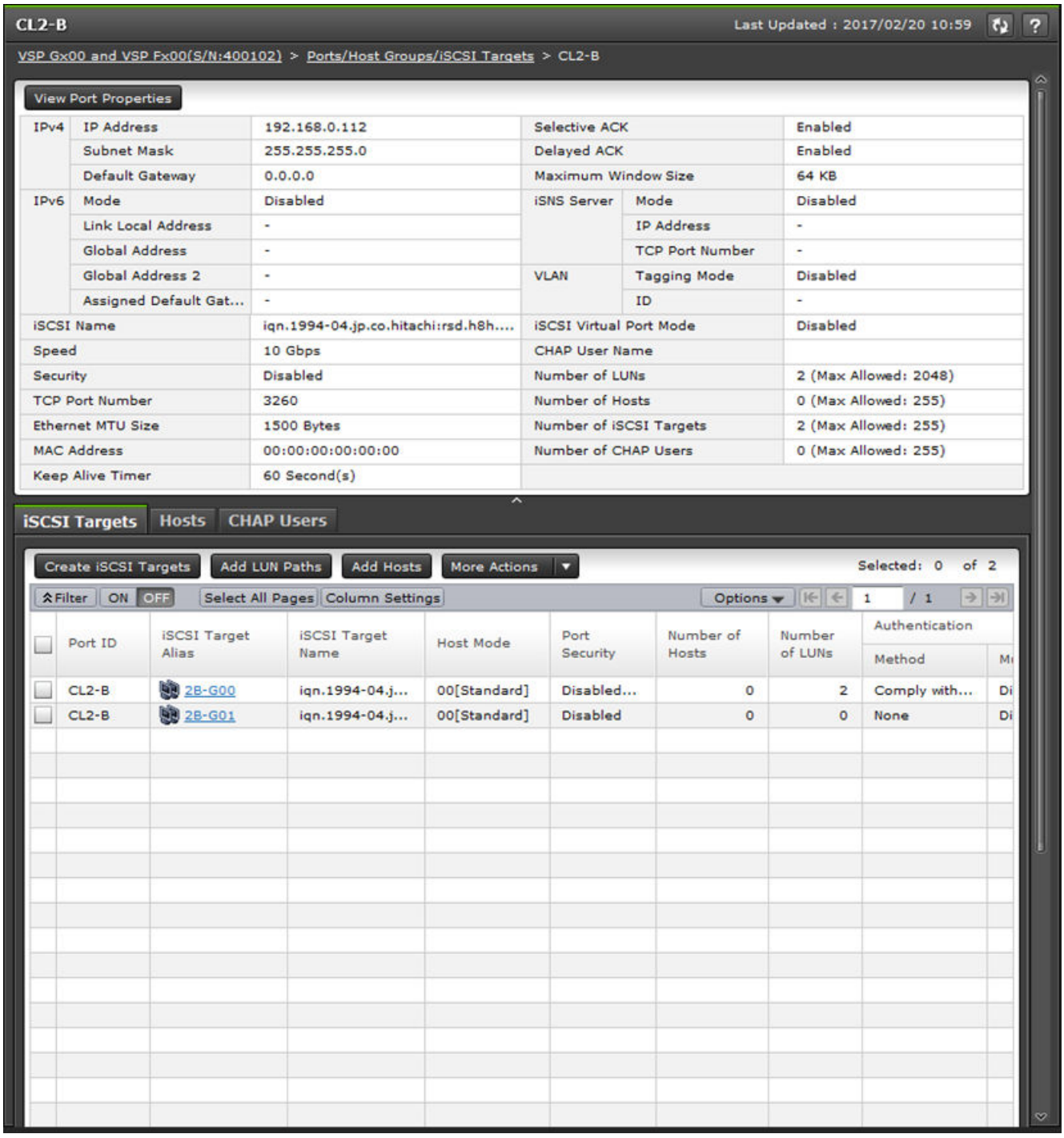
Item	Description
Mode No.	Number of the host mode option.
Option Description	Description of the host mode option.
Status	Setting (enable or disable) of the host mode option.
Edit iSCSI Targets	Opens the **Edit iSCSI Targets** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

CHAP Users tab



Item	Description
Port ID	Identifier of the port.
User Name	User name. Click a user name to open the **CHAP User Properties** window.
Number of iSCSI Targets	Number of iSCSI Targets
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Edit CHAP User	Opens the **Edit CHAP User** window.
Remove CHAP Users	Opens the **Remove CHAP Users** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Ports/iSCSI Targets: iSCSI Targets, Hosts, and CHAP Users tabs (iSCSI)



Summary

Item	Description
IPv4	Information about the setting for IPv4: • IP Address: IP address for the port. • Subnet Mask: Subnet mask for the port. • Default Gateway: Default gateway for the port. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
IPv6	Information about the setting for IPv6: • Mode: IPv6 setting (Enabled or Disabled) for the port. • Link Local Address: Link local address for the port. • Global Address: Global address for the port. • Global Address 2: Global address for the port. • Assigned Default Gateway: Assigned default gateway address for the port. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
iSCSI name	iSCSI name of the port.
Speed	Data transfer speed. Valid speeds are 1 or 10 Gbps. If Auto is set for the port speed, Auto (1 or 10 Gbps) appears. The value enclosed in parentheses is defined by the storage system.
Security	LUN security setting (Enabled or Disabled) for the port.
TCP Port Number	TCP port number. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Ethernet MTU Size	MTU size on Ethernet. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
MAC Address	MAC address.
Keep Alive Timer	Keep alive timer setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Selective ACK	Selective ACK setting (Enabled or Disabled) on the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Delayed ACK	Delayed ACK setting (Enabled or Disabled) on the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Maximum Window Size	Maximum window size setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
iSNS Server	Information about the iSNS server. • Mode: iSNS server setting (Enabled or Disabled) for the port. • IP Address: IP address of the iSNS server.

Item	Description
	• TCP Port Number: TCP port number of the iSNS server.
VLAN	Information about VLAN: • Tagging Mode: Tagging mode setting (Enabled or Disabled) for the port. • ID: VLAN identifier. • - (hyphen): The iSCSI virtual port mode is enabled for the port.
iSCSI Virtual Port Mode	Information about the setting of the iSCSI virtual port mode for a port: • Enabled: The iSCSI virtual port mode is enabled for the port. • Disabled: The iSCSI virtual port mode is enabled for the port. • - (hyphen): The port does not support the iSCSI virtual port mode.
CHAP User Name	Information about the CHAP user name.
Number of LUNs	Total number of logical units set to the relevant port, and the maximum number of logical units that can be registered to the port.
Number of Hosts	Total number of hosts set to the relevant port, and the maximum number of hosts that can be registered to the port.
Number of iSCSI Targets	Total number of iSCSI targets set to the relevant port, and the maximum number of iSCSI targets that can be registered to the port.
Number of CHAP Users	Total number of CHAP users set to the relevant port, and the maximum number of CHAP users that can be registered to the port.
View Port Properties	Opens the **Port Properties** window.

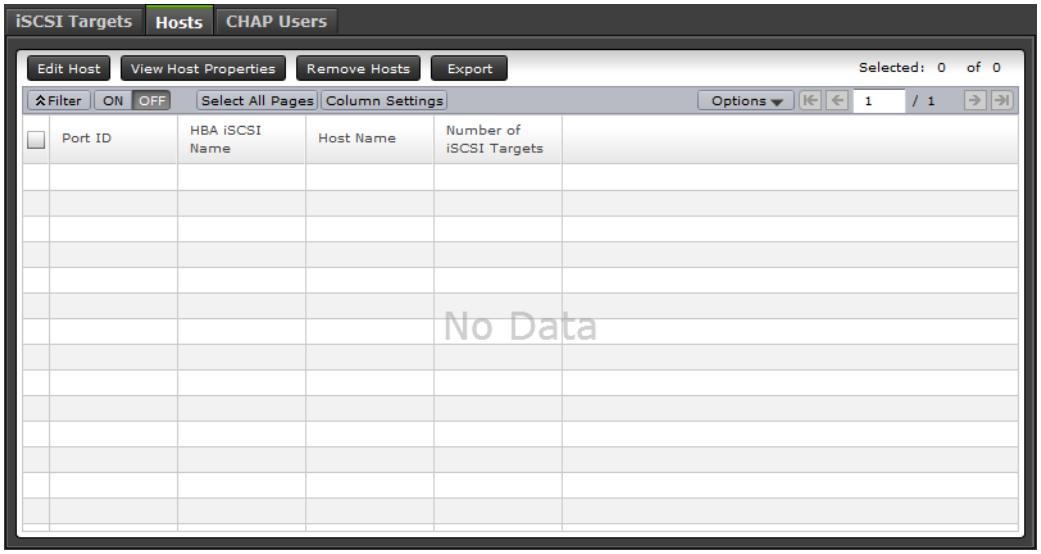
iSCSI Targets tab

This tab provides information about the host groups that are assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	Icons and names of the iSCSI target alias.
iSCSI Target ID[1]	iSCSI target ID.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Number of LUNs	Number of logical units.

Item	Description
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Number of Users
Resource Group Name (ID)	Resource group name and identifier of the iSCSI target.
Virtual Storage Machine[1]	Model name and serial number of the virtual storage machine that has the iSCSI target.
Create iSCSI Targets	Opens the **Create iSCSI Targets** window.
Add LUN Paths	Opens the **Add LUN Paths** window.
Add Hosts	Opens the **Add Hosts** window.
Delete iSCSI Targets[2]	Opens the **Delete iSCSI Targets** window.
Edit iSCSI Targets[2]	Opens the **Edit iSCSI Targets** window.
Create Alternative LUN Paths[2]	Opens the **Create Alternative LUN Paths** window.
Add CHAP Users[2]	Opens the **Add CHAP Users** window.
Remove Target CHAP Users[2]	Opens the **Remove Target CHAP Users** window.
Export[2]	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.
Notes: [1] Does not appear by default. To display this item, change the Column Settings of the table option. [2] Appears when you click More Actions.	

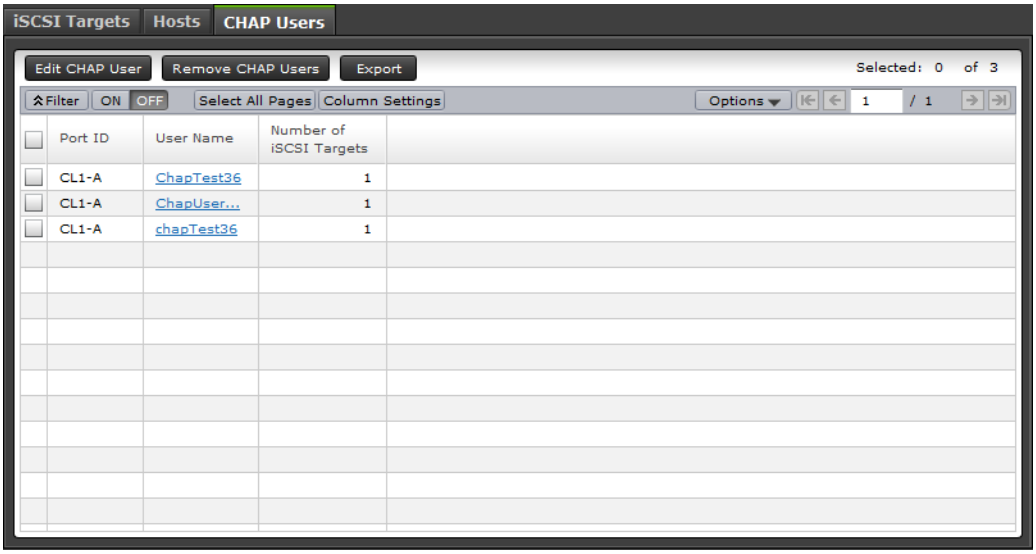
Hosts tab



This tab provides information about the iSCSI Names that are registered to the iSCSI targets assigned to the logged-on user.

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Names and their icons.
Host Name	Name of hosts.
Number of iSCSI Targets	Number of iSCSI targets.
Edit Host	Opens the **Edit Host** window.
View Host Properties	Opens the **Host Properties** window
Remove Hosts	Opens the **Remove Hosts** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

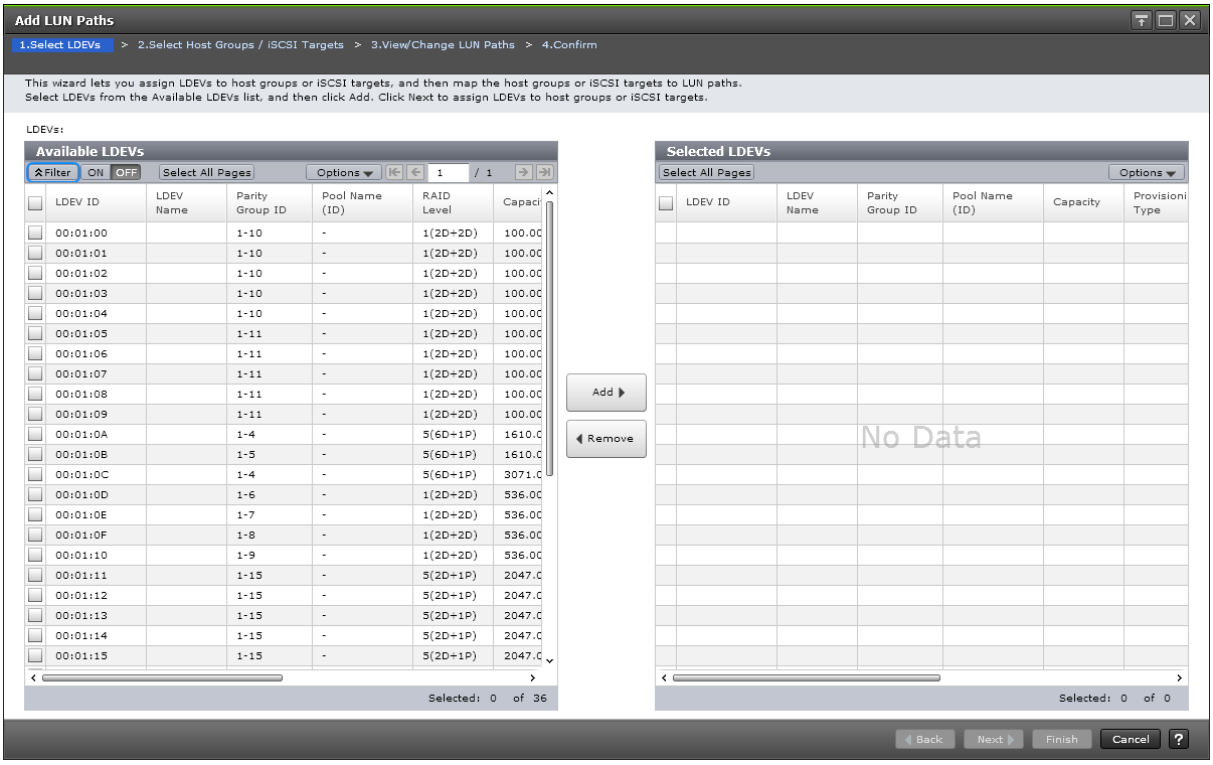
CHAP Users



Item	Description
Port ID	Identifier of the port.
User Name	User name. Clicking a user name opens the **CHAP User Properties** window.
Number of iSCSI Targets	Number of iSCSI Targets
Edit CHAP User	Opens the **Edit CHAP User** window.
Remove CHAP Users	Opens the **Remove CHAP Users** window.
Export	Opens a window where you can export configuration information listed in the table to a file that can be used for multiple purposes, such as backup or reporting.

Add LUN Paths wizard

Select LDEVs window



Available LDEVs table

This table lists logical volumes for which LU paths can be established. Only the LDEVs available to the logged-on user are available.

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Parity Group ID	Identifier of the parity group.
Pool Name (ID)	Pool name and pool identifier. If the LDEV is not used as a pool-VOL, a hyphen (-) appears.
RAID Level	Displays the RAID level. If multiple RAID levels exist in a pool, Mixed appears in this field.
Capacity	Size of each logical volume.
Provisioning Type	Provisioning type for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device.

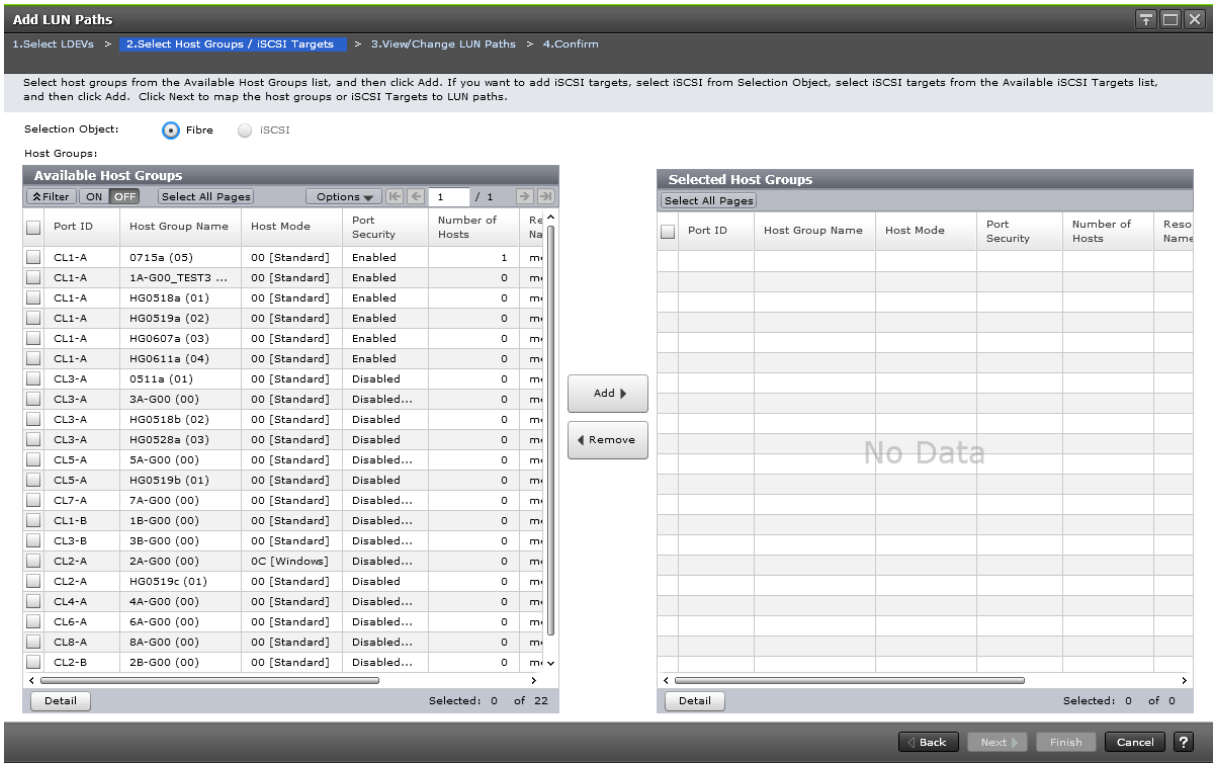
Item	Description
	• Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Hyphen (-): Volume in which the attribute is not defined.
Number of Paths	Number of paths set for the LDEV.
ALUA Mode	Information about the ALUA mode. Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the LDEV.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the LDEV.
Add	Adds logical volumes selected from the Available LDEVs table to the Selected LDEVs table.
Remove	Removes logical volumes from the Selected LDEVs table.

Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Parity Group ID	Identifier of the parity group.
Pool Name (ID)	Pool name and pool identifier. If the LDEV is not used as a pool-VOL, a hyphen (-) appears.
Capacity	Size of each logical volume.
Provisioning Type	Provisioning type for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute.

Item	Description
	• NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Hyphen (-): Volume in which the attribute is not defined.
Number of Paths	Number of paths set for the LDEV.
ALUA Mode	Information about the ALUA mode. • Enabled: LDEV can be used in ALUA. • Disabled: LDEV cannot be used in ALUA.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the LDEV.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the LDEV.

Select Host Groups/iSCSI Targets window



Selection Object

Item	Description
Selection Object	• Fibre: Select to add LUN paths to host groups.

Item	Description
	• iSCSI target: Select to add LUN paths to iSCSI targets. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed.

Available Host Groups table

This table lists host groups for which LU paths can be established. Only the host groups assigned to the logged-on user are available. However, if NAS Platform (User LU) is selected in Selection Object, host groups do not appear in this table.

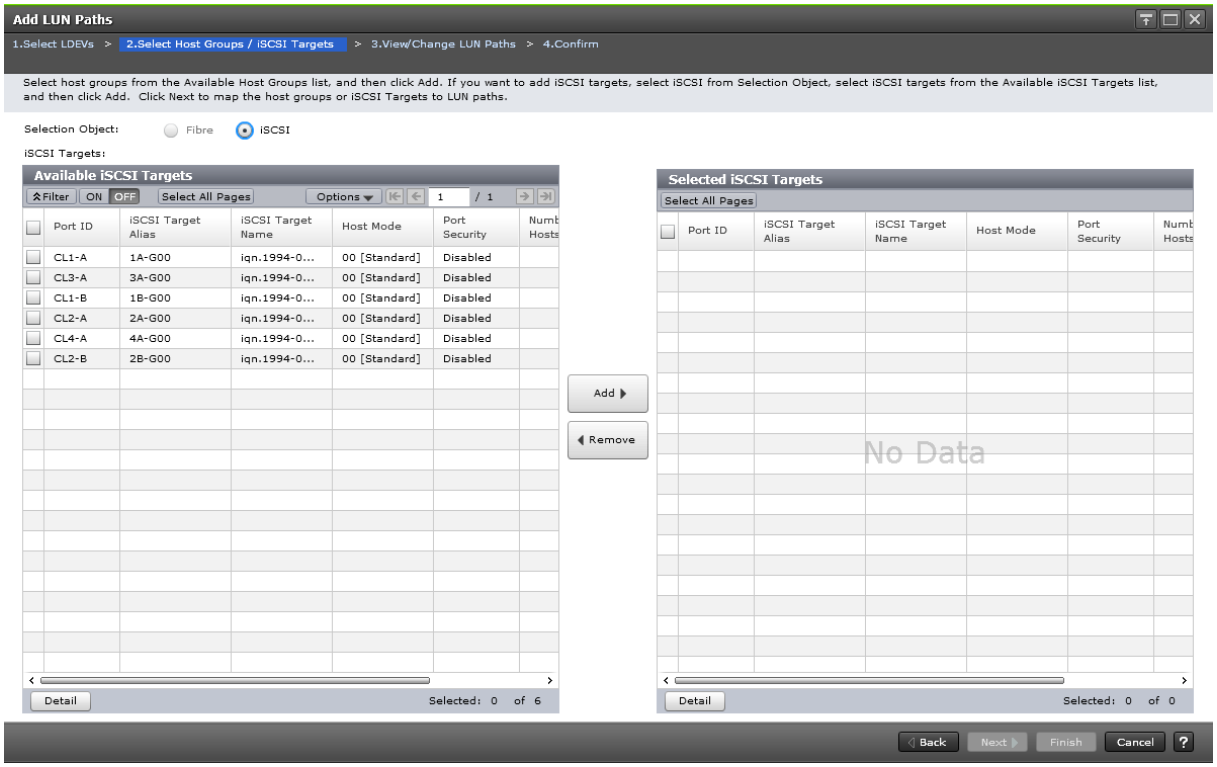
Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the host group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the port.
Detail	Details about the selected host group.
Add	Adds host groups selected from the Available Host Groups table to the Selected Host Groups table. However, if NAS Platform (User LU) is selected in Selection Object, host groups do not appear in this table.
Remove	Removes the selected host groups from the Selected Host Groups table. However, if NAS Platform (User LU) is selected in Selection Object, host groups do not appear in this table.

Selected Host Groups table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.

Item	Description
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the host group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the port.
Detail	Details about the selected host group.

iSCSI



Available iSCSI Targets table

This table lists iSCSI targets for which LU paths can be established. Only the iSCSI targets assigned to the logged-on user are available.

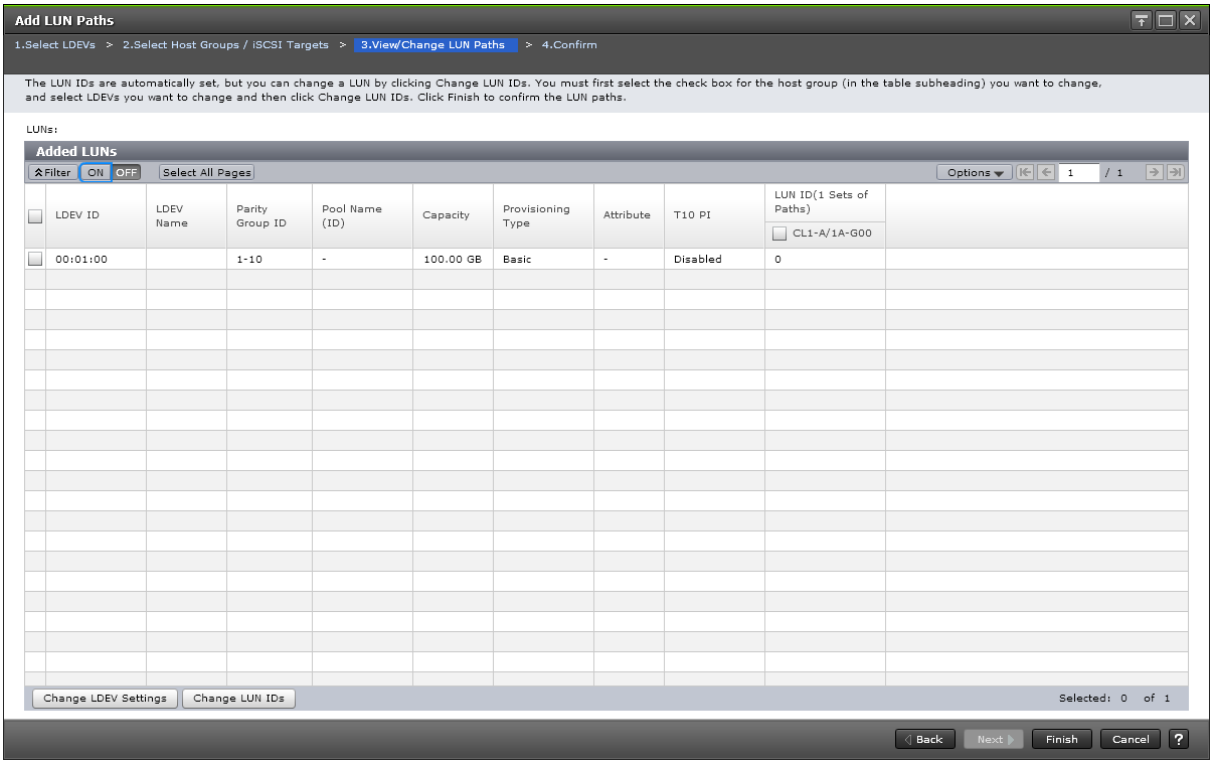
Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target ID	iSCSI target ID.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Resource Group Name (ID)	Resource group name and identifier of the iSCSI target.
Detail	Details about the selected iSCSI target.
Add	Adds host groups selected from the Available iSCSI Targets table to the Selected iSCSI Targets table.
Remove	Removes the selected host groups from the Selected iSCSI Targets table.

Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target ID	iSCSI target ID.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Resource Group Name (ID)	Resource group name and identifier of the iSCSI target.

Add LUN Paths window

This window provides information about LUs that are already set. You can view information about the LUN and change the LUN ID.



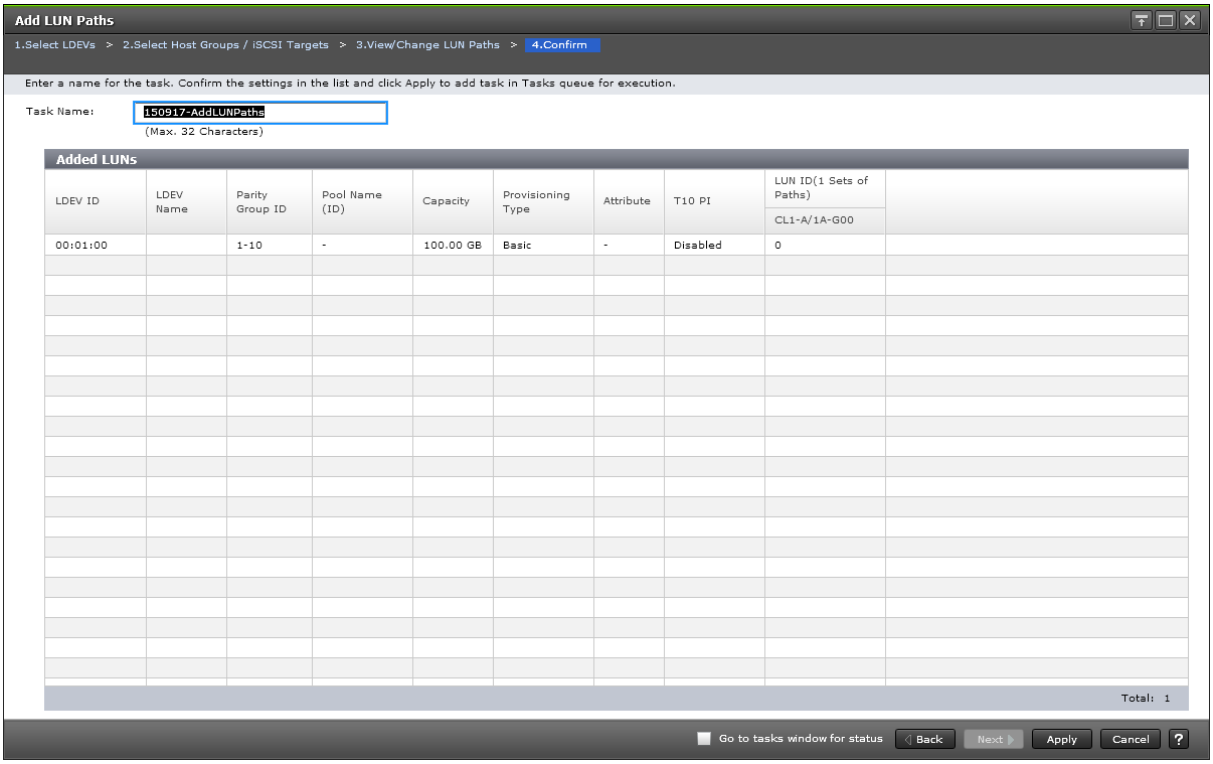
Added LUNs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Parity Group ID	Identifier of the parity group.
Pool Name (ID)	Pool names and pool identifiers. If the LDEV is not used as a pool-VOL, a hyphen (-) appears.
Capacity	Size of each logical volume.
Provisioning Type	Provisioning type of the logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed.

Item	Description
	• NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Hyphen (-): Volume in which the attribute is not defined.
ALUA Mode	Information about the ALUA mode. Enabled: The LDEV can be used in ALUA. Disabled: The LDEV cannot be used in ALUA.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
LUN ID ((*number-of-LUNs)* Sets of Paths)	Number of assigned LUNs.
port-ID/ host-group-name (or iSCSI target name)	Name of the port and the host group (or iSCSI target name) of assigned LUNs. This item appears according to the number of assigned LUNs.
Change LDEV Settings	To change the LDEV name setting, select an LDEV and then click this button.
Change LUN IDs	To change the LUN setting, select the check box in the table column of *port-ID*/*host-group-name*, select the target LDEV, and then click this button.

Add LUN Paths confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



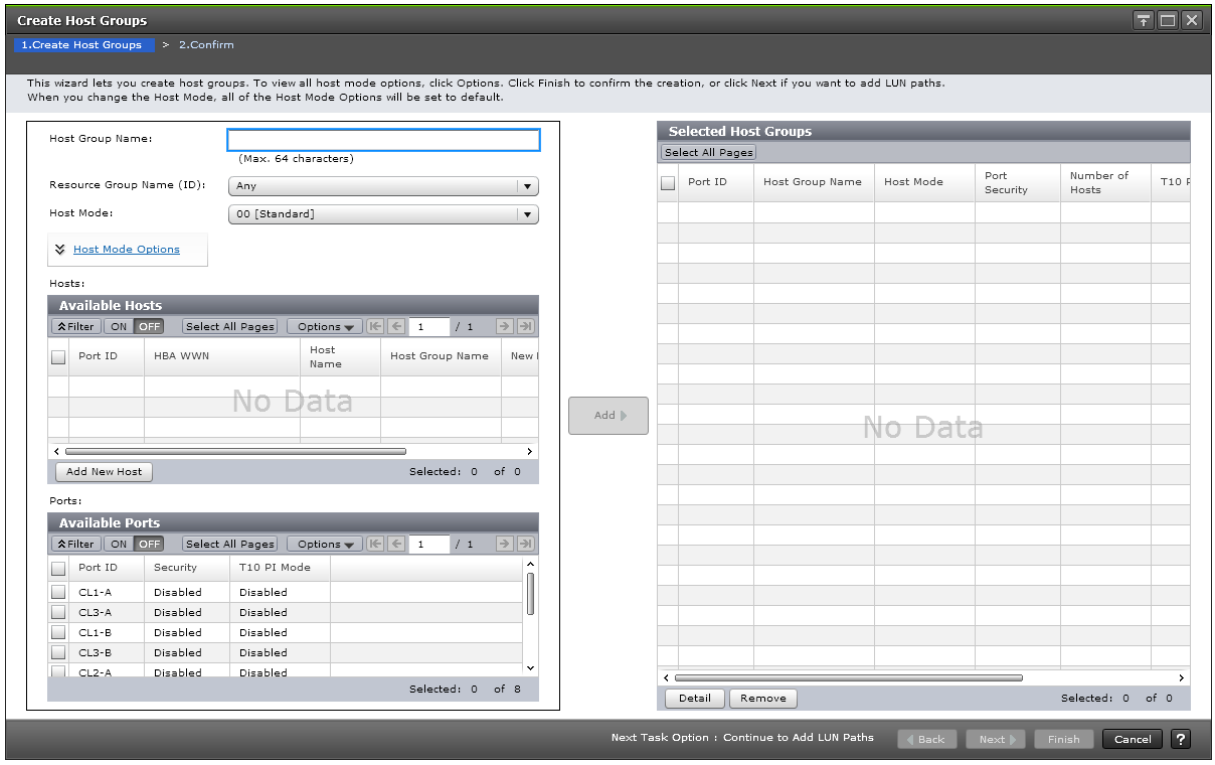
Added LUNs table

Item	Description
LDEV ID	Identifier of the LDEV.
LDEV Name	Name of the LDEV.
Parity Group ID	Identifier of the parity group.
Pool Name (ID)	Pool names and pool identifiers. If the LDEV is not used as a pool-VOL, a hyphen (-) appears.
Capacity	Size of each logical volume.
Provisioning Type	Provisioning types for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.

Item	Description
	• Hyphen (-): Volume in which the attribute is not defined.
ALUA Mode	Information about the ALUA mode. Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
LUN ID ((*number-of-LUNs)* Sets of Paths)	Number of assigned LUNs.
port-ID/ host-group-name (or iSCSI target name)	Name of the port and the host group (or iSCSI target name) of assigned LUNs. This item appears according to the number of assigned LUNs.

Create Host Groups wizard

Create Host Groups window



Item	Description
Host Group Name	Enter the name of the host group. As a host group name, you can use single-byte ASCII characters (alphanumeric characters and symbols) up to 64 characters. You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host group name.
Resource Group Name (ID)	Select the resource group in which the host group is created. If Any is selected, among all ports being allocated to the user, ports where the host group can be add are available in the Available Ports table. If other than Any is selected, among ports assigned to the selected resource group, ports where the host group can be add are available in the Available Ports table.
Host Mode	Select the host mode from the list.
Add	Adds the settings to the Selected Host Groups table.

Available Hosts table

This table lists information about the registered hosts.

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.
Host Group Name	Name of the host group.
New Host	Indicates whether this is a new host. • Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Add New Host	Adds a new host. Or, select host bus adapters and then click this button to assign a nickname to the host bus adapter.

Available Ports table

This table lists the registered ports.

Item	Description
Port ID	Identifier of the port.
Security	LUN security setting (Enabled or Disabled) on the port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Host Mode Options table

Item	Description
Mode No.	The ID number of the host mode option.
Option Description	The description of host mode option.
Status	The setting status (Enabled or Disabled) of the host mode option.
Enabled	Indicates that the host mode option is enabled.
Disabled	Indicates that the host mode option is disabled.

Selected Host Groups table

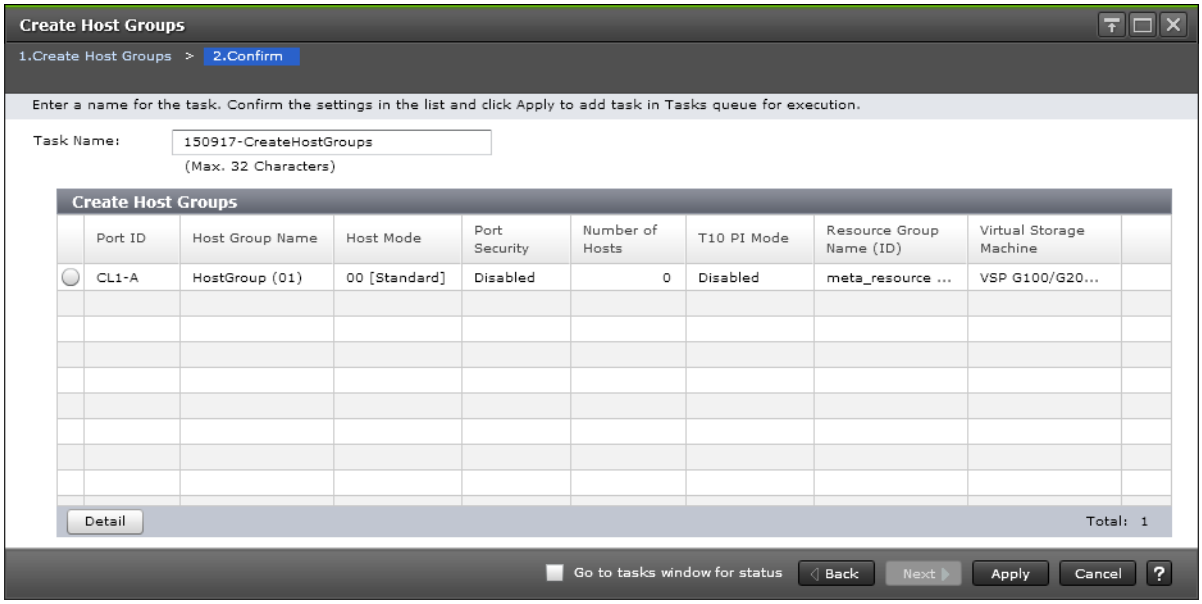
Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the host group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the host group.
Detail	Details about the selected host group.
Remove	Removes the selected host groups from the Selected Host Groups table.

Next Task Option

Click Next to go to the task setting window.

Create Host Groups confirmation window

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, and then click Help.



Create Host Groups table

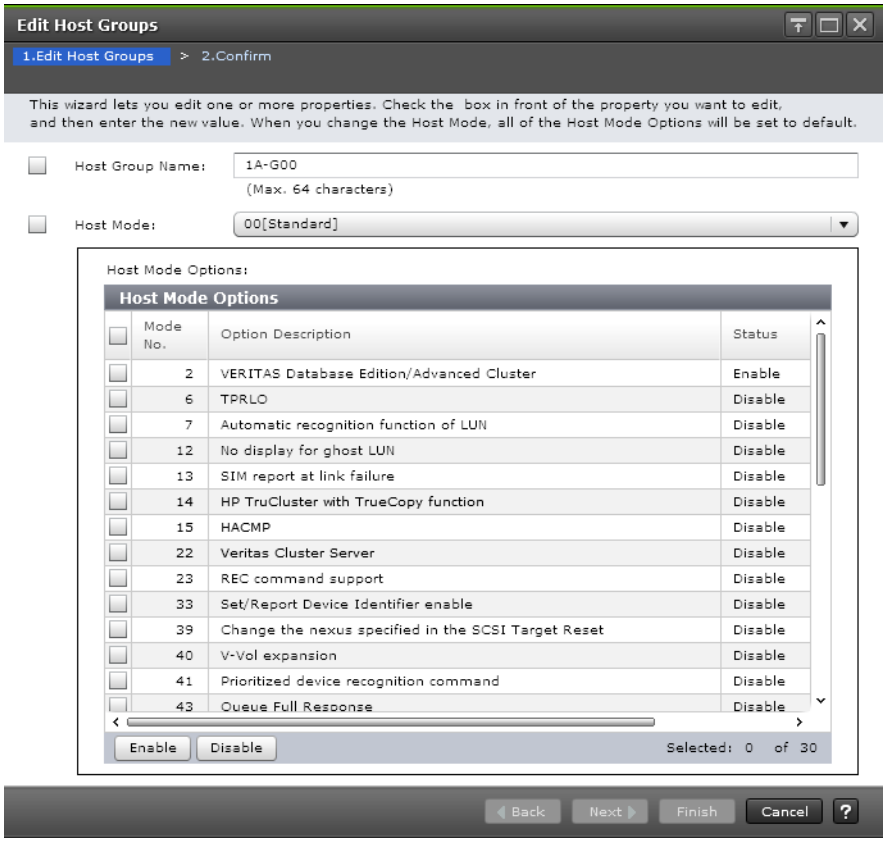
Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the host group.
Virtual Storage Machine	Model name and serial number of the virtual storage machine that has the host group.
Detail	Details about the selected host group.

Edit Host Groups wizard

Edit Host Groups window

Use this window to edit host group properties for selected host groups. Properties include host group name, host mode, or host mode options.

When you select multiple host groups to which different host modes are defined, if the host group assigned to an initiator port is included, you cannot finish the Edit Host Groups operation.



Item	Description
Host Group name	Specify the name of the host group. Host group name can be up to 64 single-byte ASCII characters (alpha-numerals and symbols). You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host group name.
Host Mode	Select the host mode from the list. If a host group assigned to an initiator port is included in the specified host groups, this item is unavailable.

Host Mode Options table

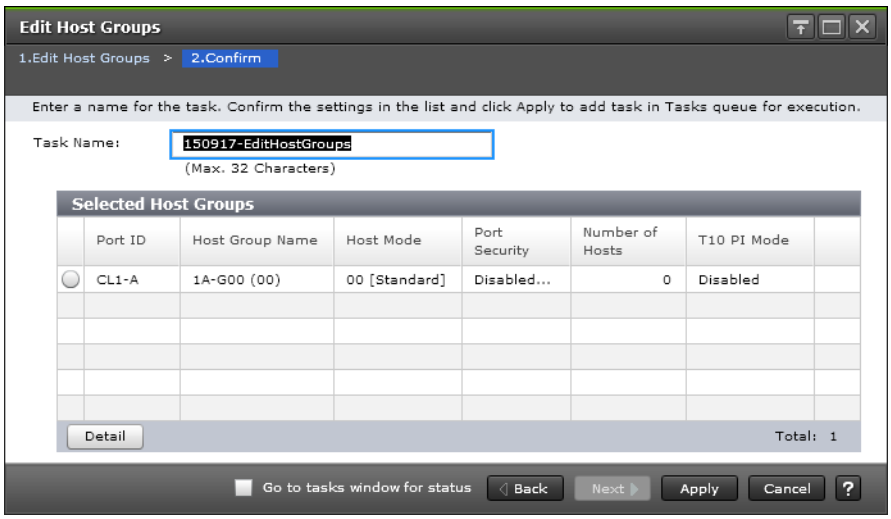
To set the host mode option, select a host mode option, and then click Enable. If you do not need a host mode option, select an unnecessary host mode option, and then click Disable.

Item	Description
Mode No.	Number identifier of the host mode option.
Option Description	Description of the host mode option.

Item	Description
Status	Indicates the current status setting (Enabled or Disabled) of the host mode option on this host group.
Enable	Enables the host mode option.
Disable	Disables the host mode option.

Edit Host Groups confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

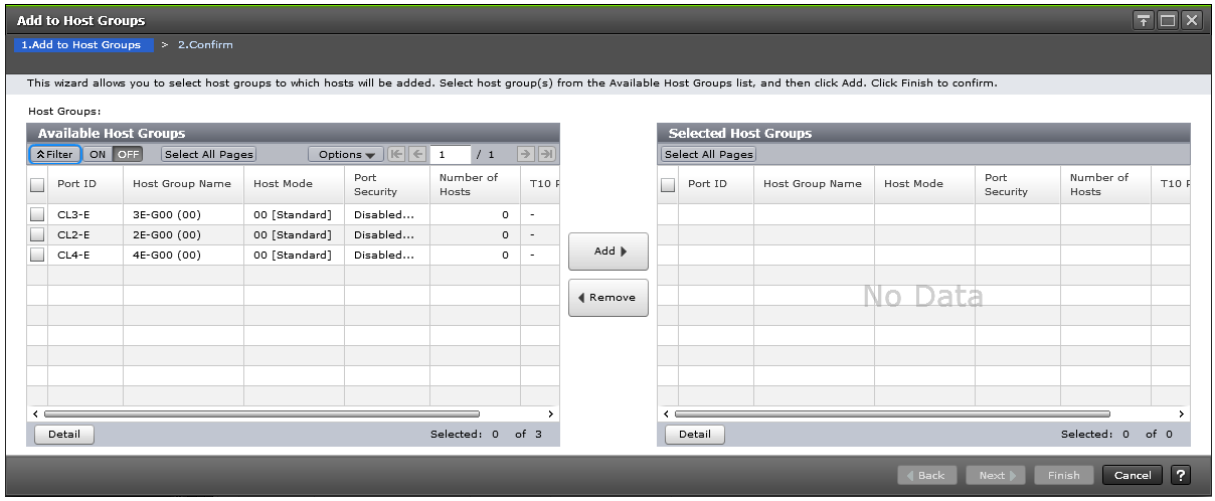


Selected Host Groups table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Detail	Details about the selected host group.

Add to Host Groups wizard (when specific host is selected)

Add to Host Groups window



Available Host Groups table

This table lists host groups in which selected hosts can be registered. Only the host groups assigned to the logged-on user are available.

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Detail	Details about the selected host group.
Add	Adds host groups selected from the Available Host Groups table to the Selected Host Groups table.
Remove	Removes the selected host groups from the Selected Host Groups table.

Selected Host Groups table

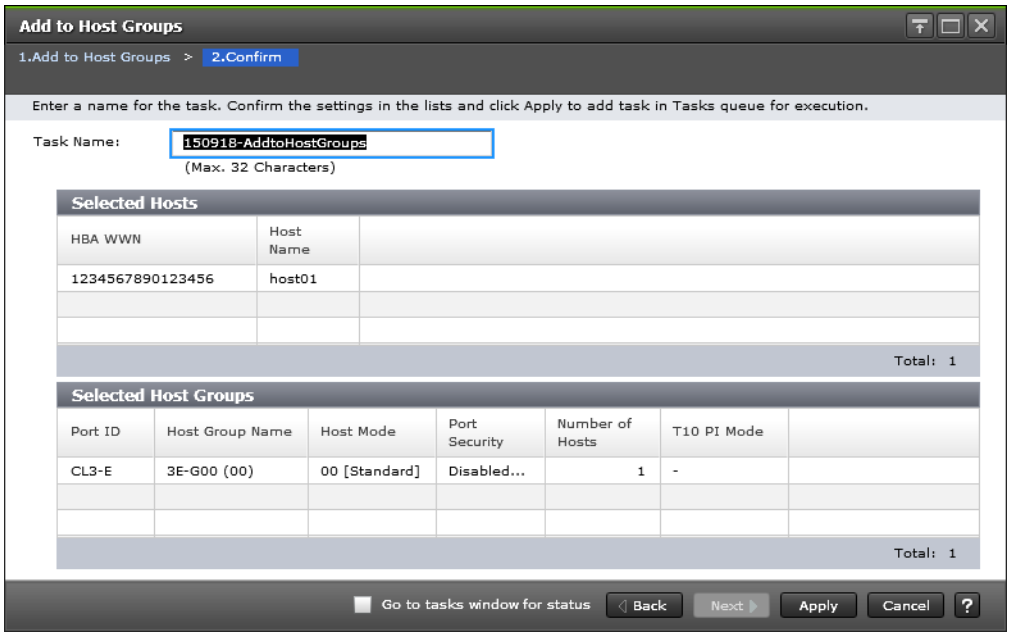
This table lists the selected host groups.

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.

Item	Description
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Detail	Details about the selected host group.

Add to Host Groups confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Hosts table

This table lists the hosts selected to be added to a host group.

Item	Description
HBA WWN	WWN of the port.
Host Name	Name of the host.

Selected Host Groups table

A list of host groups to which hosts are registered.

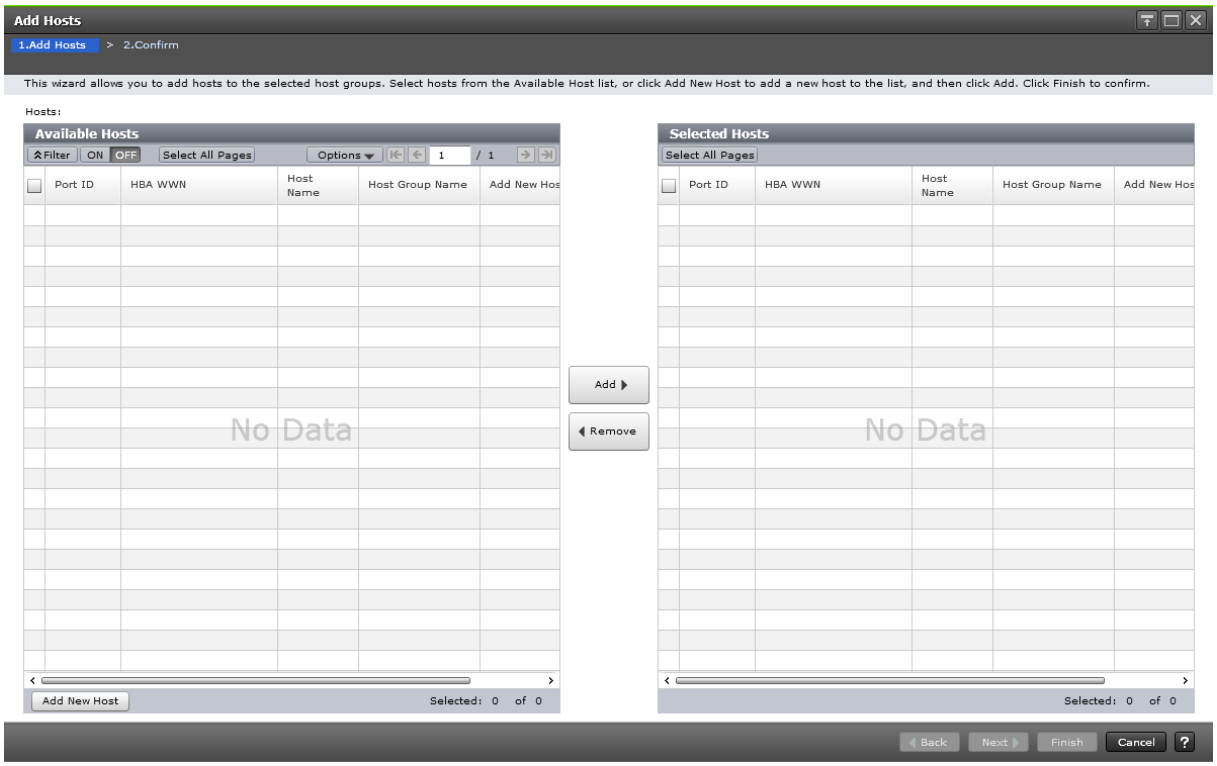
Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.

Item	Description
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Add Hosts wizard (when specific hosts group is selected)

Add Hosts window

The **Add Hosts** window displays the following information when a host group on a Fibre Channel port is selected.



Available Hosts table (Fibre Channel)

This table lists the hosts that can be registered in the selected host group.

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.
Host Group Name	Name of the host group.
New Host	Indicates whether this is a newly added host.

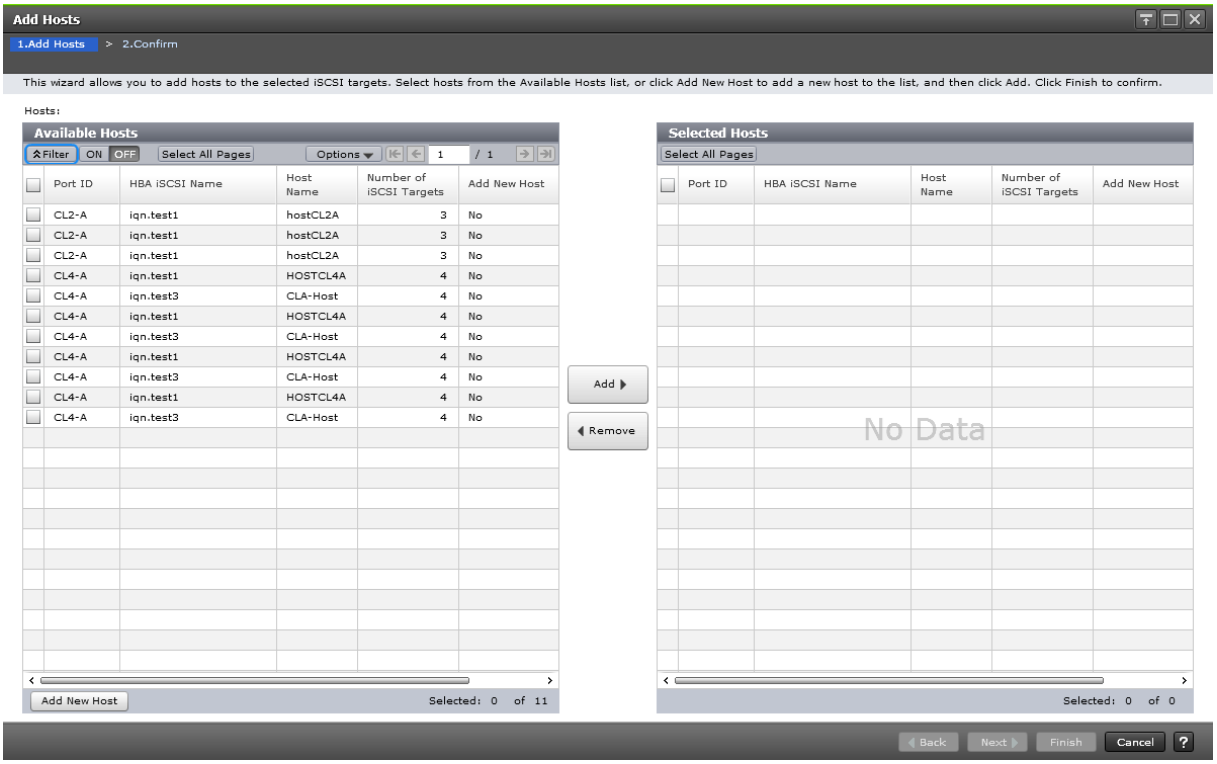
Item	Description
	• Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.
Add New Host	Adds a new host. Note that Port ID and Host Group Name will be blank after a new host is added.
Add	Adds hosts selected from the Available Hosts table to the Selected Hosts table.
Remove	Removes hosts from the Selected Hosts table.

Selected Hosts table (Fibre Channel)

This table lists hosts selected from the Available Hosts table.

Item	Description
Port ID	Identifier of the port. This field is blank for the host created by clicking Add New Host.
HBA WWN	WWN of the port.
Host Name	Name of the host.
Host Group Name	Name of the host group. Note that this field is blank for the host created by clicking Add New Host.
New Host	Indicates whether this is a newly added host. • Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.

The **Add Hosts** window displays the following information when a host group on an iSCSI port is selected.



Available Hosts table (iSCSI)

This table lists the hosts that can be registered in the selected iSCSI target.

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Name of the port.
Host Name	Name of the host.
Number of iSCSI Targets	Number of iSCSI Targets.
New Host	Indicates whether this is a newly added host. • Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.
Add New Host	Adds a new host. Note that Port ID and Host Group Name will be blank after a new host is added.
Add	Adds hosts selected from the Available Hosts table to the Selected Hosts table.
Remove	Removes hosts from the Selected Hosts table.

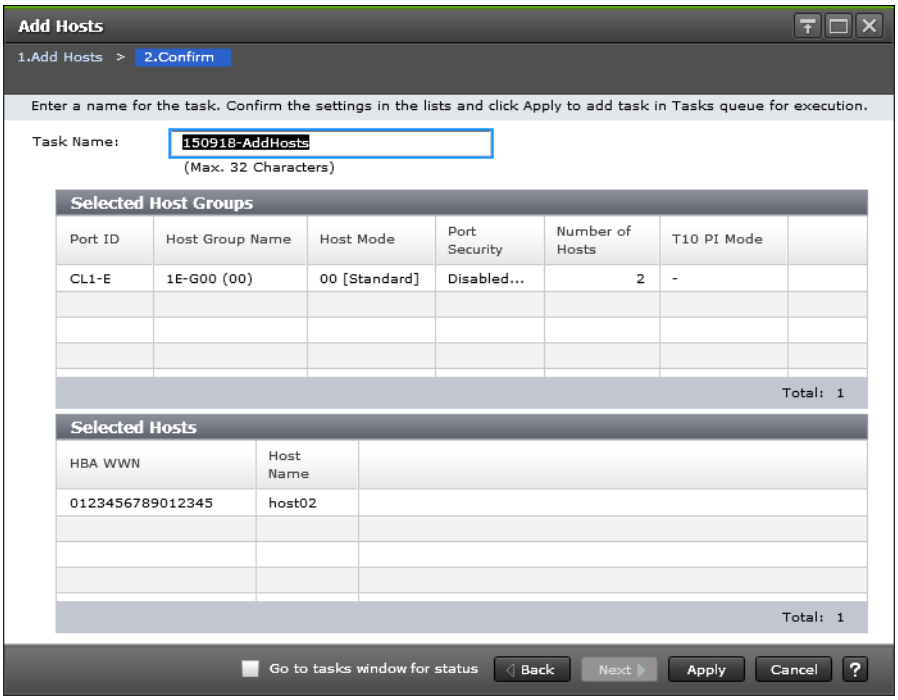
Selected Hosts table (iSCSI)

This table lists hosts selected from the Available Hosts table.

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Name of the port.
Host Name	Name of the host.
Number of iSCSI Targets	Number of iSCSI Targets.
New Host	Indicates whether this is a newly added host. • Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.

Add Hosts confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Host Groups table (Fibre Channel)

This table lists the selected hosts.

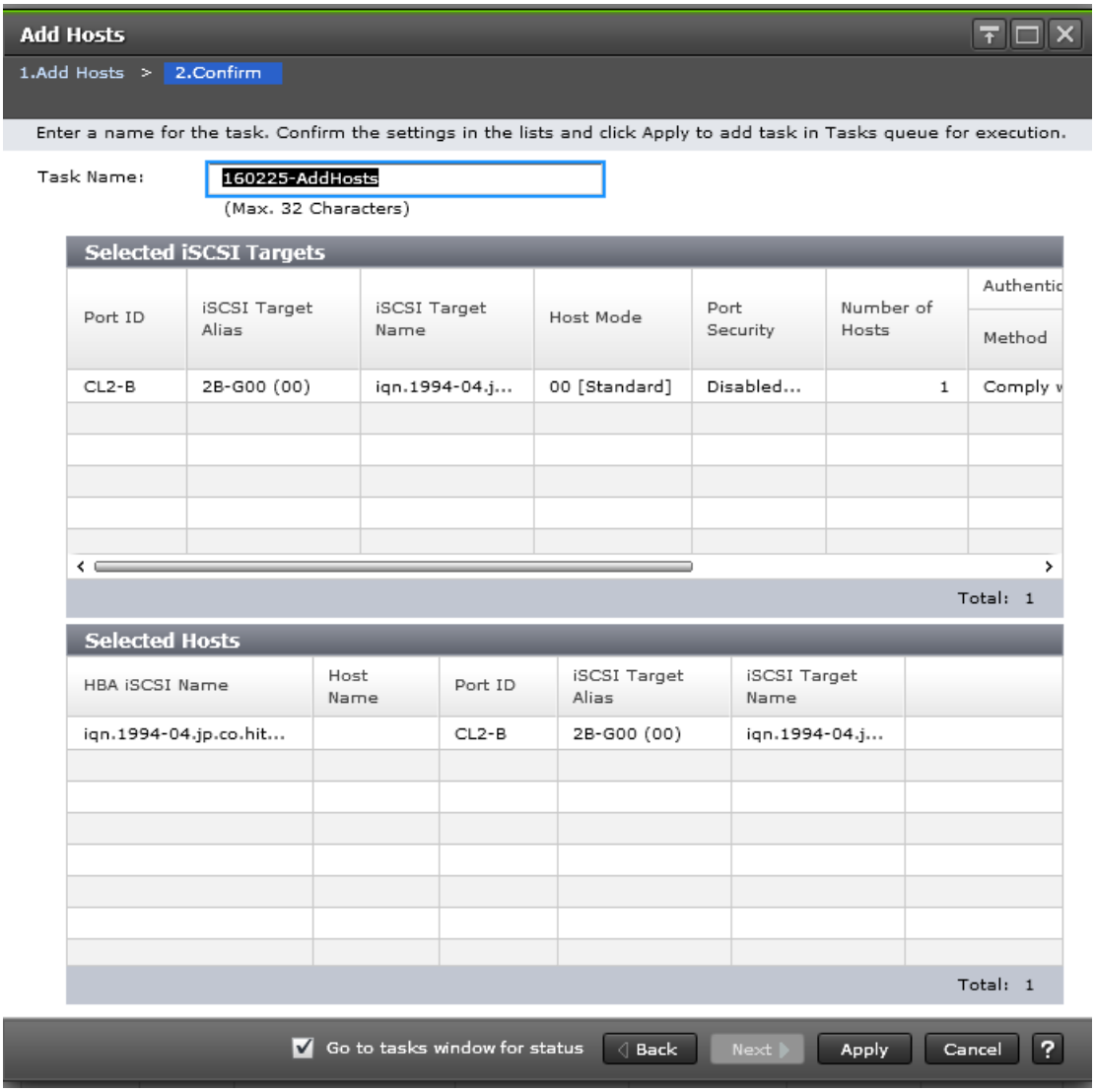
Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.

Item	Description
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Selected Hosts table (Fibre Channel)

This table contains a list of added host groups.

Item	Description
HBA WWN	WWN of the port.
Host Name	Name of the host.



Selected iSCSI Targets table (iSCSI)

This table lists the selected iSCSI targets.

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode .	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User name • Number of users

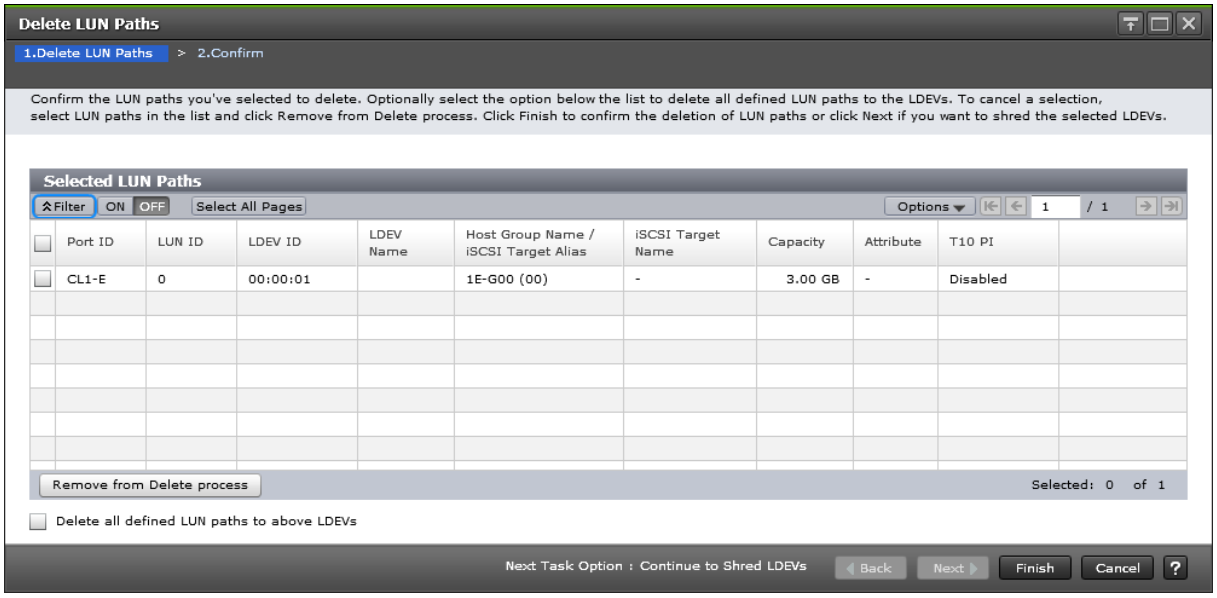
Selected Hosts table (iSCSI)

This table contains a list of added host groups.

Item	Description
HBA iSCSI Name	HBA iSCSI name of the port.
Host Name	Name of the host.
Port ID	Port ID
iSCSI Target Alias	iSCSI target alias
iSCSI target Name	iSCSI target name

Delete LUN Paths wizard

Delete LUN Paths window



Selected LUN Paths table

This table provides information about the selected LUN paths.

Item	Description
Port ID	Identifier of the port.
LUN ID	Identifier of the selected LUN paths.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Host Group Name / iSCSI Target Alias	Name of the host group or iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Capacity	Size of each logical volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Hyphen (-): Volume in which the attribute is not defined.

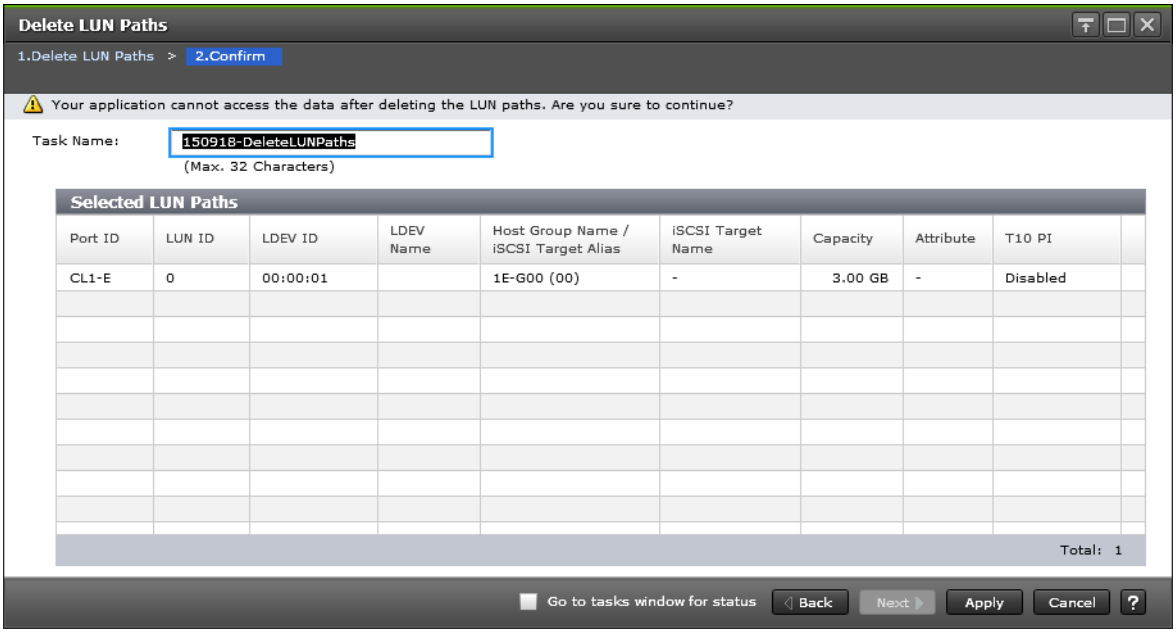
Item	Description
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
Remove from Delete process	Removes LUN paths from the Selected LUN Paths table.
Delete all defined LUN paths to above LDEVs	Removes LUN paths from the Selected LUN Paths table. When this check box is selected, the host groups of all the alternate paths in the LDEV displayed in the Selected LUNs table must be assigned to the Storage Administrator group permitted to manage them.

Next Task Option

Click Next to go to the task setting window.

Delete LUN Paths confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected LUN Paths table

Item	Description
Port ID	Identifier of the port.
LUN ID	Identifier of the selected LUN path.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Host Group Name / iSCSI Target Alias	Name of the host group iSCSI target alias .
iSCSI Target Name	iSCSI target name
Capacity	Size of each logical volume.
Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV of the data direct mapping attribute. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • Hyphen (-): Volume in which the attribute is not defined.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).

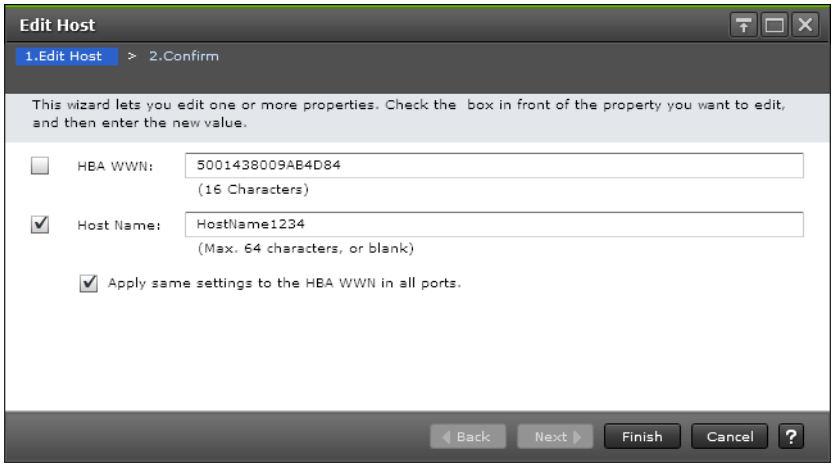
Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, and then click Help.

Edit Host wizard

Use this wizard to edit host parameters.

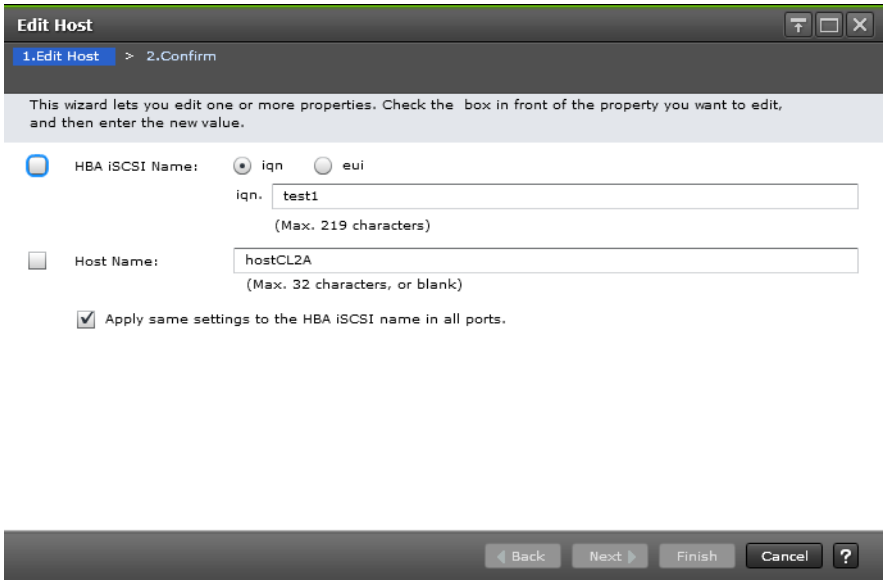
Caution: In one host, if the setting operations are performed with two times or more to edit many setting items, wait until the primary task applies then perform the secondary operation. If the secondary operation is performed while being applying of the primary task, the primary task is canceled and the secondary task is applied to the storage system.

Edit Host window



For Fibre Channel Ports

Item	Description
HBA WWN	Specify the WWN of the port in 16 digits of hexadecimal numbers.
Host Name	Specify the host name. Host name can be up to 64 single-byte ASCII characters (alpha-numerals and symbols). You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host name. A host name is case-sensitive.
Apply same settings to the HBA WWN in all ports	If this check box is selected, the changes made in this dialog box will also affect other ports.

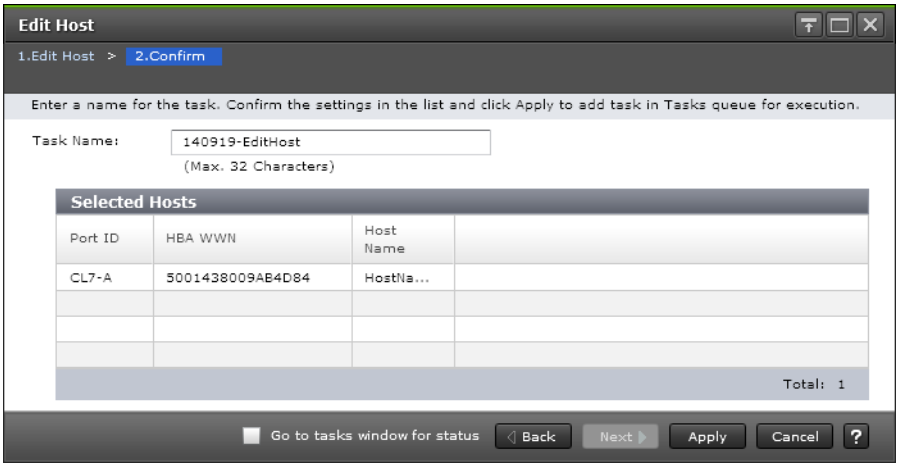


For iSCSI Ports

Item	Description
HBA iSCSI Name	Specify the WWN of the port in 16 digits of hexadecimal numbers. • iqn or eui: Select the format of the iSCSI name. • Text box: Specify the iSCSI name. For the iqn format, an iSCSI name takes up to 219 single-byte ASCII characters (alpha-numerals and symbols). You cannot use the following symbols: ! " # $ % & ' ( ) * + , / ; < = > ? @ [\ ] ^ _ ` { | } ~ For the eui format, an iSCSI name takes fixed to 16 alpha-numerals.
Host Name	Specify the host name. Host name can be up to 32 single-byte ASCII characters (alpha-numerals and symbols). You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host name. A host name is case-sensitive.
Apply same settings to the HBA iSCSI name in all ports.	If this check box is selected, the changes made in this dialog box will also affect other ports.

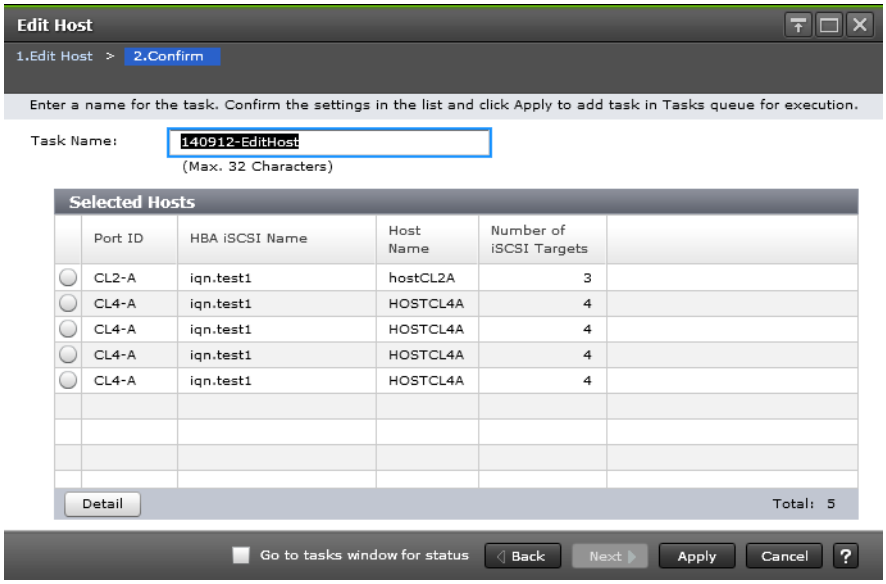
Edit Host confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Hosts table (Fibre Channel)

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.



Selected Hosts table (iSCSI ports)

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Name of the port.
Host Name	Name of the host.
Number of iSCSI Targets	Number of iSCSI targets.
Detail	Details about the selected host.

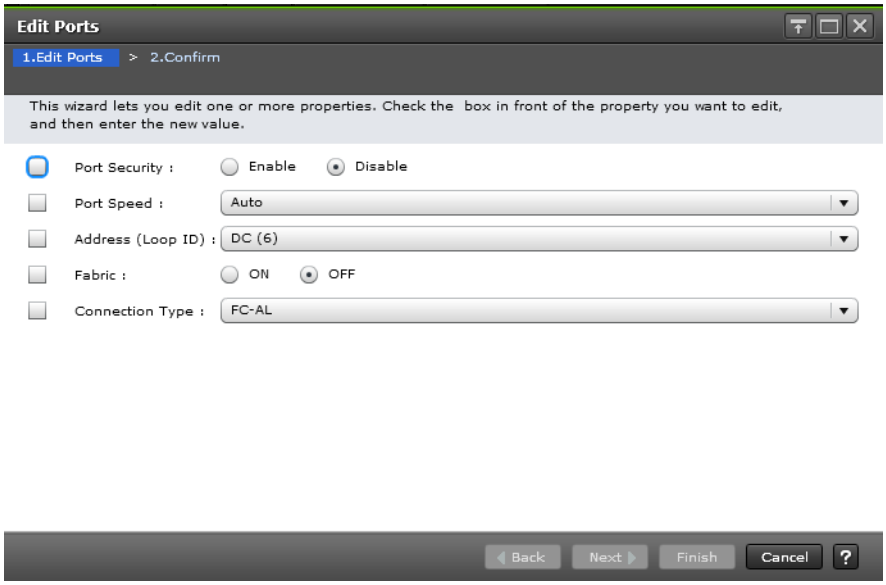
Edit Ports wizard

Use this wizard to edit port parameters.

Caution: In one port, if the setting operations are performed with two times or more to edit many setting items, wait until the primary task applies then perform the secondary operation. If the secondary operation is performed while being applying of the primary task, the primary task is canceled and the secondary task is applied to the storage system.

Edit Ports window

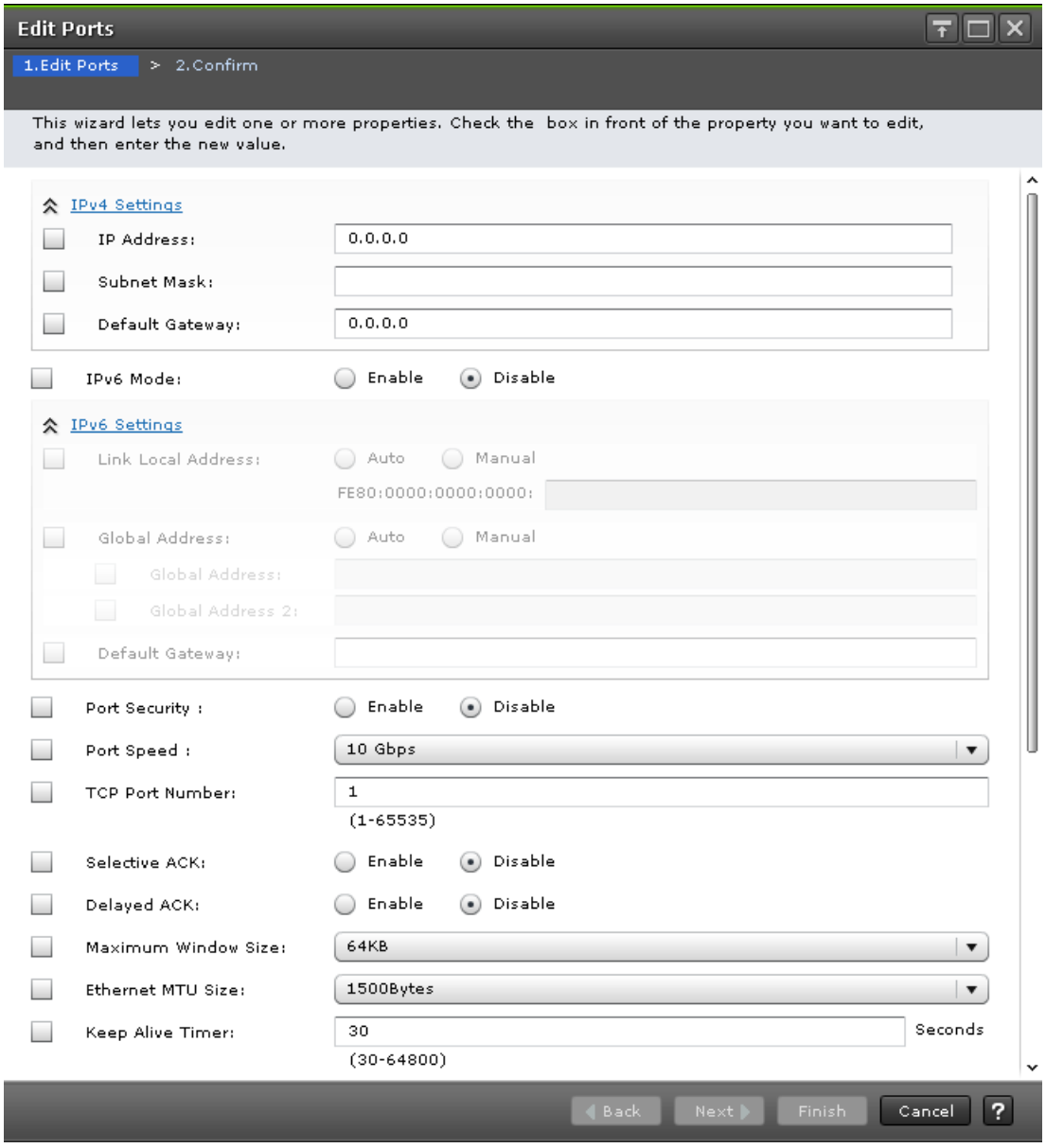
Fibre Channel



For Fibre Channel ports

Item	Description
Port Security	Select whether LUN security is Enabled or Disabled.
Port Speed	Select the data transfer speed, in Gbps, for the selected Fibre Channel port. If Auto is selected, the storage system automatically sets the data transfer speed to 2, 4, 8, 10, or 16 Gbps. **Caution:** If you are using 2-Gbps HBA and switch, set the transfer speed of the CHF (Fibre Channel adapter) port for VSP G1000, VSP G1500, and VSP F1500, or CHB(FC) (Fibre Channel board) for as 2 Gbps. If you are using 4-Gbps HBA and switch, set the transfer speed of the CHF or CHB(FC) port as 4 Gbps. If you are using 8-Gbps HBA and switch, set the transfer speed of the CHF or CHB(FC) port as 8 Gbps. If you are using 16-Gbps HBA and switch, set the transfer speed of the CHF or CHB(FC) port as 16-Gbps. If you are using a 32-Gbps HBA and switch, set the transfer speed of the CHB(FC) port to 32 Gbps. If the Auto Negotiation setting is required, the linkup might become improper at server restart. Check a channel lamp, and if it is blinking, remove and re-insert the cable to perform the signal synchronization and linkup. When the transfer speed of the CHF port is set to Auto, the data might not be transferred at the maximum speed depending on the connected device. Confirm the transfer speed appearing in Speed in the Ports list when you start up the storage system, HBA, or switch. When the transfer speed is not the maximum speed, select the maximum speed from the list on the right or remove and reinsert the cable. Only 10 Gbps can be specified for the FCoE port. Auto cannot be specified for the FCoE port.
Address (Loop ID)	Select the address of the selected port. .

Item	Description
Fabric	Select whether a fabric switch is set to ON or OFF. .
Connection Type	Select the topology: • FC-AL: Fibre Channel arbitrated loop • P-to-P (point-to-point). **Caution:** Some fabric switches require that you specify point-to-point topology. If you enable a fabric switch, check the documentation for the fabric switch to determine whether your switch requires point-to-point topology.



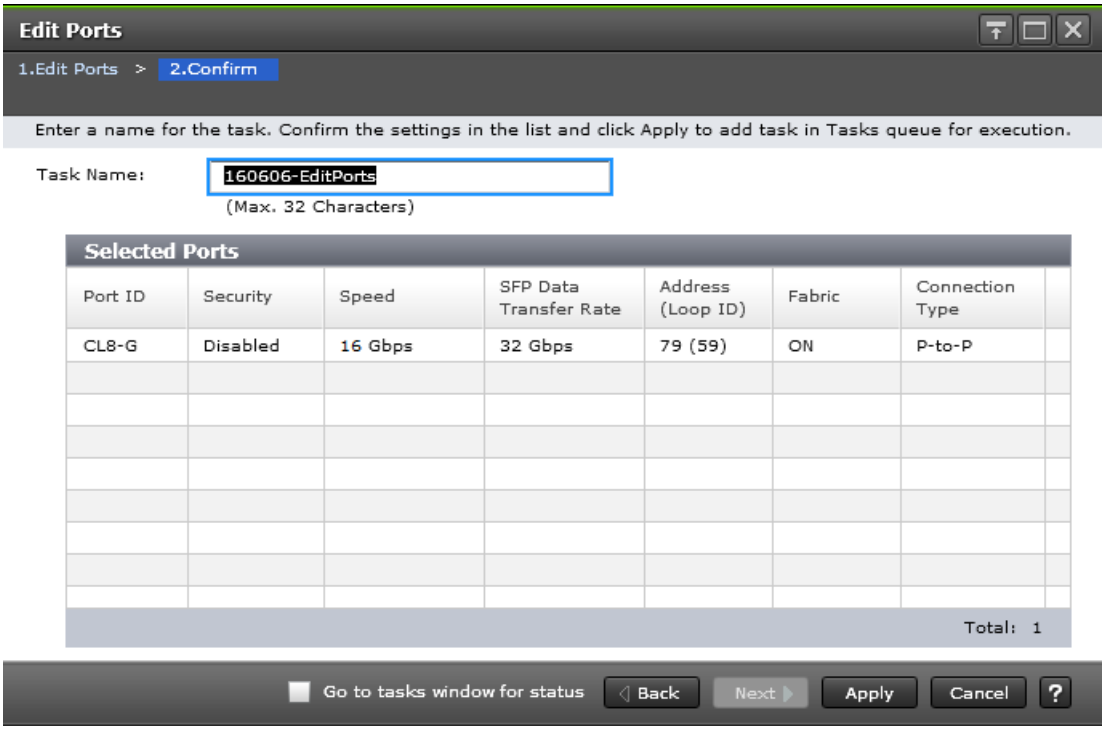
For iSCSI ports

Item	Description
IPv4 Settings	Information about IPv4. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • IP Address: IP address of the port. If 2 or more ports are selected, this information cannot be specified. • Subnet Mask: Subnet mask of the port. • Default Gateway: Default gateway of the port.
IPv6 Mode	Specify this information if IPv6 is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: IPv6 mode is enabled. If Enable is selected, the IPv6 Settings can be specified. • Disable: IPv6 mode is disabled.
Port Security	Specify whether to use LUN security on the port. • Enable: Use LUN security on the port. • Disable: Do not use LUN security on the port.
Port Speed	Select the data transfer speed for the selected port: 1 Gbps, 10 Gbps, or Auto.
TCP Port Number	Specify the TCP port number. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Selective ACK	Specify this information if the selective ACK is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The selective ACK is enabled. • Disable: The selective ACK is disabled.
Delayed ACK	Specify this information if the delayed ACK is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The delayed ACK is enabled. • Disable: The delayed ACK is disabled.
Maximum Window Size	Select the maximum window size from 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Ethernet MTU Size	Select Ethernet MTU size from 1500 bytes, 4500 bytes, or 9000 bytes. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
Keep Alive Timer	Specify the interval time to perform the keep alive timer option. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
VLAN Tagging Mode	Specify this information if the VLAN tagging mode is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The VLAN tagging mode is enabled and specify the VLAN ID in the text box. • Disable: The VLAN tagging mode is disabled.
iSNS Server	Specify this information if the iSNS server is used or not used. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected. • Enable: The iSNS server mode is enabled. And specify the IP Address and TCP Port Number of the following.

Item	Description
	• Disable: The iSNS server mode is disabled.
IP Address	Specify the IP address for IPv4 or IPv6. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
TCP Port Number	Specify the TCP port number. If the iSCSI virtual port mode is enabled for the port, this item cannot be selected.
CHAP User Name	Specify the CHAP user name.
Secret	Specify the secret to be used for host authentication.
Re-enter Secret	Specify the secret again for confirmation.

Caution: If you change multiple parameters for the same port separately, change the next parameter after the first task is completed. Otherwise, the latter change overwrites the first one. Therefore, the changes might be different from the ones you expected.

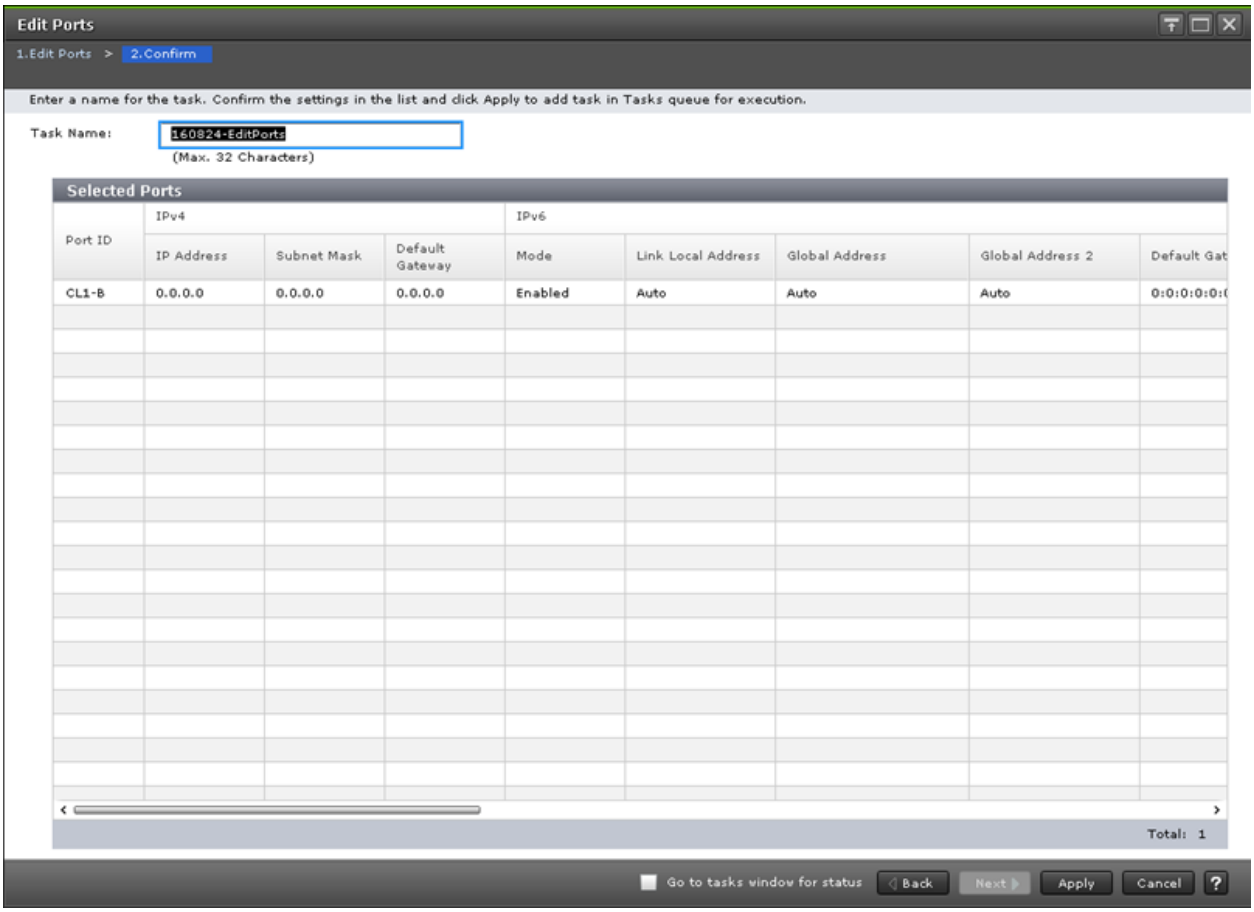
Edit Ports confirmation window



Selected Ports table for Fibre Channel ports

Item	Description
Port ID	Identifier of the port.

Item	Description
Security	LUN security setting (Enabled or Disabled) on the port.
Speed	Data transfer speed for the selected Fibre Channel port in Gbps (Gigabits per second).
SFP Data Transfer Rate	SFP data transfer rate of 8 Gbps, 16 Gbps, or 32 Gbps.
Address (Loop ID)	Address of the selected port.
Fabric	Status setting (ON or OFF) for a fabric switch.
Connection Type	Topology of the selected port. • FC-AL: Fibre Channel arbitrated loop • P-to-P: Point-to-point



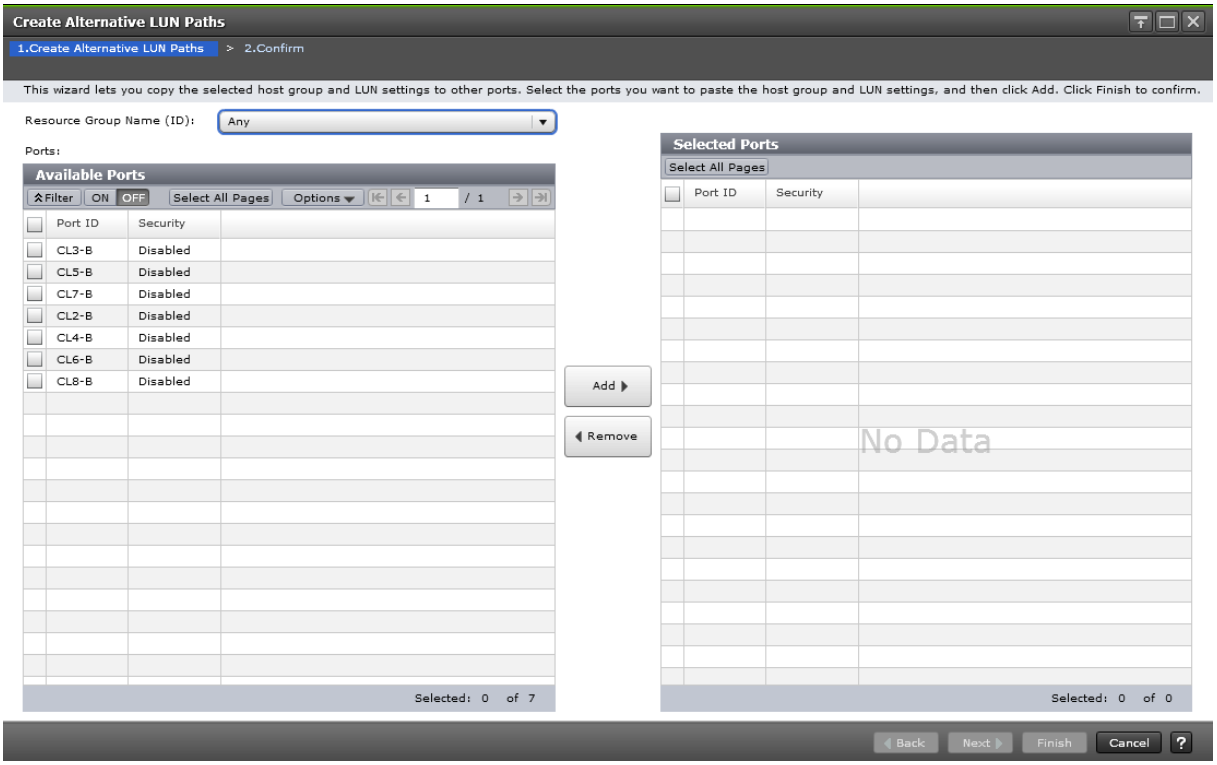
Selected Ports table for iSCSI ports

Item	Description
Port ID	Identifier of the port.
IPv4	Information about IPv4.

Item	Description
	• IP Address: IP address of the port. • Subnet Mask: Subnet mask of the port. • Default Gateway: Default gateway of the port.
IPv6	Information about IPv6. • Mode: IPv6 setting (Enabled or Disabled) for the port. • Link Local Address: Link local address for the port. • Global Address: Global address for the port. • Global Address 2: Global address for the port. • Default Gateway: Default gateway address for the port.
Port Security	Specify this information if the LUN security is used or not used. • Enable: The LUN security is enabled. • Disable: The LUN security is disabled.
Port Speed	Select the data transfer speed for the selected port. 1 Gbps, 10 Gbps, or Auto can be selected.
TCP Port Number	Specify the TCP port number.
Selective ACK	Specify this information whether the selective ACK is used or not used. • Enable: The selective ACK is enabled. • Disable: The selective ACK is disabled.
Delayed ACK	Appears with enabled or disabled for the delayed ACK.
Maximum Window Size	Select the maximum window size from 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB.
MTU	Ethernet MTU size.
Keep Alive Timer	Specify the interval time to perform the keep alive timer option.
VLAN	• Tagging Mode: Appears with enabled or disabled for VLAN. • ID: Identifier of VLAN.
iSNS Server	• Mode: iSNS server setting (Enabled or Disabled). • IP Address: IP address of the iSNS server. • TCP Port Number: TCP port number of the iSNS server.
CHAP Authentication	Information for the host authentication. • User Name: User name appears. • Secret: If the secret is specified, a character string of six asterisks (*) appears.

Create Alternative LUN Paths wizard

Create Alternative LUN Paths window



Item	Description
Resource Group Name (ID)	Select the resource group in which the host group is created. If Any is selected, among all ports being allocated to the user, ports where the host group can be add are available in the Available Ports table. If other than Any is selected, among ports assigned to the selected resource group, ports where the host group can be add are available in the Available Ports table.

Available Ports table

This table lists the ports for which alternate paths can be created.

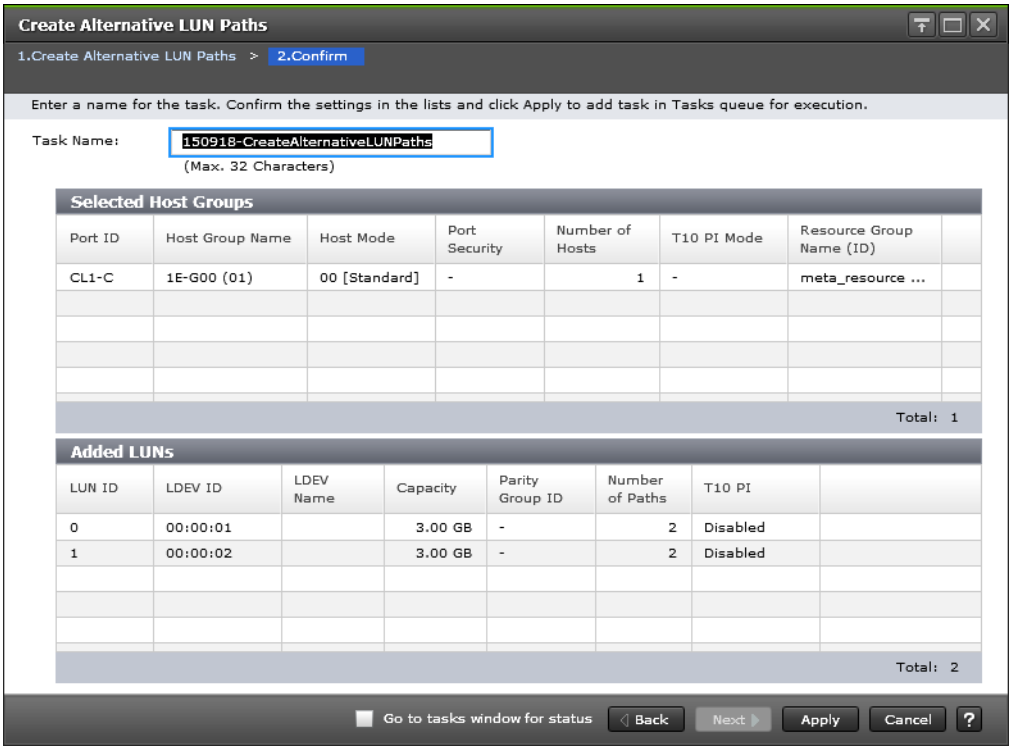
Item	Description
Port ID	Identifier of the port.
Security	LUN security setting (Enabled or Disabled) on the port.
Add	Adds ports selected from the Available Ports table to the Selected Ports table.
Remove	Removes ports from the Selected Ports table.

Selected Ports table

Item	Description
Port ID	Identifier of the port.
Security	LUN security setting (Enabled or Disabled) on the port.

Create Alternative LUN Paths confirmation window

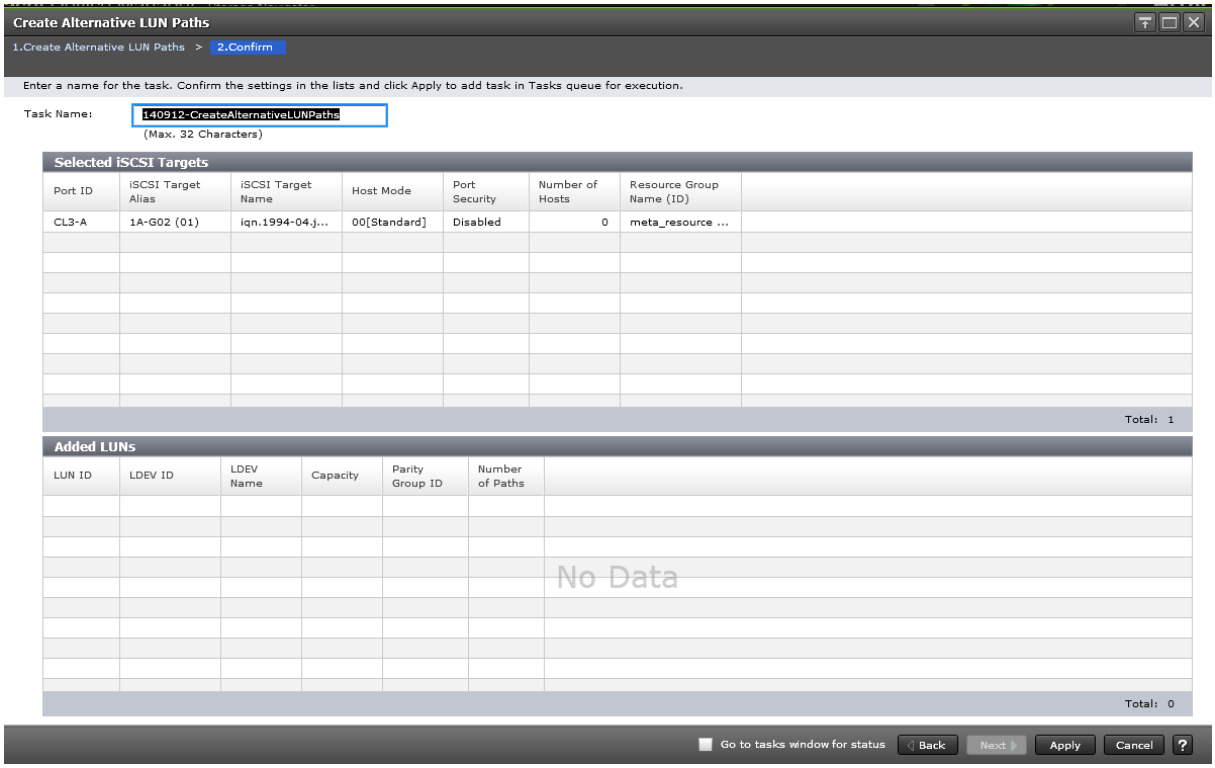
Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Host Groups table for Fibre Channel ports

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group name and identifier of the resource group containing the host groups.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed.

Item	Description
	Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.



Selected iSCSI Targets table for iSCSI ports

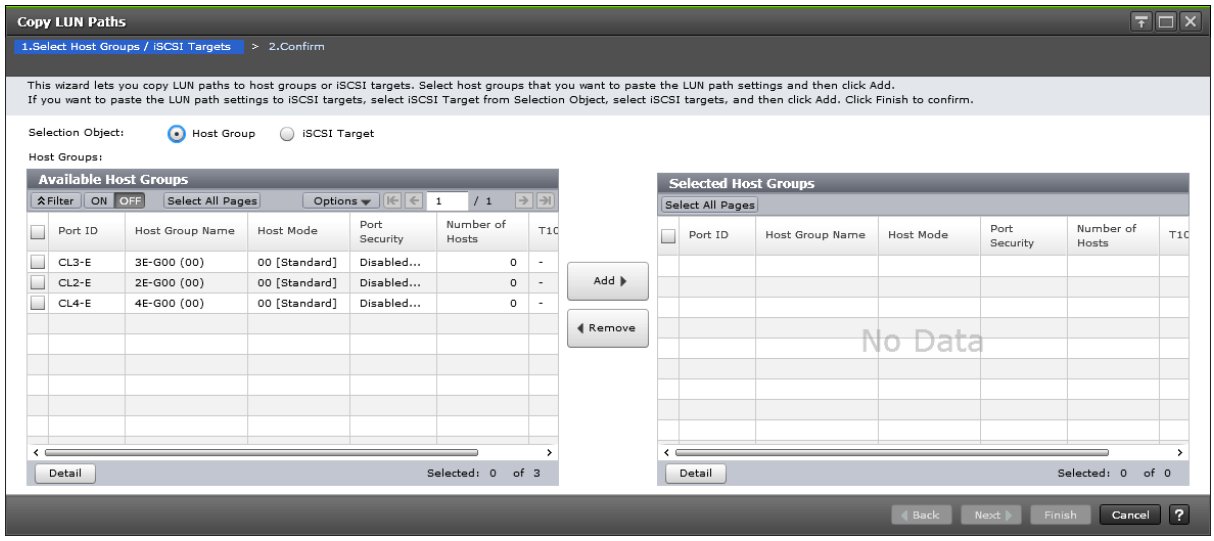
Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	Alias of the iSCSI target.
iSCSI Target Name	Name of the iSCSI target.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Resource Group Name (ID)	Resource group name and identifier of the resource group containing the host groups.

Added LUNs table

Item	Description
LUN ID	Identifier of the added logical unit.
LDEV ID	Identifier of the LDEV.
LDEV Name	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
Capacity	Size of each logical volume.
Parity Group ID	Identifier of the parity group.
Number of Paths	Number of paths set for the LDEV.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Copy LUN Paths wizard

Copy LUN Paths window



Selection Object

Item	Description
Selection Object	• Host Group: Select to copy LUN paths to host groups. • iSCSI target: Select to copy LUN paths to iSCSI targets.

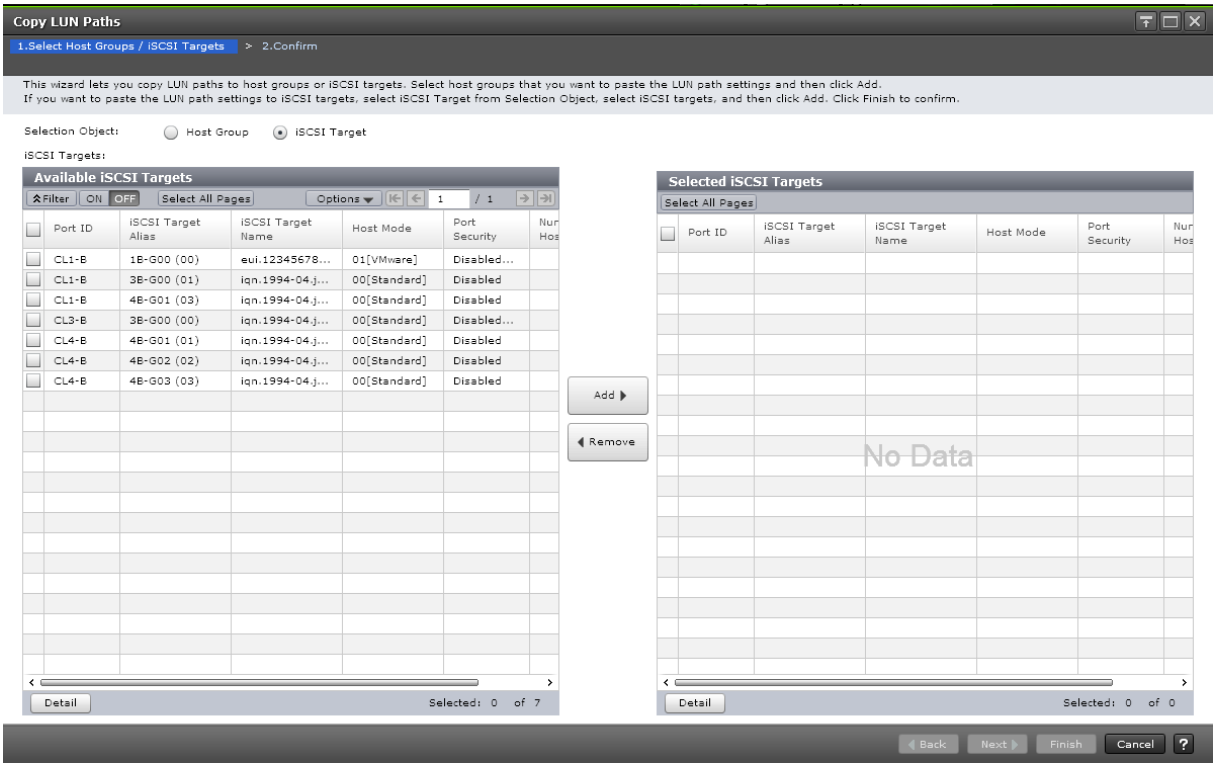
Available Host Groups table

This table lists the host groups for which LU paths can be copied. Only the host group assigned to the logged-on user are available.

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Detail	Details about the selected host group.
Add	Adds host groups selected from the Available Host Groups table to the Selected Host Groups table.
Remove	Removes the selected host groups from the Selected Host Groups table.

Selected Host Groups table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Detail	Details about the selected host group.



Available Selected iSCSI Targets table

This table lists iSCSI targets for which LU paths can be copied. Only iSCSI targets assigned to the logged-on user are available.

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Detail	Details about the selected iSCSI target.
Add	Adds host groups selected from the Available iSCSI Targets table to the Selected iSCSI Targets table.
Remove	Removes the selected host groups from the Selected iSCSI Targets table.

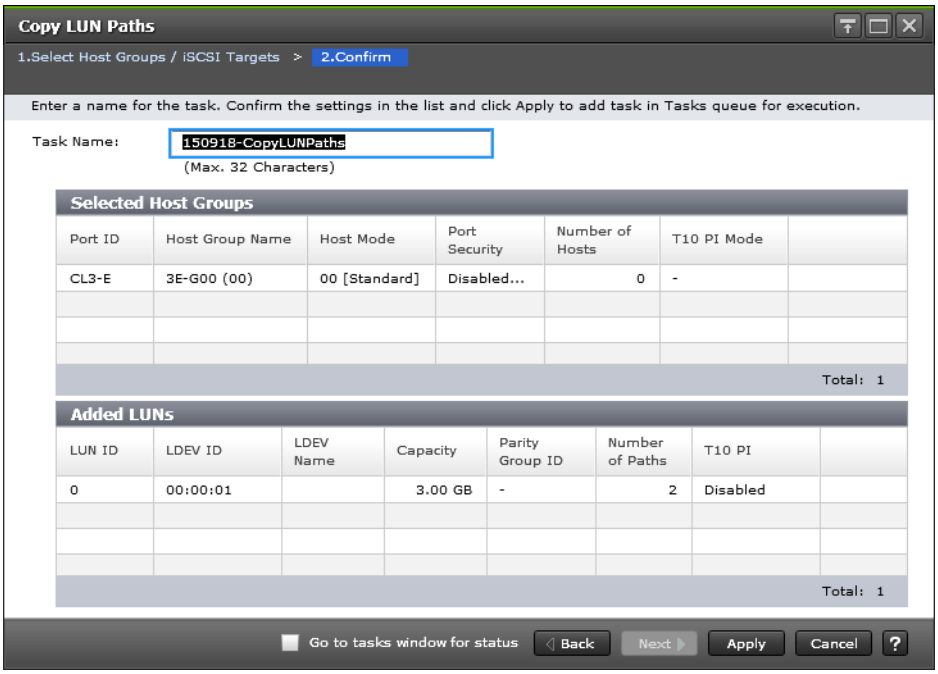
Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.

Item	Description
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Detail	Details about the selected iSCSI target.

Copy LUN Paths confirmation window

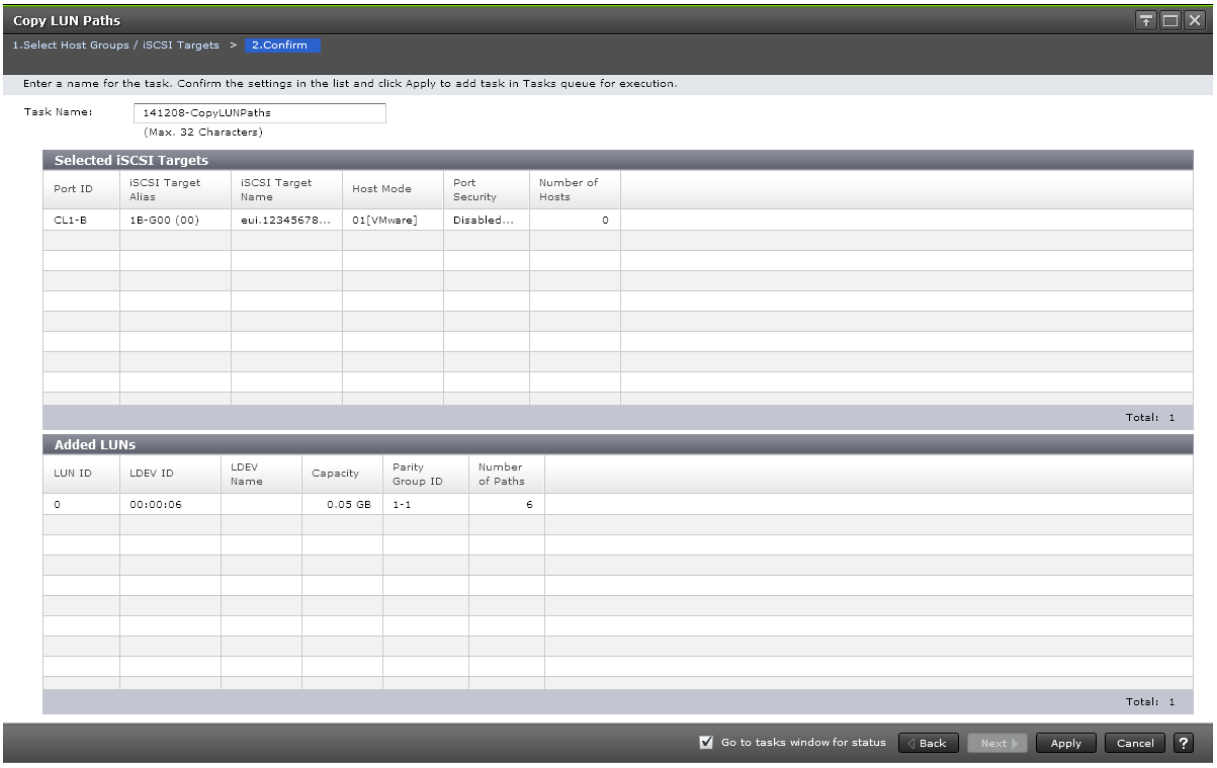
Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected Host Groups table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port.

Item	Description
	Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).



Selected iSCSI Targets (iSCSI)

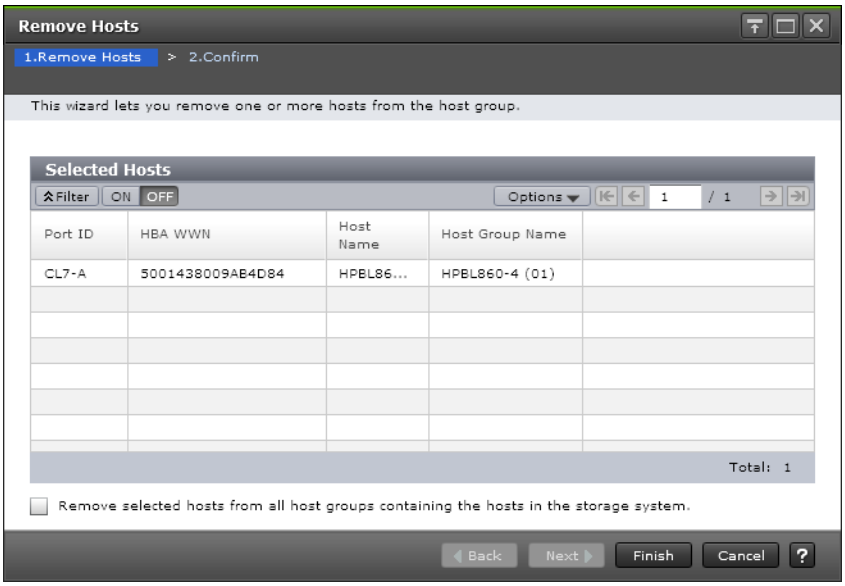
Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts set to the relevant port.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.

Added LUNs table

Item	Description
LUN ID	Identifier of the added logical unit.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Capacity	Size of each logical volume.
Parity Group ID	Displays the IDs of parity groups.
Number of Paths	Displays the number of paths set to the relevant LDEV.
ALUA Mode	Information about the ALUA mode. Enabled: LDEV can be used in ALUA. Disabled: LDEV cannot be used in ALUA.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Remove Hosts wizard

Remove Hosts window



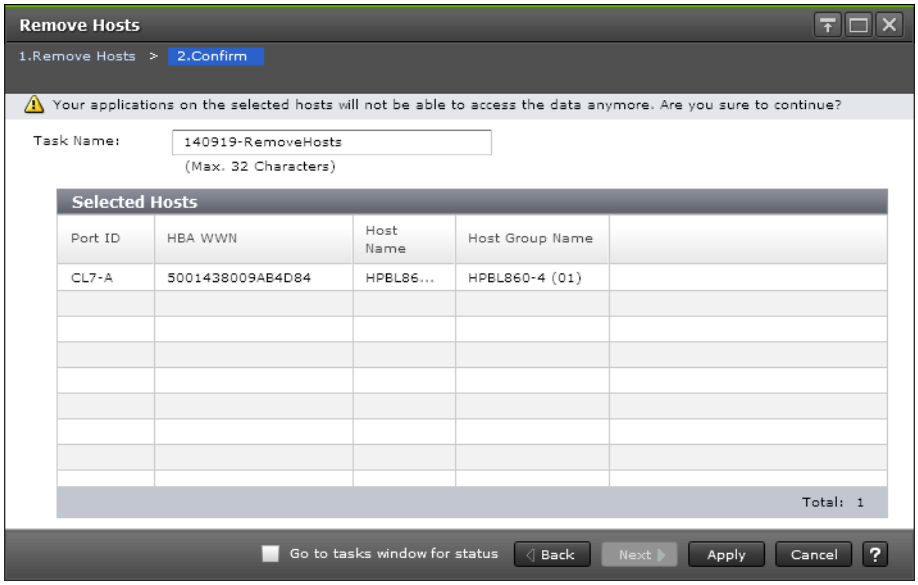
Selected Hosts table

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.

Item	Description
Host Group Name	Name of the host group.
Remove selected hosts from all host groups containing the hosts in the storage system	If this check box is selected, selected hosts are removed from all host groups containing the hosts in the storage system.

Remove Hosts confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

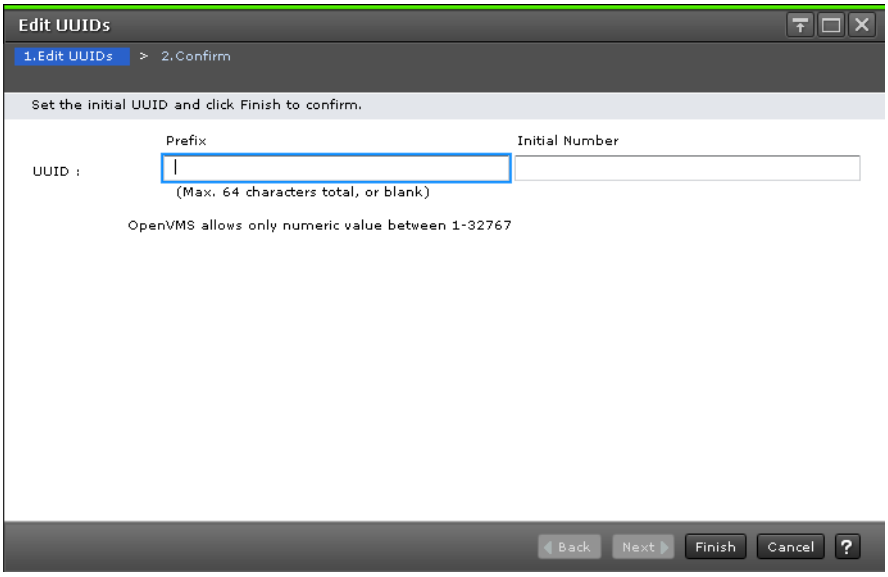


Selected Hosts table

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.
Host Group Name	Name of the host group.

Edit UUIDs wizard

Edit UUIDs window



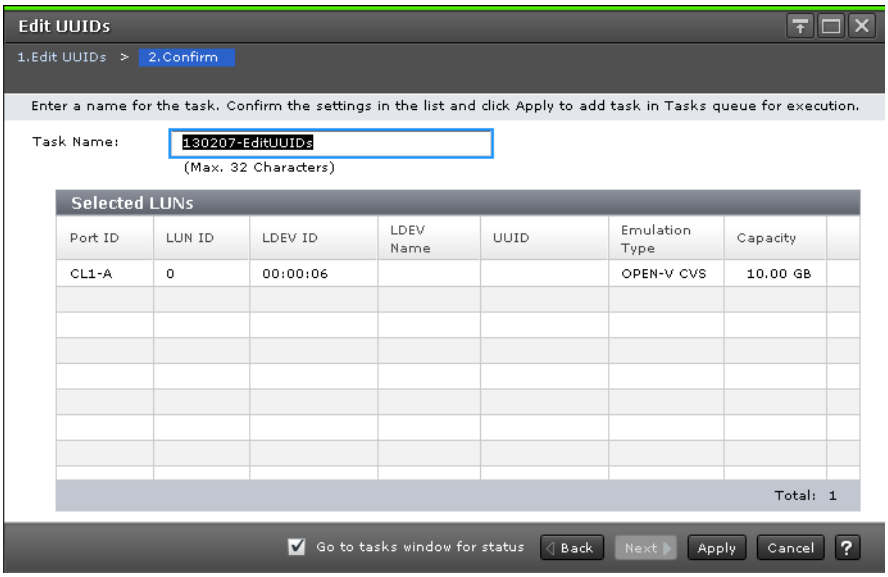
Item	Description
Prefix	For an OpenVMS server host: The total length of the Prefix and the Initial Number cannot exceed 5 characters. If the Prefix is 5 characters, you cannot specify an Initial Number and vice versa. For a server host other than OpenVMS: The total length of the Prefix and the Initial Number cannot exceed 64 characters. If the Prefix is 64 characters, you cannot specify an Initial Number and vice versa. The following rules apply to UUID: • These characters cannot be used: \ / : , ; * ? " < > | • A space character cannot be used for the first and the last characters. • UUIDs are case-sensitive. For example, `Abc` and `abc` are different UUIDs.
Initial Number	For an OpenVMS server host: The total length of the Prefix and the Initial Number cannot exceed 5 characters. If the Prefix is 5 characters, you cannot specify an Initial Number and vice versa. For a server host other than OpenVMS: The total length of the Prefix and the Initial Number cannot exceed 64 characters. If the Prefix is 64 characters, you cannot specify an Initial Number and vice versa. The following rules apply to the initial number. Example: • 1: Up to 9 numbers are added (1, 2, 3 ... 9) • 08: Up to 92 numbers are added (08, 09, 10 ... 99) (If the host mode is OpenVMS, the numbers are: 8, 9, 10 ... 99)

Item	Description
	• 23: Up to 77 numbers are added (23, 24, 25 ... 99)

Caution: If UUID is blank, the UUID setting is released.

Edit UUIDs confirmation window

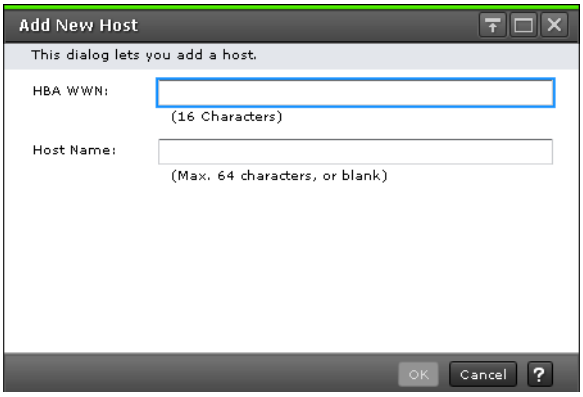
Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.



Selected LUNs table

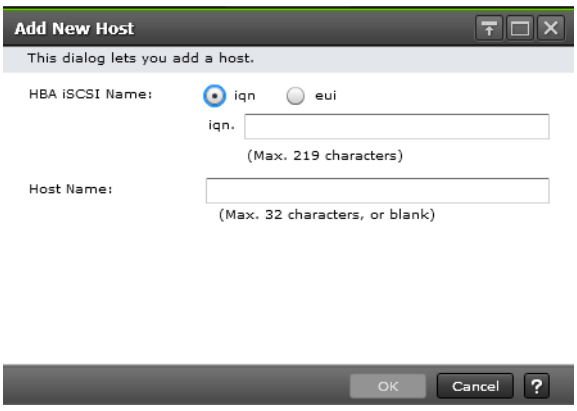
Item	Description
Port ID	Identifier of the port.
LUN ID	Logical units whose UUID has been changed.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
UUID	Identifies the set or changed UUID. A blank field indicates that the UUID is released.
Capacity	Size of each logical volume.

Add New Host window



For Fibre Channel Ports

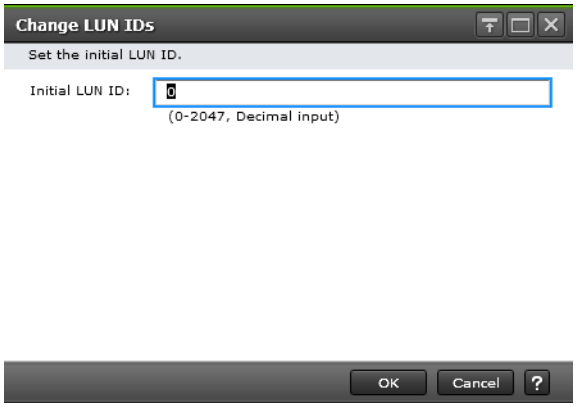
Item	Description
HBA WWN	Specify the WWN of the port in 16 digits of hexadecimal numbers.
Host Name	Specify the host name. As a host name, you can use single-byte ASCII characters (alpha-numerals and symbols) up to 64 characters. You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host name. A host name is case-sensitive.



For iSCSI ports

Item	Description
HBA iSCSI Name	Specify the WWN of the port in 16 digits of hexadecimal numbers. • iqn or eui: Select the format of the iSCSI name. • Text box: Specify the iSCSI name. For the iqn format, an iSCSI name takes up to 219 single-byte ASCII characters (alpha-numerals and symbols). You cannot use the following symbols: ! " # $ % & ' ( ) * + , / ; < = > ? @ [\ ] ^ _ ` { | } ~ For the eui format, an iSCSI name takes fixed to 16 alpha-numerals.
Host Name	Specify the host name. As a host name, you can use single-byte ASCII characters (alpha-numerals and symbols) up to 32 characters. You cannot use the following symbols: \ / : , ; * ? " < > | You cannot use blanks at the beginning or end of the host name. A host name is case-sensitive.

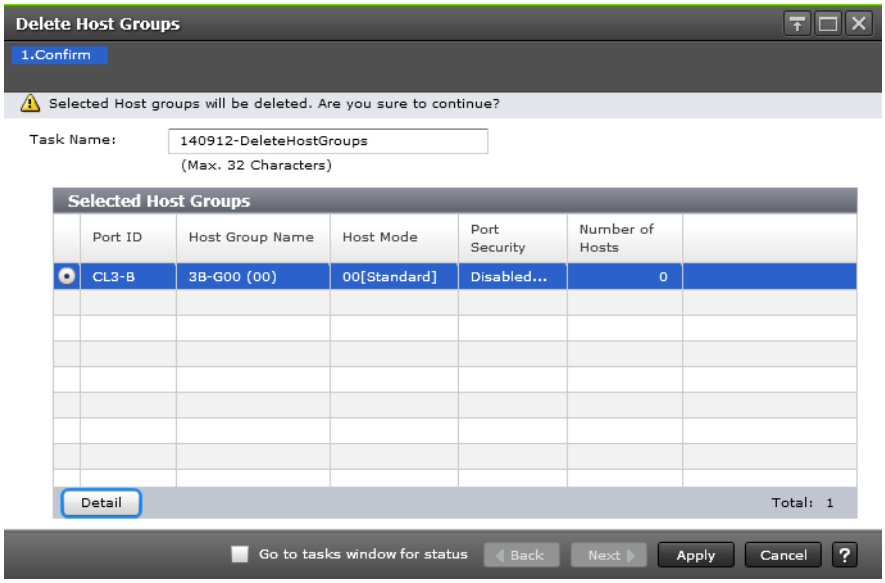
Change LUN IDs window



Setting field

Item	Description
Initial LUN ID	Specify the initial LUN ID. If multiple LUs are selected, LUN IDs are set consecutively from the specified LUN ID.

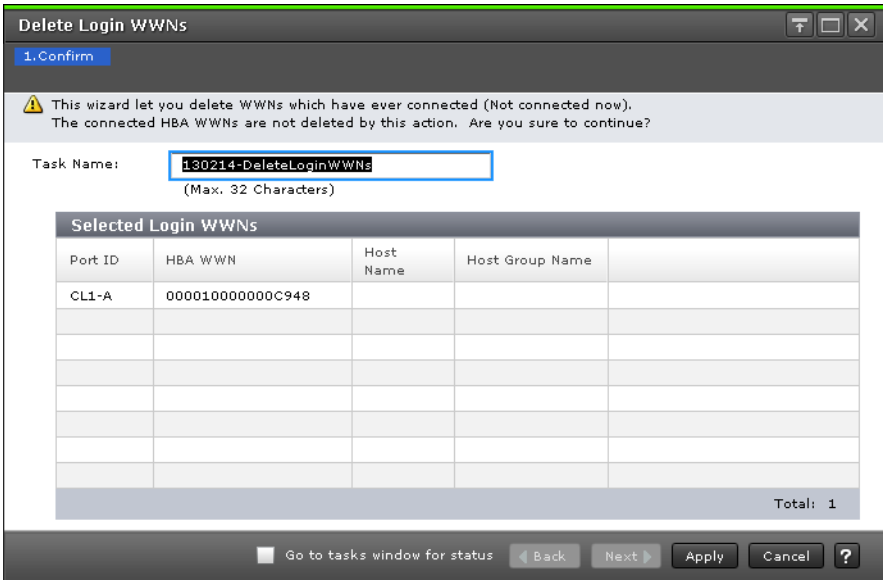
Delete Host Groups window



Selected Host Groups table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.
Detail	Details about the selected host group.

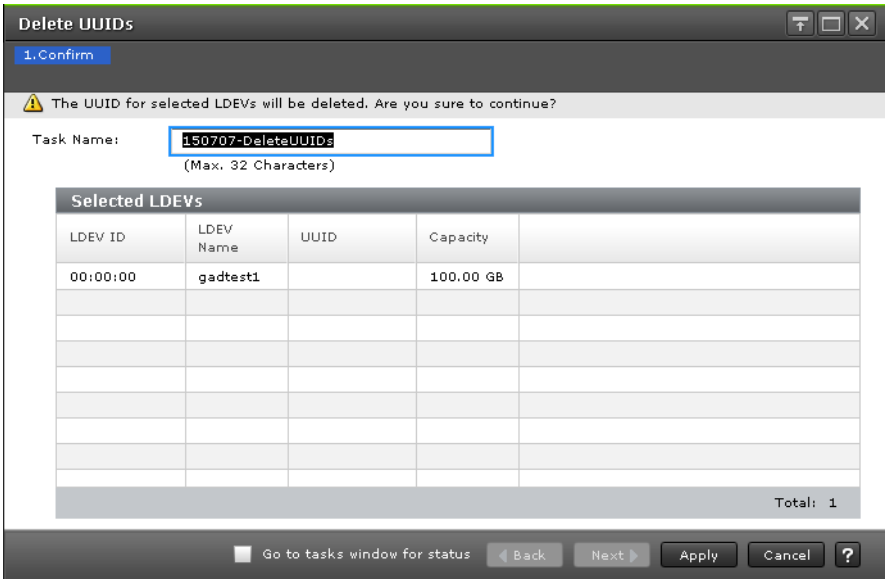
Delete Login WWNs window



Selected Login WWNs table

Item	Description
Port ID	Identifier of the port.
HBA WWN	WWN of the port.
Host Name	Name of the host.
Host Group Name	Name of the host group.

Delete UUIDs window

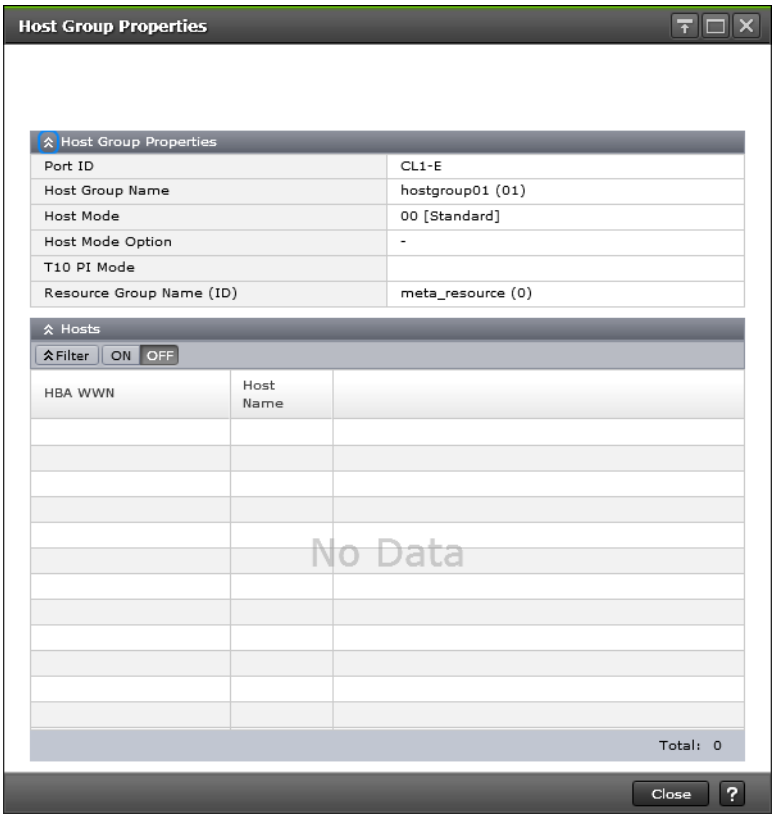


Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
UUID	This field is blank because the UUID is to be deleted.
Capacity	Size of each logical volume.

Host Group Properties window

Use this window to view properties about a selected host group.



Host Group Properties table

Item	Description
Port ID	Identifier of the port.
Host Group Name	Name of the host group.
Host Mode	The host mode of the host group.
Host Mode Option	The number of host mode options that are enabled.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).
Resource Group Name (ID)	Resource group names and IDs of host groups. The ID is provided in parentheses.

Hosts table

Item	Description
HBA WWN	WWN of the port.
Host Name	Name of the host.

LUN Properties window

LUN Properties table

This table provides information about the selected LUN.

Item	Description
LUN ID	Identifier of the selected logical unit.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Host Group Name / iSCSI Target Alias	Name of the host group or iSCSI target alias.
iSCSI Target Name	Name of the iSCSI target.
Host Mode	The host mode of the host group.
Host Mode Option	The number of host mode options that are enabled.
Port ID	Identifier of the port on this volume.
Type	Type of port: • Fibre: Fibre Channel port. • iSCSI: iSCSI port.

Item	Description
	• NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Emulation Type	Emulation types for the logical volume (or logical device).
Capacity	Size of the logical volume.
Provisioning Type	Provisioning type assigned to this logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
LDEV Attribute	Displays the attribute of the LDEV. • Command Device: Command device. • Remote Command Device: Remote command device. • Data Direct Mapping: LDEV with the data direct mapping attribute enabled. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed. • - (hyphen): Volume in which the attribute is not defined.
Command Device Attributes	If the logical volume is used as a command device, indicates the status of the attributes on this LDEV. • Security: Indicates the status of command device security is (enable or disable). • User Authentication: Indicates the status of user authentication (enable or disable). • Device Group Definition: Indicates the status of device group definition (enable or disable).
Access Attribute	Access attribute assigned to this LDEV. • Read/Write: Both read and write operations are permitted on the logical volume. • Read-only: Read operations are permitted on the logical volume. • Protect: Neither read nor write operations are permitted.
Number of Paths	Number of paths set for the LDEV.
UUID	User-definable LUN identifier. This field is blank if the UUID is not set.
CLPR	Cache logical partition numbers. For detailed information about CLPRs, see the Performance Guide.
Encryption	Displays the information about parity group encryption. • Enable: Encryption setting of a parity group in which the LDEV is placed is enabled. Or the virtual volume associated

Item	Description
	with the pool whose pool-VOLs are enabled of the encryption setting. • Disable: Encryption setting of a parity group (or a pool) in which the LDEV is placed is disabled. Or the virtual volume associated with the pool whose pool-VOLs are disabled of the encryption setting. • Mixed: This status is displayed when two or more of the following are specified as pool-VOLs: ○ Volume encryption setting is enabled. ○ Volume encryption setting is disabled. ○ External volume **Caution**: The data encryption is not ensured in the pool that has the Mixed encryption setting. To manage the data encryption securely, use the pool with an encryption setting of Enabled or Disabled. • - (hyphen): External volume or migration volume. As for DP-VOL of Dynamic Provisioning, the pool-VOL in the pool of which DP-VOL belongs is an external volume, or the pool of which DP-VOL belongs is being blocked. This item is not displayed when using Virtual Storage Platform G200.
ALUA Mode	Information about the ALUA mode. • Enabled: LDEV can be used in ALUA. • Disabled: LDEV cannot be used in ALUA.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.
T10 PI	The LDEV's T10 PI attribute setting (Enabled or Disabled).
Data Direct Mapped LDEV	Displays LDEV ID of pool-VOL in the pool with data direct mapping enabled. A hyphen (-) is displayed if the data direct mapping attribute is disabled.
Capacity Saving	Capacity saving setting of the LDEV: • Compression: The compression function is used. • Deduplication and Compression: The deduplication and compression functions are used. • Disabled: The capacity saving function is not used.
Capacity Saving Status	Status of the capacity saving function: • Enabling: The format for enabling the capacity saving function is being performed. • Rehydrating: The format for disabling the capacity saving function is being performed. • Deleting Volume: The deletion of DP-VOL whose capacity saving function is Enabled is being performed. • Enabled: The capacity saving function is enabled. • Disabled: The capacity saving function is disabled. • Failed: Data cannot be secured.

Item	Description
	• - (hyphen): The LDEV does not support the capacity saving function.
Deduplication Data	Displays whether the deduplication function is applied to the volume (DP-VOL). • Enabled: The deduplication function is applied. • Disabled: The deduplication function is not applied. • - (hyphen): The LDEV is not a DP-VOL, or the firmware version does not support deduplication. If the capacity saving setting of a DP-VOL is Deduplication and Compression, Enabled is displayed even if the used capacity is 0. When the capacity saving setting is Disabled and the disabling of the capacity saving setting is in process, Enabled is displayed for Deduplication Data while deduplicated data remains in the DP-VOL. When the disabling of the capacity saving setting is complete and no deduplicated data remains in the DP-VOL, Disabled is displayed.
Virtual Storage Machine	Information about the virtual storage machine. • Model / Serial Number: Model name and serial number of the virtual storage machine that has the LDEV. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to the LDEV, this column is blank. • Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If Virtual SSID is not set for an LDEV, this column is blank. • Attribute: Virtual LDEV attribute. If the attribute is not set for LDEV, this column is blank.

LUNs table

This table provides information about the LUN ID registered for the selected LDEV.

Item	Description
Port ID	Identifier of the port.
Type	Type of port: • Fibre: Fibre Channel port. • iSCSI: iSCSI port. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed.

Item	Description
	• NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
Host Group Name / iSCSI Target Alias	Name of the host group or iSCSI target alias.
iSCSI Target Name	Name of the iSCSI target.
LUN ID	Identifier of the logical unit.
Asymmetric Access States	Asymmetric access states of the port. When using iSCSI, a hyphen (-) is displayed. Active/Optimized: Access from the host is preferentially performed on this port. Active/Non-Optimized: When the Active/Optimized port is disabled, access from the host is performed on this port.

Hosts table

Lists the hosts that belong to the host group in which the selected LUN ID is registered.

Item	Description
Type	Type of port: • Fibre: Fibre Channel port. • iSCSI: iSCSI port. • NAS Platform (User LU): LDEV used for storing the NAS user data. This value appears if the NAS module is installed. • NAS Platform (System LU): LDEV used for storing the NAS firmware system data. This value appears if the NAS module is installed.
HBA WWN / iSCSI Name	WWN of HBA or iSCSI name.
Host Name	Name of the host.

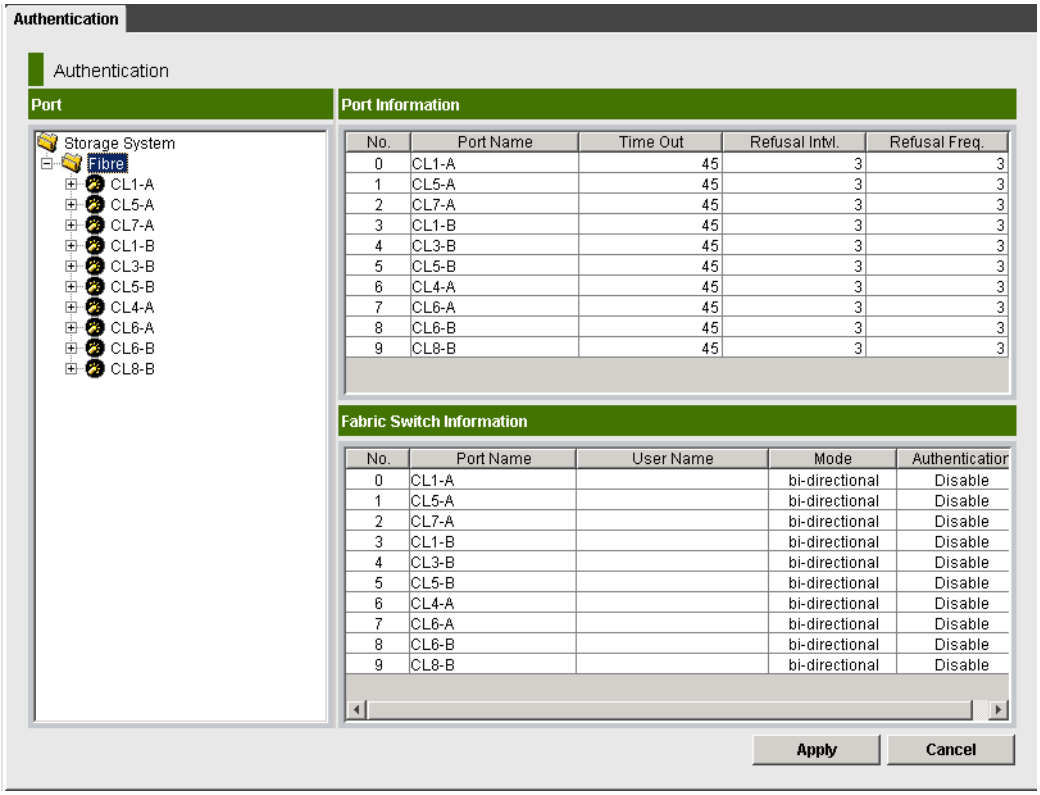
Authentication window

Authentication window (Fibre Channel folder selected)

To display the **Authentication** window, the Hitachi Device Manager - Storage Navigator secondary windows must be usable in advance. If the user authentication settings are performed, you must set the modify mode in the secondary window. The modify mode is an exclusive access control for operations of secondary windows. If you set the modify mode to ON, other users or programs cannot apply settings to a storage system. If you close the secondary window, the modify mode is released. For more information about

Hitachi Device Manager - Storage Navigator secondary windows and modify mode, see the *System Administrator Guide* of your storage system.

On the menu bar, click Actions > Port/Host Group, Fibre > Authentication. The **Authentication** secondary window opens.



Port tree

The Port tree provides information about user authentication on each port.

Double-click the Fibre folder to show the Fibre Channel ports in the storage system.

If you select the Fibre folder, information about ports and fabric switches appears in the table on the right of the tree. The Fibre folder is available only if the storage system contains a Fibre Channel board.

Item	Description
CLX-Y	This icon indicates a Fibre Channel port.

Port information list

Item	Description
Port Name	Fibre Channel port names.
Time out	The period of time between authentication sessions to the same port. If the previous authentication session to a port failed, the next authentication session starts after the specified period of time elapses. The unit is seconds.
Refusal Intvl.	If authentication fails for the number of times specified in Refusal Freq., connection to the port fails. Refusal Intvl. shows the interval (in minutes) from when connection to a port fails to when the next authentication session starts.
Refusal Freq.	Number of times that authentication is allowed for connection to a port. If authentication fails for the specified number of times, connection to the port fails.

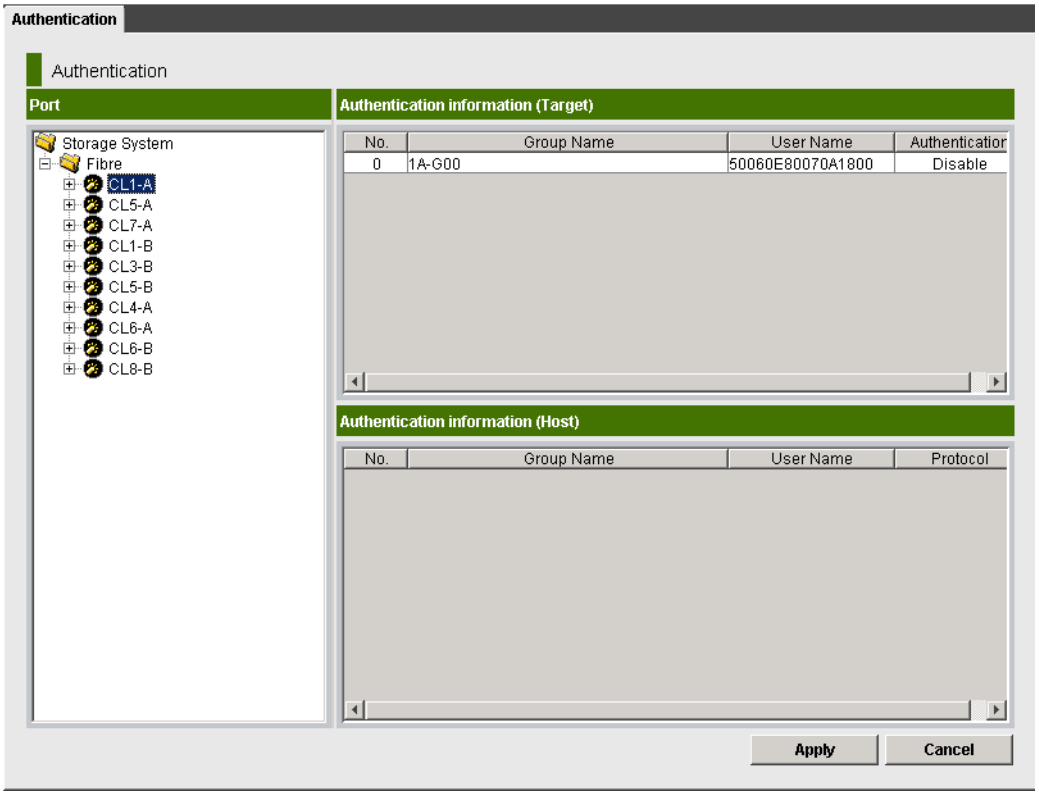
Fabric Switch information list

Item	Description
Port Name	Fibre Channel port name.
User Name	User name of the fabric switch.
Mode	Mode of authentication between ports and fabric switches. • bidirectional: The authentication mode is mutual. • unidirectional: The authentication mode is not mutual.
Authentication	Indicates whether to perform authentication for the fabric switch. • Enable: The fabric switch is a target of user authentication. • Disable: The fabric switch is not a target of user authentication.

Authentication window (Fibre Channel port selected)

Hitachi Device Manager - Storage Navigator secondary windows must be defined for use in advance. When you select Modify from this window to make user authentication settings, other users or programs are prevented from changing storage system settings. When you close the secondary window, Modify mode is released. For more information about Hitachi Device Manager - Storage Navigator secondary windows and Modify mode, see the *System Administrator Guide* of your storage system.

On the menu bar, click Actions > Port/Host Group, Fibre > Authentication. The **Authentication** secondary window opens.



Port tree

Use this tree to find information about user authentication on each port. When you select a port from this tree, the Authentication Information (Target) list on the right provides user information of the hosts that are registered on the port. In addition, the Authentication Information (Host) list below the Authentication Information (Target) list provides the user information of the selected port.

Double-click the Fibre folder to view all Fibre Channel ports in the storage system. The Fibre folder is available only if the storage system contains a Fibre Channel board. Double-click the Fibre Channel ports to view host groups in that port. The host group name appears beside the icon.

Item	Description
CLX-Y	Indicates a Fibre Channel port.
host group name	Indicates that the host group performs authentication of hosts.
host group name	Indicates that the host group does not perform authentication of hosts.

Authentication information (target) list

The list on the right provides user information of the host groups that are allowed to connect to the port or host group specified in the tree.

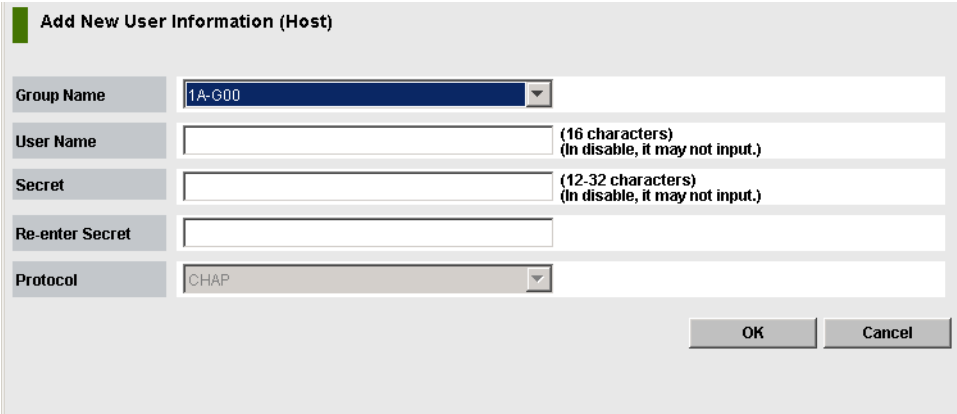
Item	Description
Group Name	Names of the host group.
User Name	User name of the host group. When the user name is not defined for a host group, this column is blank.
Authentication	Indicates whether to perform user authentication for the host. • Enable: The host is a target of user authentication. • Disable: The host is not a target of user authentication.

Authentication information (host) list

Below the User Information (Target) list appears a list that provides user information of the host selected in the port or host group in the tree. In this list, you can register up to 64 user information items.

Item	Description
Group Name	Name of the host group.
User Name	User name of the host. When the user name is not defined for a host, this column is blank.
Protocol	Indicates the protocol in use for user authentication. Always CHAP.

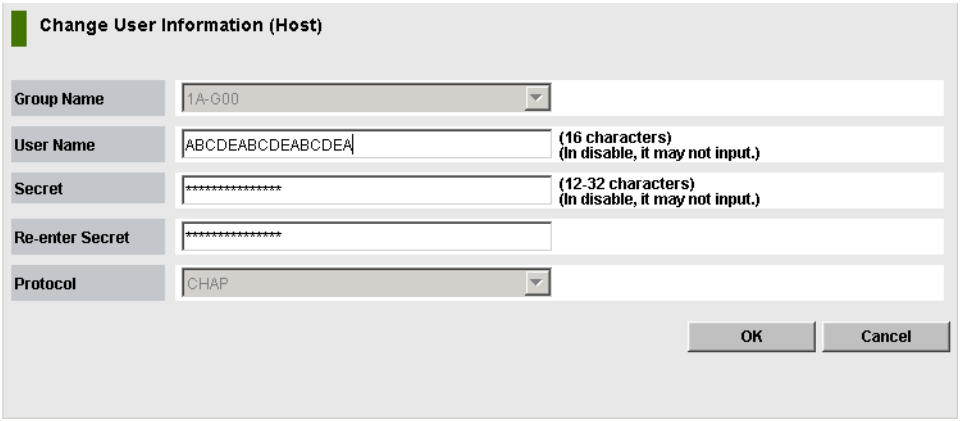
Add New User Information (Host) window



Item	Description
Group Name	Select the group name where the user will be registered.
User Name	Specify the user name of the host. 16 hexadecimal characters can be used. The user name is not case-sensitive.
Secret	Specify the secret to be used for host authentication.

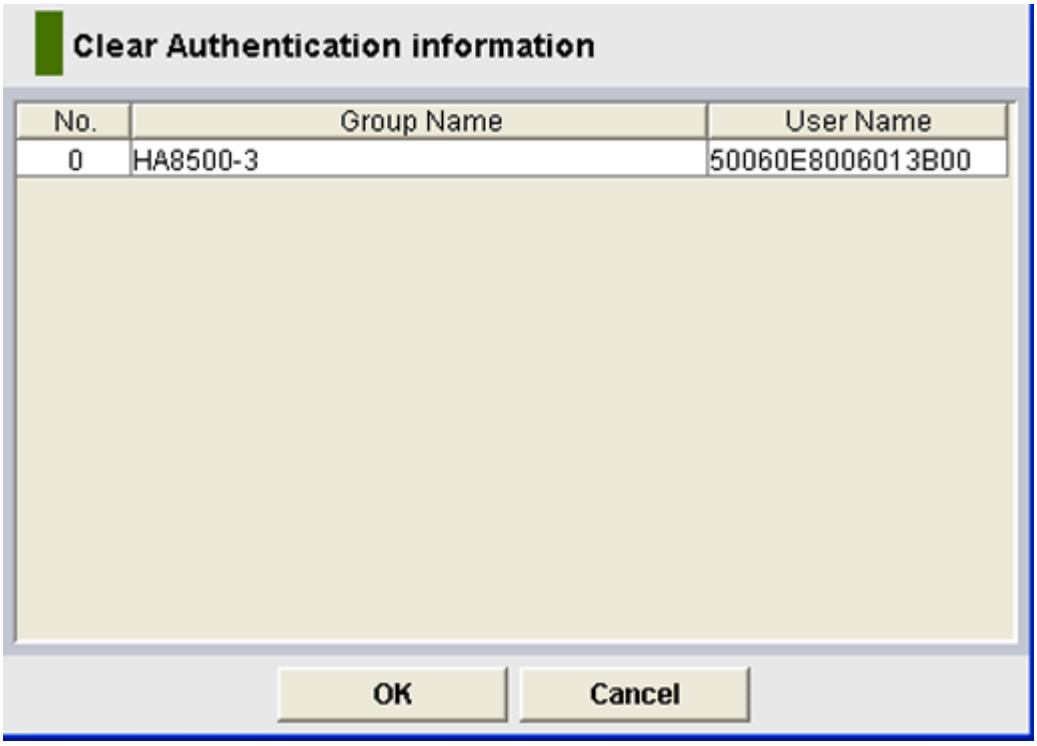
Item	Description
	Use 12 to 32 characters, including alphanumerics, spaces, and the following symbols: . - + @ _ = : / [ ] , ~
Re-enter Secret	Specify the secret again for confirmation. An error occurs if you enter incorrect characters, and then click OK.
Protocol	Protocol to be used for user authentication. This protocol is always CHAP (Challenge-Handshake Authentication Protocol).

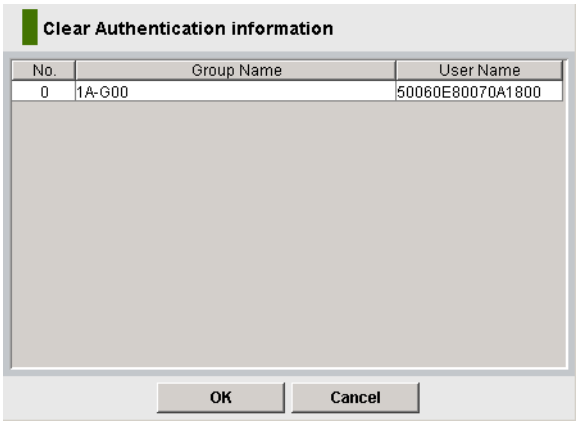
Change User Information (Host) window



Item	Description
Group Name	Group name where the user is registered.
User Name	Specify the user name of the host. 16 hexadecimal characters can be used. The user name is not case-sensitive.
Secret	Specify the secret to be used for host authentication. Use 12 to 32 characters, including alphanumerics, spaces, and the following symbols: . - + @ _ = : / [ ] , ~
Re-enter Secret	Specify the secret again for confirmation. An error occurs if you enter incorrect characters, and then click OK.
Protocol	Protocol to be used for user authentication. This protocol is always CHAP (Challenge-Handshake Authentication Protocol).

Clear Authentication information window

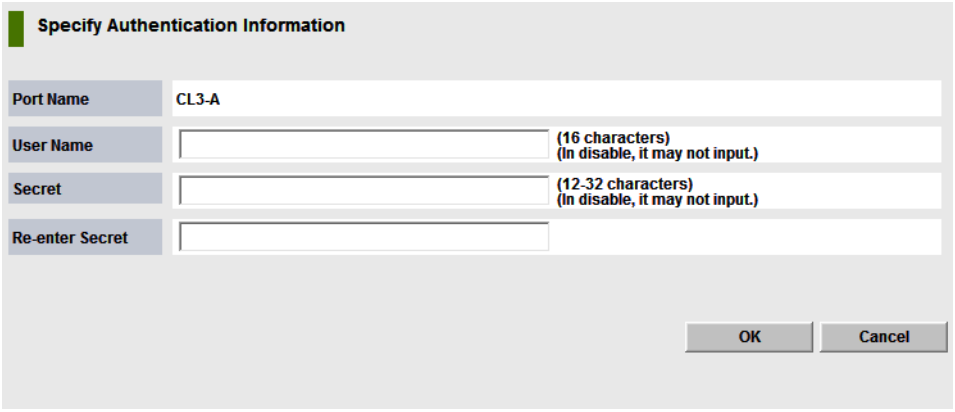




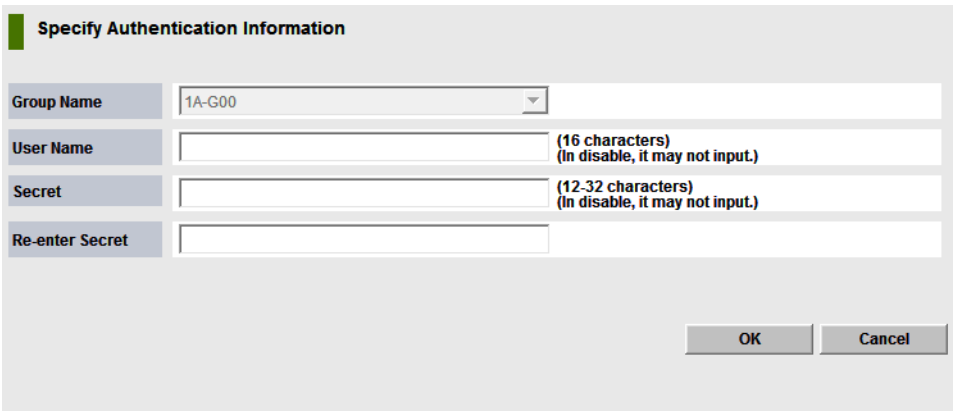
Item	Description
No	Item number.
Group Name	Group name to be deleted.
User Name	The name of the user to be deleted.

Specify Authentication Information window

When selecting a port

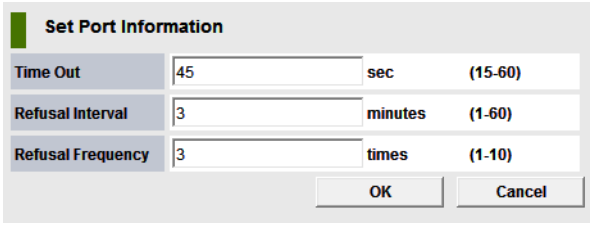


When selecting a host group



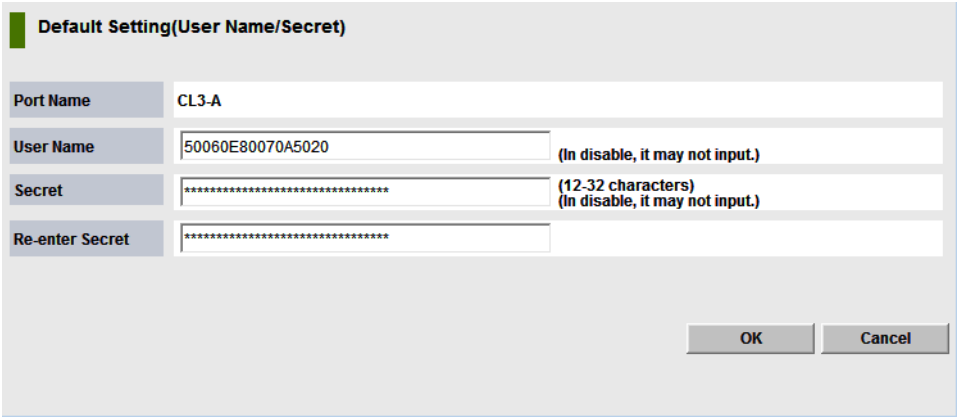
Item	Description
Port Name	Port name where the authentication information is specified in the window that opens when you select a port.
Group Name	Group name where the authentication information is specified in the window that opens when you select a host group.
User Name	Specify the user name of the host. 16 hexadecimal characters can be used. The user name is not case-sensitive.
Secret	Specify the secret to be used for host authentication. Use 12 to 32 characters, including alphanumerics, spaces, and the following symbols: . - + @ _ = : / [ ] , ~
Re-enter Secret	Specify the secret again for confirmation. An error occurs if you enter incorrect characters, and then click OK.

Set Port Information



Item	Description
Time out	Specify the period of time from when authentication fails to when the next authentication session is ended. This period of time is between 15 to 60 seconds. The initial value is 45.
Refusal Interval	Specify the interval from when connection to a port fails to when the next authentication session starts, with up to 60 minutes. The initial value is 3.
Refusal Frequency	Specify the number of times of authentication allowable for connection to a port with up to 10 times. The initial value is 3.

Default Setting(User Name/Secret) window



Item	Description
Port Name	Fibre Channel port names.
User Name	Specify the user name of the Fibre Channel switch with 16 characters. You can use hexadecimal characters in a user name. The user name is not case-sensitive.
Secret	Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters. You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : / [ ] , ~
Re-enter secret	Specify the secret, again, for confirmation.

Edit Command Devices wizard

The system administrator can enter CCI commands from open-system hosts to perform operations such as TrueCopy or ShadowImage operations or both on logical devices. For example, CCI commands can be used to create and to split pairs. If you want to allow the system administrator to enter CCI commands from open-system hosts, you must specify at least one logical device as the command device. If desired, you must also apply command device security to other logical devices in the storage system.

Use the **Edit Command Devices** window to edit command devices.

Caution: The following volumes cannot be specified as a command device:

- Volume whose access attribute is other than read/write.
- TrueCopy pair volume.
- Global-active device pair volume.
- ShadowImage pair volume.
- Universal Replicator pair volume.
- Virtual volume (V-VOL) for Thin Image.
- Volume reserved by Data Retention Utility.
- Journal volume.
- Pool volume that includes a DP-VOL with the direct mapping attribute enabled.
- Remote command device.
- LDEV of the ALU attribute.
- Quorum disk for global-active device.
- LDEV with ALUA mode enabled.
- LDEV with the T10 PI attribute enabled.
- LDEV with NAS Platform (User LU) enabled.
- LDEV with NAS Platform (System LU) enabled.

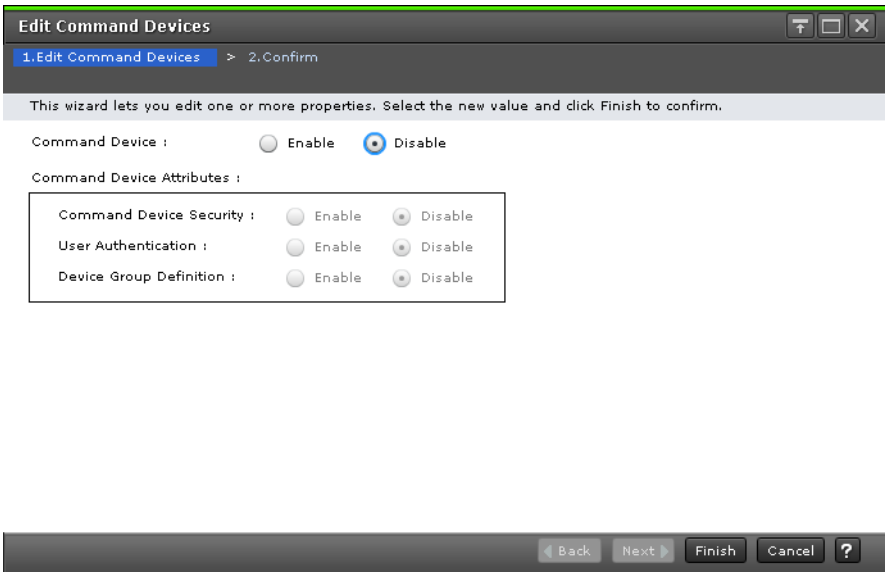
Procedure

1. Click **Storage Systems**, and then expand the **Storage Systems** tree.
2. Click **Logical Devices**.
3. Click **More Actions > Edit Command Devices**.
   The **Edit Command Devices** window opens.

Edit Command Devices window

If you want to enable command device security, user authentication, and device group definition, you must enable the command device in this window.

If the command device is disabled, you cannot enable command device security, user authentication, and device group definition.



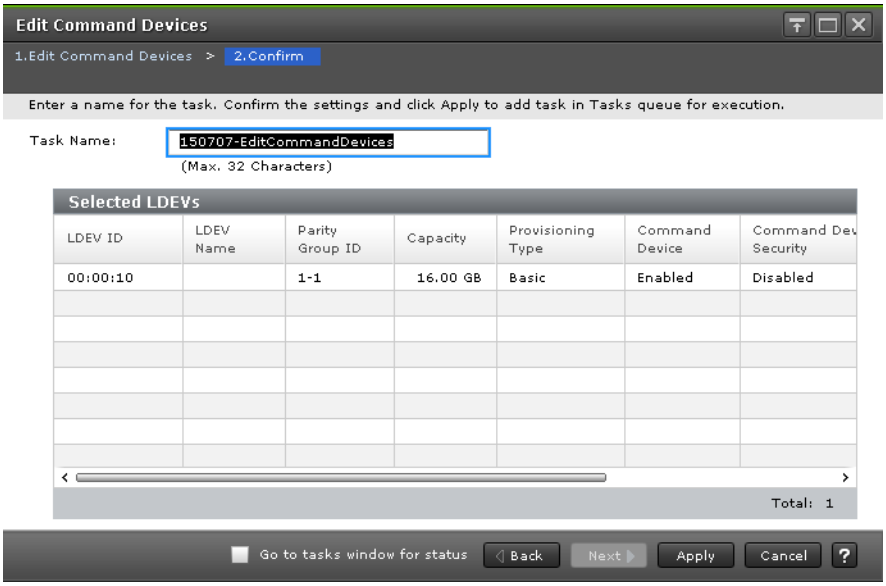
Item	Description
Command Device	Select Enable to enable command devices. Select Disable to release command devices.
Command Device Security	Select Enable to apply command device security to a logical device in a storage system. Select Disable to release command device security. If you want to protect logical volumes from the use of CCI commands, you must apply command device security to the logical volumes. If command device security is applied to a logical device, the logical device will not be affected by CCI commands issued via command devices from the hosts.[1]
User Authentication	Select Enable to apply user authentication to a command device. Select Disable to release user authentication.[1]
Device Group Definition	Select Enable to apply device group definition to a command device. Select Disable to release device group definition.[1]

Note:

1. For details about command device attribute settings, see the *Command Control Interface User and Reference Guide*.

Edit Command Devices confirmation window

Confirm proposed settings, name the task, and then click Apply. The task will be added to the execution queue.

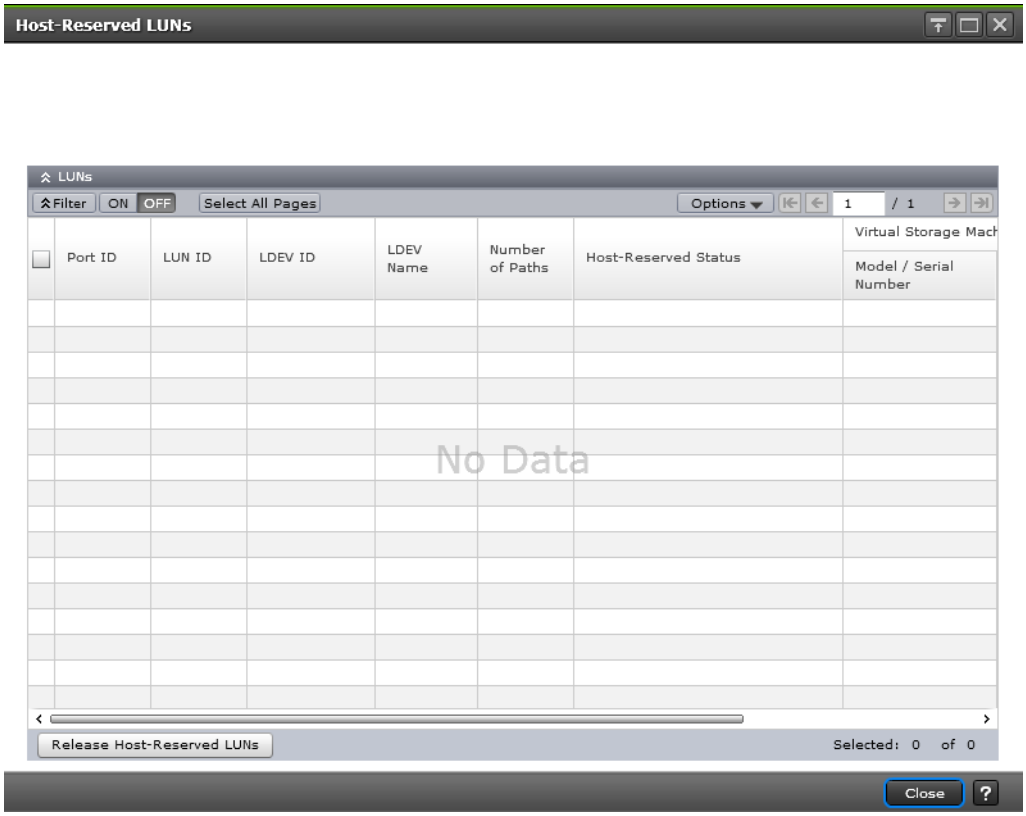


Selected LDEVs table

Item	Description
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Name of the LDEV.
Parity Group ID	Identifier of the parity group.
Capacity	Size of each logical volume.
Provisioning Type	Provisioning types for each logical volume. • Basic: Internal volume. • External: External volume. • DP: V-VOL of Dynamic Provisioning. • Snapshot: Thin Image volume.
Command Device	Indicates whether the selected logical device is a command device. • Enabled: The command devices are enabled. • Disabled: The logical device is not a command device.
Command Device Security	Indicates whether command device security is applied to the selected command device. • Enabled: Command device security is applied to the command device. • Disabled: Command device security is not applied to the command device.
User Authentication	Indicates whether user authentication is applied to the selected command device. • Enabled: User authentication is applied to the command device. • Disabled: User authentication is not applied to the command device.
Device Group Definition	Indicates whether the device group definition is applied to the selected command device.

Item	Description
	• Enabled: Device group definition is applied to the command device. • Disabled: Device group definition is not applied to the command device.

Host-Reserved LUNs window



LUNs table

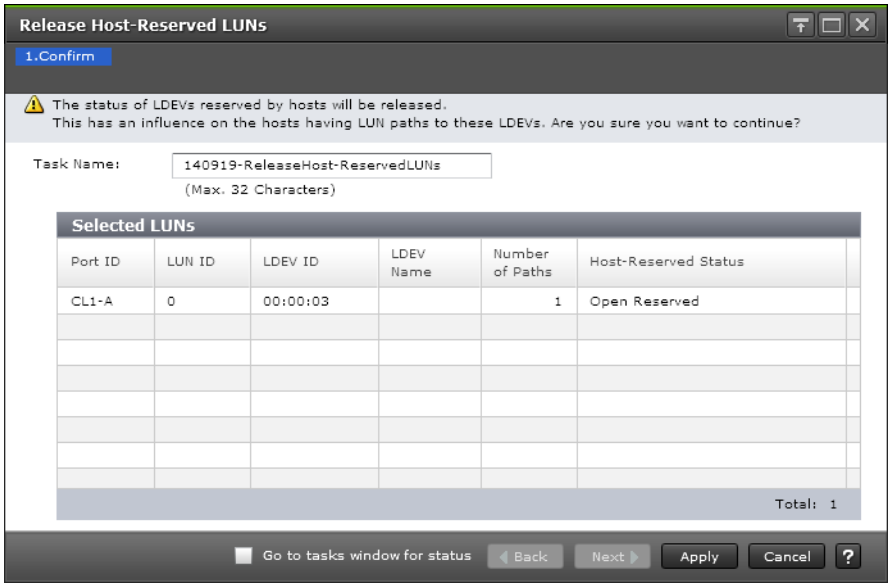
LUNs reserved by hosts are displayed.

Item	Description
Port ID	Displays names of ports.
LUN ID	Displays IDs of the LUNs.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays names of LDEVs.
Number of Paths	Displays the number of paths set for the relevant LDEV.
Host-Reserved Status	Displays the status of the host-reserved LUN. • Open Reserved: LUN is reserved by the Open Reserved command.

Item	Description
	• Persistent Reserved: LUN is reserved by the Persistent Group Reserve command. • ACA Active: LUN is in the ACA active status.
Virtual Storage Machine	Information about the virtual storage machine. • Model / Serial Number: Model name and serial number of the virtual storage machine that has LDEV. • LDEV ID: Virtual LDEV ID. If a Virtual LDEV ID is not assigned to LDEV, this column is blank. • Device Name: Virtual device name, which is a combination of the virtual emulation type, virtual LUSE volume number, and the virtual CVS attribute. Values of the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute appear only for items that have been set. This column is blank when the virtual emulation type, virtual LUSE volume number, and virtual CVS attribute are not set. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. • SSID: Virtual SSID. If Virtual SSID is not set for LDEV, this column is blank.
Release Host-Reserved LUNs	Displays the **Release Host-Reserved LUNs** window.

Release Host-Reserved LUNs wizard

Release Host-Reserved LUNs window

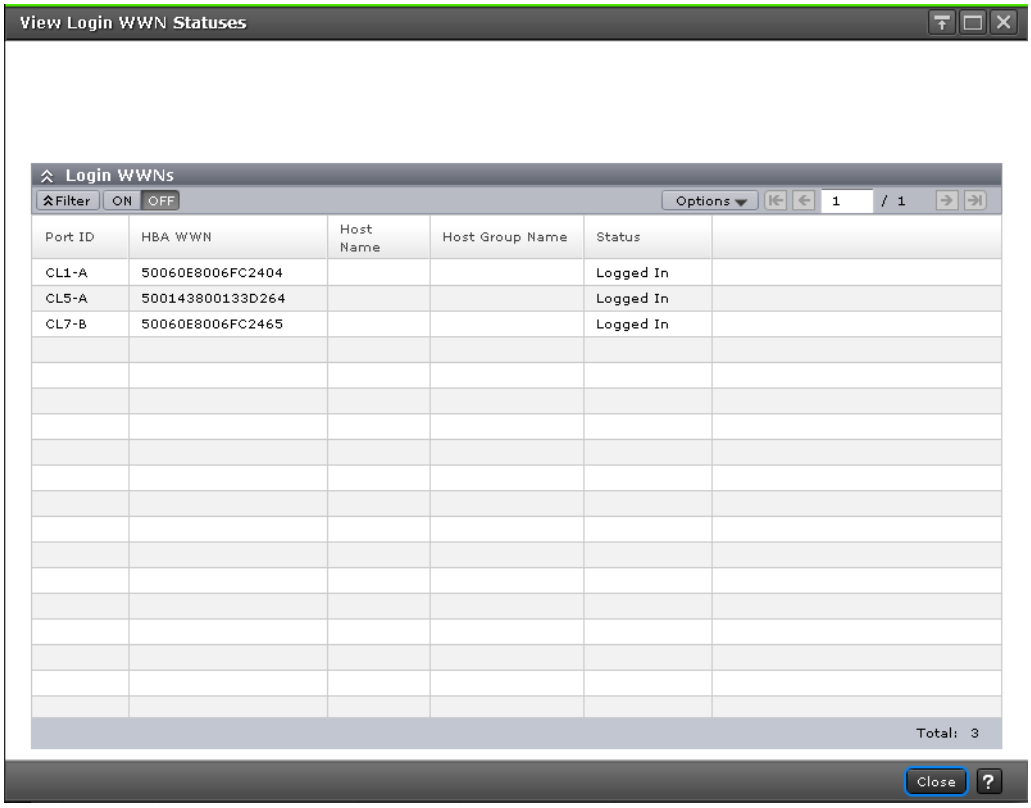


LUNs to release the reservations by hosts are displayed.

Selected LUNs table

Item	Description
Port ID	Displays names of ports.
LUN ID	Displays IDs of the LUNs.
LDEV ID	LDEV identifier, which is the combination of LDKC, CU, and LDEV.
LDEV Name	Displays names of LDEVs.
Number of Paths	Displays the number of paths set for the relevant LDEV.
Host-Reserved Status	Displays the status of the host-reserved LUN. • Open Reserved: LUN is reserved by the Open Reserved command. • Persistent Reserved: LUN is reserved by the Persistent Group Reserve command. • ACA Active: LUN is in the ACA active status.

View Login WWN Statuses window

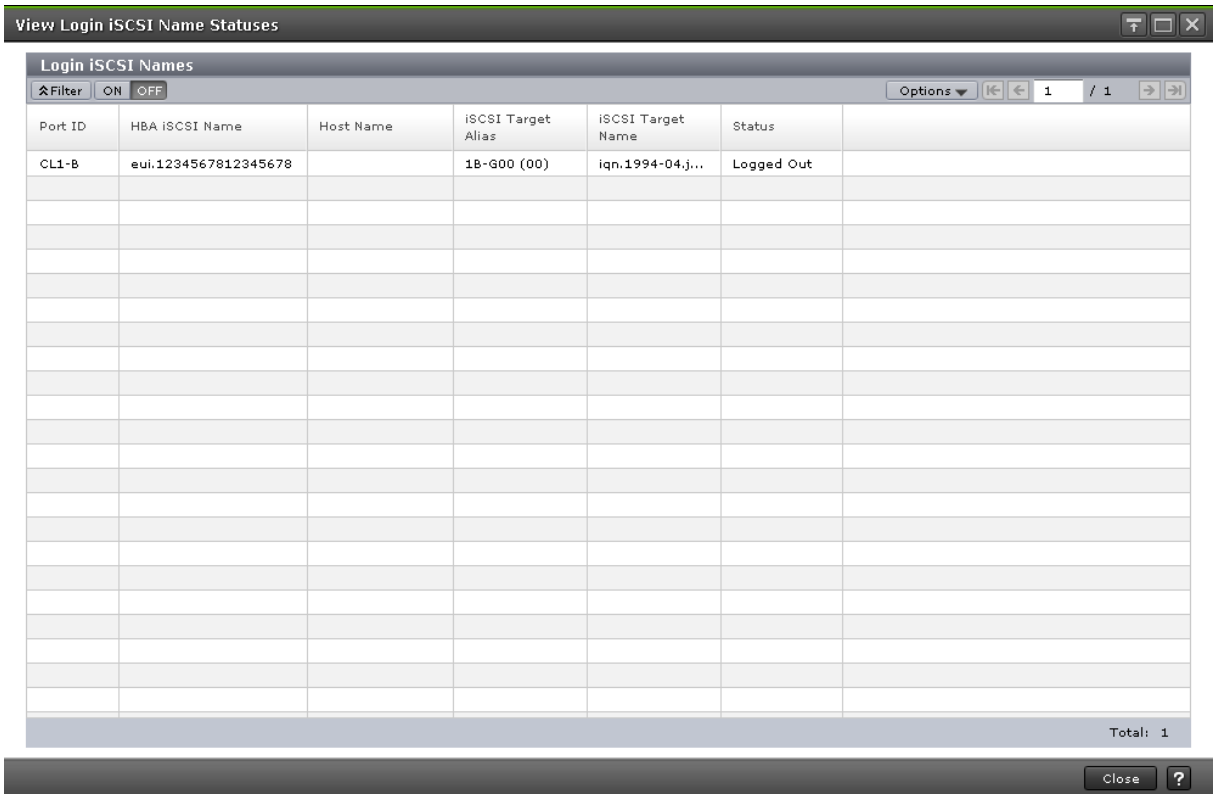


Login WWNs table

Item	Description
Port ID	Displays names of ports.

Item	Description
HBA WWN	Displays the HBA WWNs and their icons.
Host Name	Displays the names of hosts.
Host Group Name	Displays the names of host groups.
Status	Displays the host login status (Logged In or Logged Out).

View Login iSCSI Name Statuses window



Login iSCSI Names table

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI name.
Host Name	Host name.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Status	Status of the login from the host. Logged In or Logged Out appears.

Port Properties window

Port Properties

Port Properties		
Port ID		CL2-B
Type		iSCSI
IPv4	IP Address	192.168.0.112
	Subnet Mask	255.255.255.0
	Default Gateway	0.0.0.0
IPv6	Mode	Disabled
	Link Local Address	-
	Link Local Address Status	-
	Global Address	-
	Global Address Status	-
	Global Address 2	-
	Global Address 2 Status	-
	Subnet Prefix	-
	Assigned Default Gateway	-
	Current Default Gateway	-
	Default Gateway Status	-
Speed		10 Gbps
Security		Disabled
TCP Port Number		3260
Ethernet MTU Size	MTU	1500 Bytes
	Linked MTU	-1 Bytes
MAC Address		00:00:00:00:00:00
Keep Alive Timer		60 Second(s)
Selective ACK		Enabled
Delayed ACK		Enabled
Maximum Window Size		64 KB
iSNS Server	Mode	Disabled
	IP Address	-
	TCP Port Number	-
VLAN	Tagging Mode	Disabled
	ID	-
iSCSI Virtual Port Mode		Disabled

Close ?

Port Properties table

Item	Description
Port ID	Identifier of the port.
Type	Type of the port. iSCSI: iSCSI port.
IPv4	Information about IPv4. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port. • IP Address: IP address of the port. If two or more ports are selected, this information cannot be specified. • Subnet Mask: Subnet mask of the port. • Default Gateway: Default gateway of the port.
IPv6	Information about IPv6. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port. • Mode: IPv6 setting (Enabled or Disabled) for the port. • Link Local Address: Link local address for the port. • Link Local Address Status: Link local address status for the port. • Global Address: The first global address for the port. • Global Address Status: Status of the first global address for the port. • Global Address 2: The second global address for the port. • Global Address 2 Status: Status of the second global address for the port. • Subnet Prefix: Subnet prefix for the port address. • Assigned Default Gateway: Assigned default gateway address for the port. • Current Default Gateway: Current default gateway address for the port. • Default Gateway Status: Default gateway status.
Speed	Data transfer speed for the selected port.
Security	LUN security setting (Enabled or Disabled) on the port.
TCP Port Number	TCP port number. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Ethernet MTU Size	MTU size on Ethernet. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port. • MTU: Specified MTU size. • Linked MTU: Present MTU size for the data transfer.
MAC Address	MAC address.

Item	Description
Keep Alive Timer	Keep alive timer setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Selective ACK	Selective ACK setting (Enabled or Disabled) of the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Delayed ACK	Delayed ACK setting (Enabled or Disabled) of the port. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
Maximum Window Size	Maximum window size setting. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port.
iSNS Server	Information about the iSNS server. • Mode: iSNS server setting (Enabled or Disabled). • IP Address: IP address of the iSNS server. • TCP Port Number: TCP port number of the iSNS server.
VLAN	Information about VLAN. A hyphen (-) is displayed if the iSCSI virtual port mode is enabled for the port. • Tagging Mode: Tagging mode setting (Enabled or Disabled) for the port. • ID: VLAN identifier.
iSCSI Virtual Port Mode	Information about the setting of the iSCSI virtual port mode for a port. • Enabled: The iSCSI virtual port mode is enabled for the port. • Disabled: The iSCSI virtual port mode is disabled for the port. • - (hyphen): The port does not support the iSCSI virtual port mode.

CHAP User Properties window

CHAP User Properties table

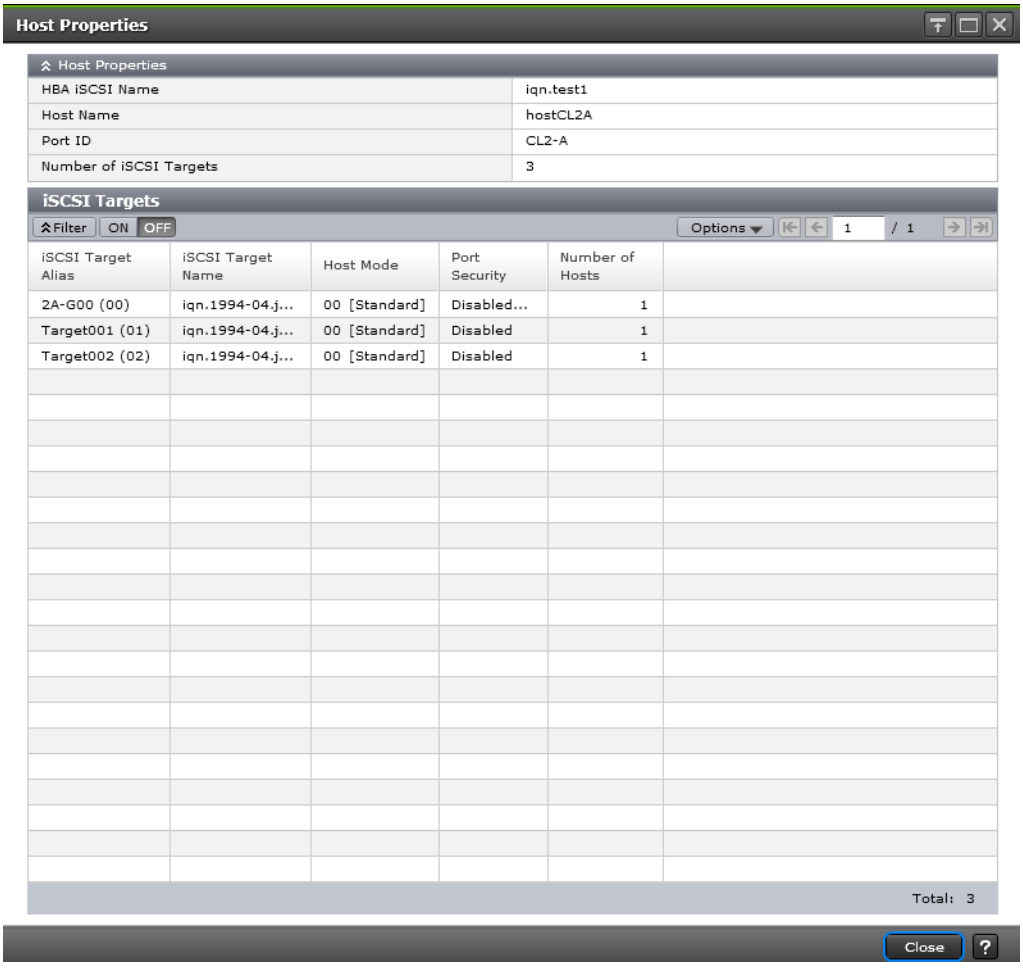
Item	Description
User Name	User name.
Port ID	Identifier of the port.
Number of iSCSI Targets	Number of iSCSI targets.

iSCSI Targets table

Item	Description
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Authentication	Information about the authentication.

Item	Description
	• Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Number of Users

Host Properties window



Host Properties table

Item	Description
HBA iSCSI Name	HBA iSCSI Names and their icons.
Host Name	Name of hosts.
Port ID	Identifier of the port.

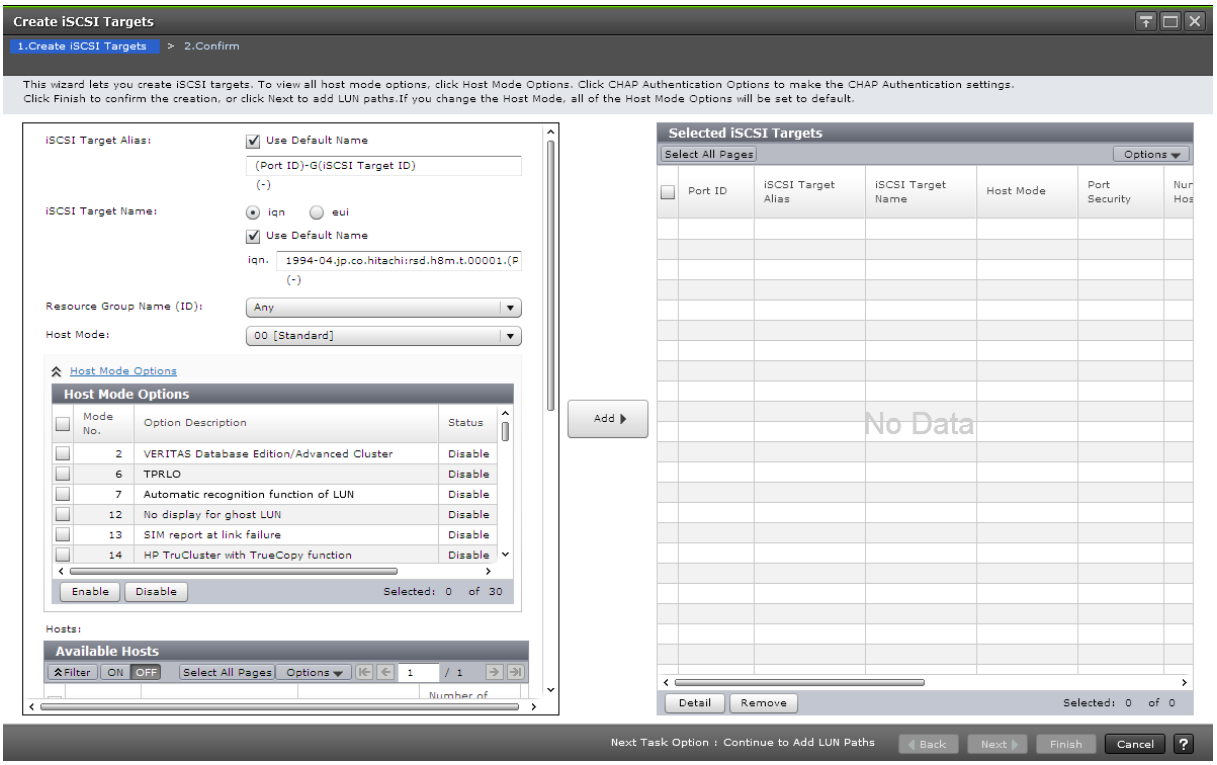
Item	Description
Number of iSCSI Targets	Number of iSCSI targets.

iSCSI Targets table

Item	Description
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	Host mode of the host group.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the host group.

Create iSCSI Targets wizard

Create iSCSI Targets window



Setting field

Item	Description
iSCSI Target Alias	• Use Default Name: If this check box is selected, the iSCSI target alias is input by default. • Text box: Specify the iSCSI target alias. If Use Default Name is selected, the default value appears with the following format: *Port-ID*-G*iSCSI-target-ID* For instance, 1A-G00 appears. If Use Default Name is not selected, the blank field appears. You can enter up to 32 ASCII characters and symbols, with the exception of: \ / , ; * ? " < > |.
iSCSI Target Name	• iqn or eui: Select the format which you want to use. • Use Default Name: If this check box is selected, the iSCSI target name is input by default. • Text box: Specify the iSCSI target name. If Use Default Name is selected, the default value appears with the following format: For the iqn format: iqn.1994-04.jp.co.hitachi:rsd.*Model-name*.t.*Serial-number*.*Port-identifieriSCSI-target-identifier* For instance, iqn.1994-04.jp.co.hitachi:rsd.r80.t.62507.1a000 appears. For the eui format: eui.*(6-digits-of-OUI)(Fixed-value-given-to-each-storage)(Serial-number)(Port-name)(iSCSI-target-identifier)* For instance,eui.02004567A425678D appears. If Use Default Name is not selected, the default value for the iqn format is as follows: For the iqn format: iqn.1994-04.jp.co.hitachi:rsd.*Model-name*.t.*Serial-number*.*Port-identifieriSCSI-target-identifier* You can enter up to 219 ASCII characters and symbols, with the exception of: \ / , ; * ? " < > |. If Use Default Name is not selected, the default value for the eui format is blank. You can enter fixed to 16 alphanumeric characters that are case-sensitive.
Resource Group Name (ID)	Select the resource group in which the iSCSI target is created. If Any is selected, among all ports being allocated to the user, ports where the host group can be add are available in the Available Ports table. If other than Any is selected, among ports assigned to the selected

Item	Description
	resource group, ports where the host group can be add are available in the Available Ports table.
Host Mode	Select the host mode from the list.

Host Mode Options table

Item	Description
Mode No.	The ID number of the host mode option.
Option Description	The description of host mode option.
Status	The setting status (Enabled or Disabled) of the host mode option.
Enabled	Indicates that the host mode option is enabled.
Disabled	Indicates that the host mode option is disabled.

Available Hosts table

This table lists information about the registered hosts.

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	iSCSI name of the port.
Host Name	Name of the host.
Number of iSCSI Target	Number of the iSCSI targets.
New Host	Indicates whether the host is newly connected. • Yes: The host is newly added and has never been connected via a cable to any port in the storage system. • No: The host has been connected via a cable to another port.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Add New Host	Adds a new host. Or, select host bus adapters then click to assign a nickname to the host bus adapter.

Available Ports table

This table lists the registered ports.

Item	Description
Port ID	Identifier of the port.
Security	LUN security setting (Enabled or Disabled) on the port.

Authentication Method

Select the CHAP Authentication setting from Enable, Disable, or Use Host Setting.

CHAP Authentication Options

Item	Description
Mutual CHAP	Select the mutual authentication mode to Enable or Disable. If Disable is selected, the unidirectional authentication mode is performed
User Name	Specify the user name. If Disable is selected in the Mutual CHAP, this item is optionally specified. If Mutual is selected, this item must be specified. Specify the user name between 1 to 223 characters. You can use case-sensitive alphanumeric characters, spaces, and the following symbols: . - + @ _ = : [ ] , ~
Secret	Specify the secret which is used for host authentication. If Disable is selected in the Mutual CHAP, this item is optionally specified. If Mutual is selected, this item must be specified. Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters. You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : [ ] ~
Re-enter Secret	Specify the secret again for confirmation. If incorrect, an error message appears when clicking Add.

Available CHAP Users table

Item	Description
Port ID	Identifier of the port.
User Name	Name of the user.
User Seq. No.	User sequence identifier.
Number of iSCSI Target	Number of the iSCSI targets.
New CHAP User	Indicates whether the CHAP user is newly added or not. Yes: New CHAP user added by using of the **Add New CHAP User** window. No: Existing CHAP user.
Port Security	LUN security setting (Enabled or Disabled) on the port.

Item	Description
Add New CHAP User	Click this button to add the new CHAP user. If the new CHAP user is added, Port ID is blank.

Add button

Adds the settings to the Selected iSCSI Targets table.

Selected iSCSI Targets table

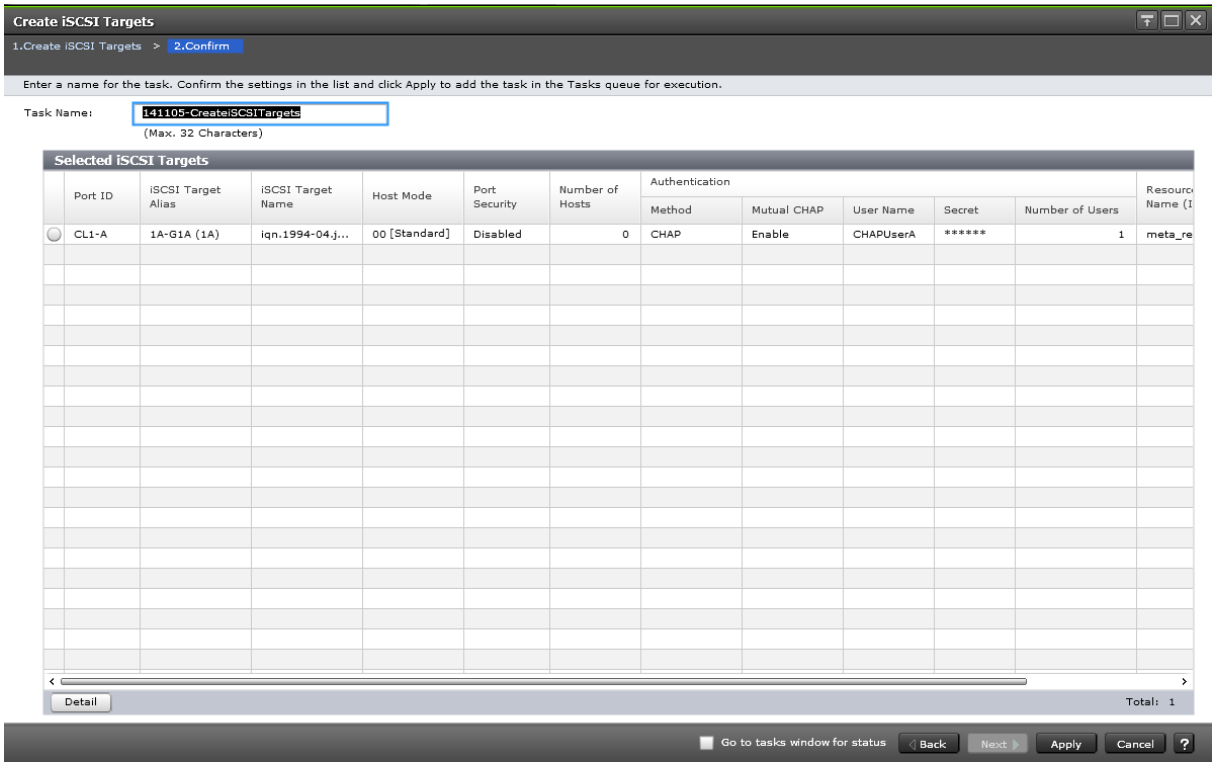
Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Number of Users
Resource Group Name (ID)	Resource group name and identifier of the resource group containing the iSCSI target.
Virtual Storage Machine	Model name and serial number of the virtual storage machine.
Detail	Details about the selected iSCSI target.
Remove	Removes the selected iSCSI targets from this table.

Next Task Option

Click Next to go to the task setting window, which is indicated in Next Task Option.

Create iSCSI Targets Confirm window

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, then click Help.



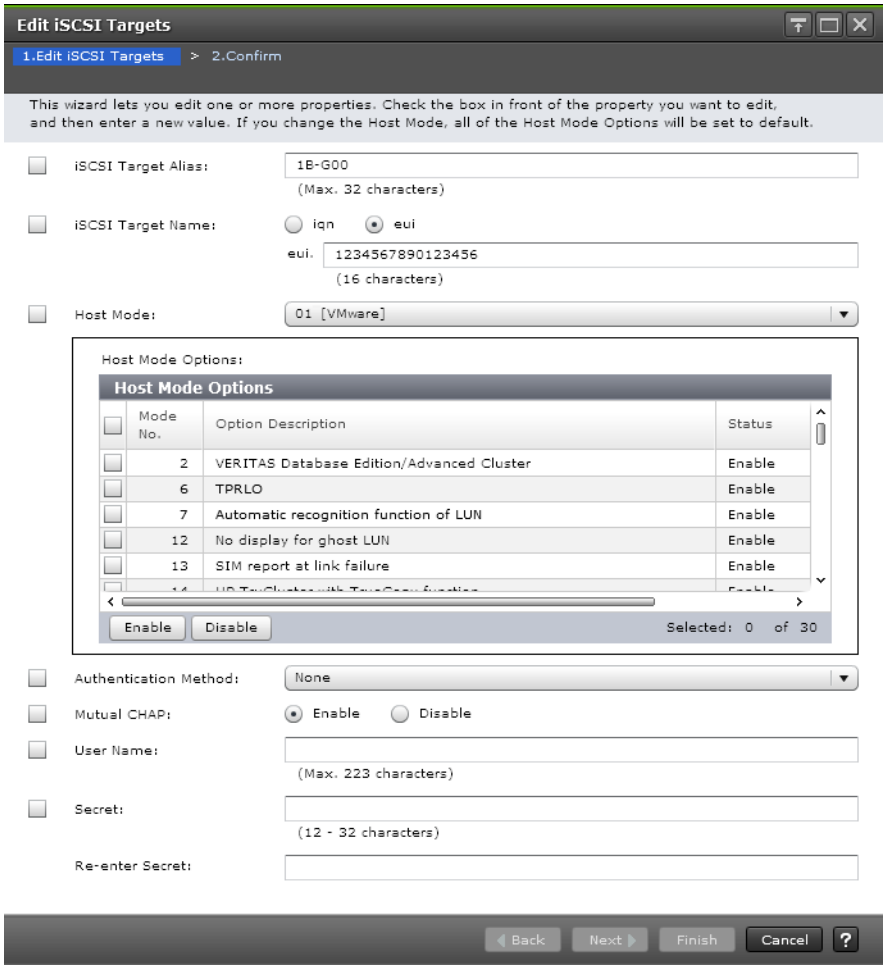
Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Secret: If the secret is specified, the character string of six asterisks (*) appears. • Number of Users
Resource Group Name (ID)	Resource group name and identifier of the resource group containing the iSCSI target.
Virtual Storage Machine	Model name and serial number of the virtual storage machine.

Item	Description
Detail	Details about the selected iSCSI target.

Edit iSCSI Targets wizard

Edit iSCSI Targets window



Item	Description
iSCSI Target Alias	Specify the iSCSI target alias.
iSCSI Target Name	• iqn or eui: Select the format which you want to use. • Text box: Specify the iSCSI target name. For the iqn format: iqn.1994-04.jp.co.hitachi:rsd.*Model-name*.t.*Serial-number* .*Port-identifier iSCSI-target-identifier*

Item	Description
	For instance, iqn.1994-04.jp.co.hitachi:rsd.r80.t.62507.1a000 appears. You can enter up to 219 ASCII characters and symbols, with the exception of: \ / , ; * ? " < > |. For the eui format: eui.*(6-digits-of-OUI)(Fixed-value-given-to-each-storage)(Serial-number)(Port-name)(iSCSI-target-identifier)* For instance, eui.02004567A425678D appears. You can enter fixed to 16 alphanumeric characters that are case-sensitive.
Host Mode	Select the host mode from the list.

Host Mode Options table

To set the host mode option, select a host mode option, then click Enable. If you do not need a host mode option, select an unnecessary host mode option, then click Disable.

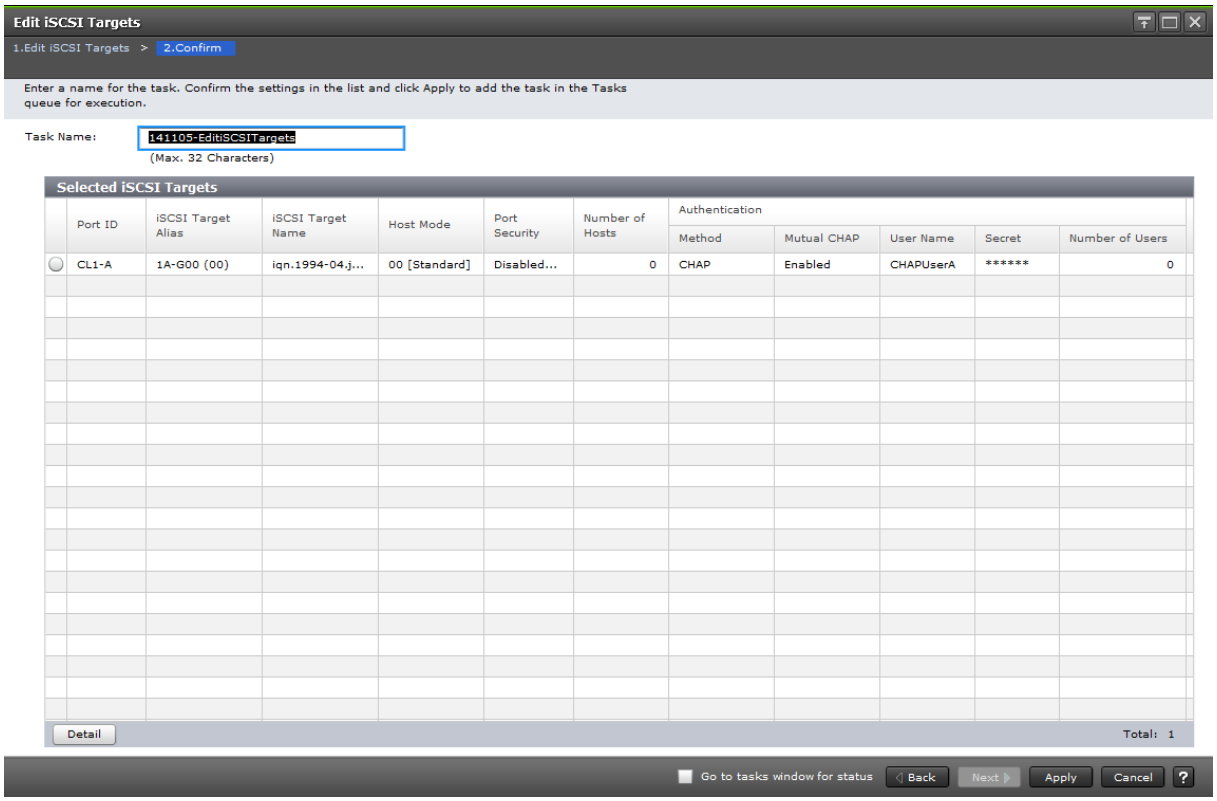
Item	Description
Mode No.	Number identifier of the host mode option.
Option Description	Description of the host mode option.
Status	Indicates the current status setting (Enabled or Disabled) of the host mode option on this host group.
Enable	Enables the host mode option.
Disable	Disables the host mode option.

Item	Description
Authentication Method	Select the authentication setting from CHAP, None or Comply with Host Setting. If CHAP is selected, following items can be specified.
Mutual CHAP	Select Enable or Disable. If Enable is selected, the mutual authentication mode is performed. If Disable is selected, the unidirectional authentication mode is performed.
User Name	Specify the user name between 1 to 223 characters. You can use case-sensitive alphanumeric characters, spaces, and the following symbols: . - + @ _ = : [ ] , ~

Item	Description
Secret	Specify the secret (that is, a password used in CHAP authentication) between 12 to 32 characters. You can use alphanumeric characters, spaces, and the following symbols in a secret: . - + @ _ = : [ ] ~
Re-enter Secret	Specify the secret again for confirmation. If incorrect, an error message appears when clicking Finish.

Edit iSCSI Targets Confirm window

Note: If multiple tasks that are connected in one wizard are executed, this window shows all configured items of tasks. To show information of configured items other than this topic, click Back to display related setting windows, then click Help.



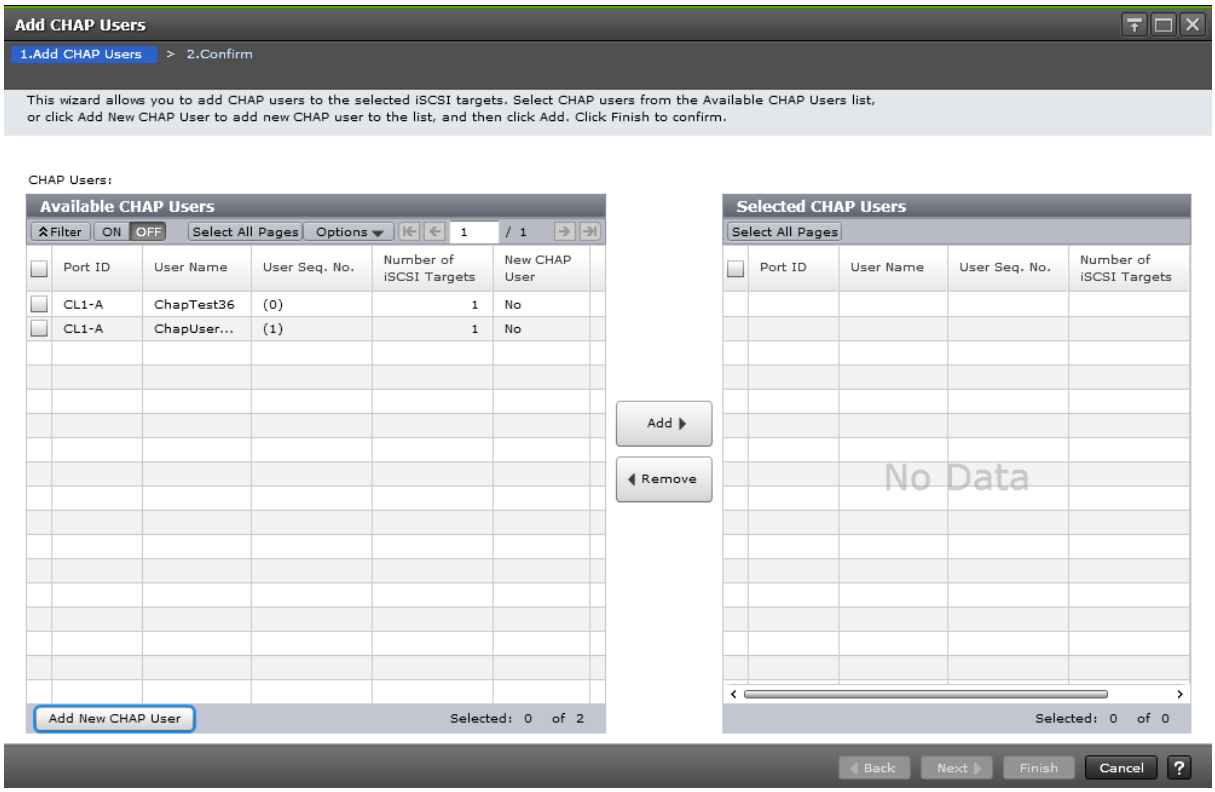
Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.

Item	Description
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name • Secret: If the secret is specified, the character string of six asterisks (*) appears. • Number of Users
Detail	Details about the selected iSCSI target.

Add CHAP Users wizard when selected iSCSI target

Add CHAP Users window



Available CHAP Users table

This window lists CHAP users that can be registered to the selected iSCSI target

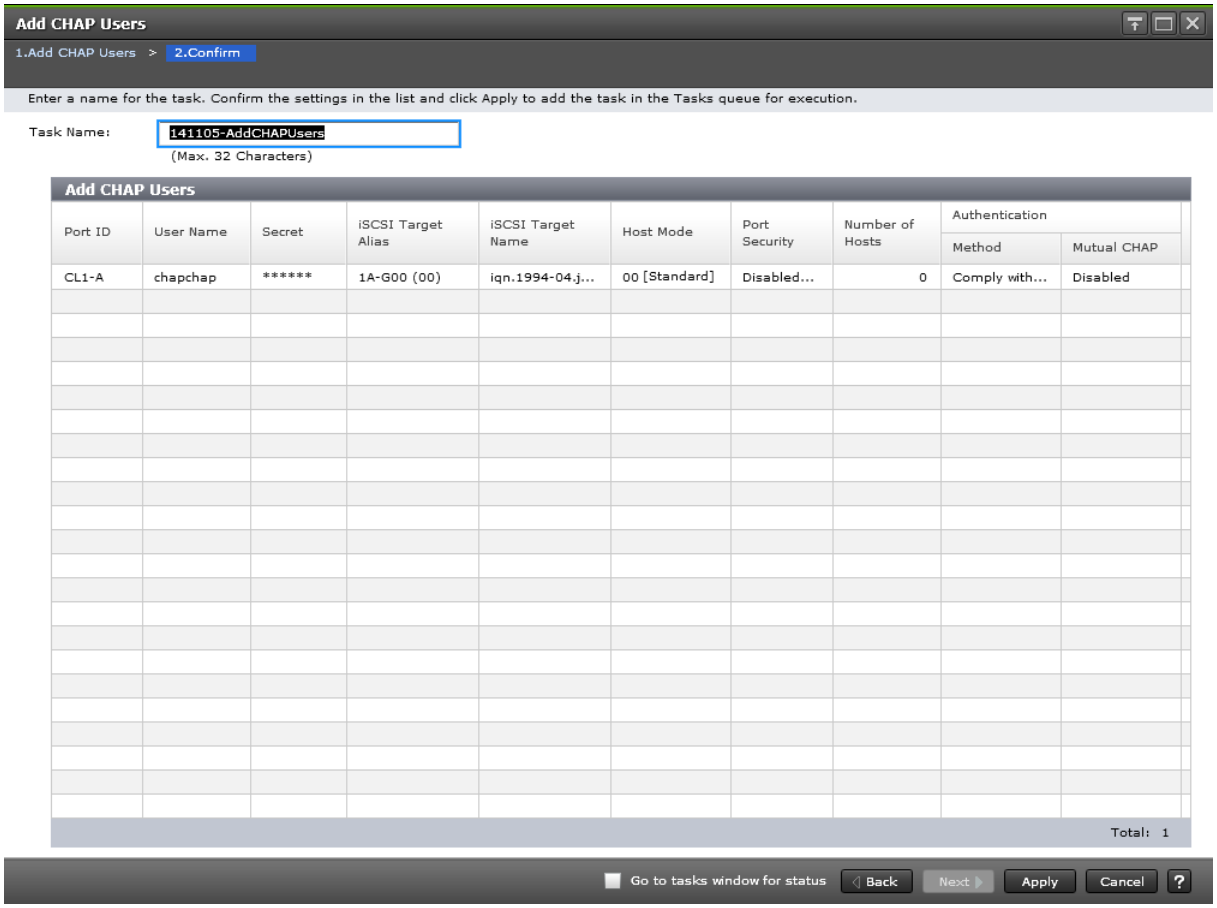
Item	Description
Port ID	Identifier of the port.
User Name	Name of the user.
User Seq. No.	User sequence identifier.
Number of iSCSI Target	Number of the iSCSI targets.
New CHAP User	Indicates whether the CHAP user is newly added or not. Yes: New CHAP user added by using the **Add New CHAP User** window. No: Existing CHAP user.
Add New CHAP User	Click this button to add the new CHAP user. If the new CHAP user is added, Port ID is blank.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Add	Adds CHAP users selected from the Available LDEVs table to the Selected LDEVs table.
Remove	Removes logical volumes from the Selected LDEVs table.

Selected CHAP Users table

This table lists CHAP users that are selected from the Available CHAP Users table.

Item	Description
Port ID	Identifier of the port.
User Name	Name of the user.
User Seq. No.	User sequence identifier.
Number of iSCSI Target	Number of the iSCSI targets.
New CHAP User	Indicates whether the CHAP user is newly added or not. Yes: New CHAP user added by using the **Add New CHAP User** window. No: Existing CHAP user.

Add CHAP Users Confirm window



Add CHAP Users table

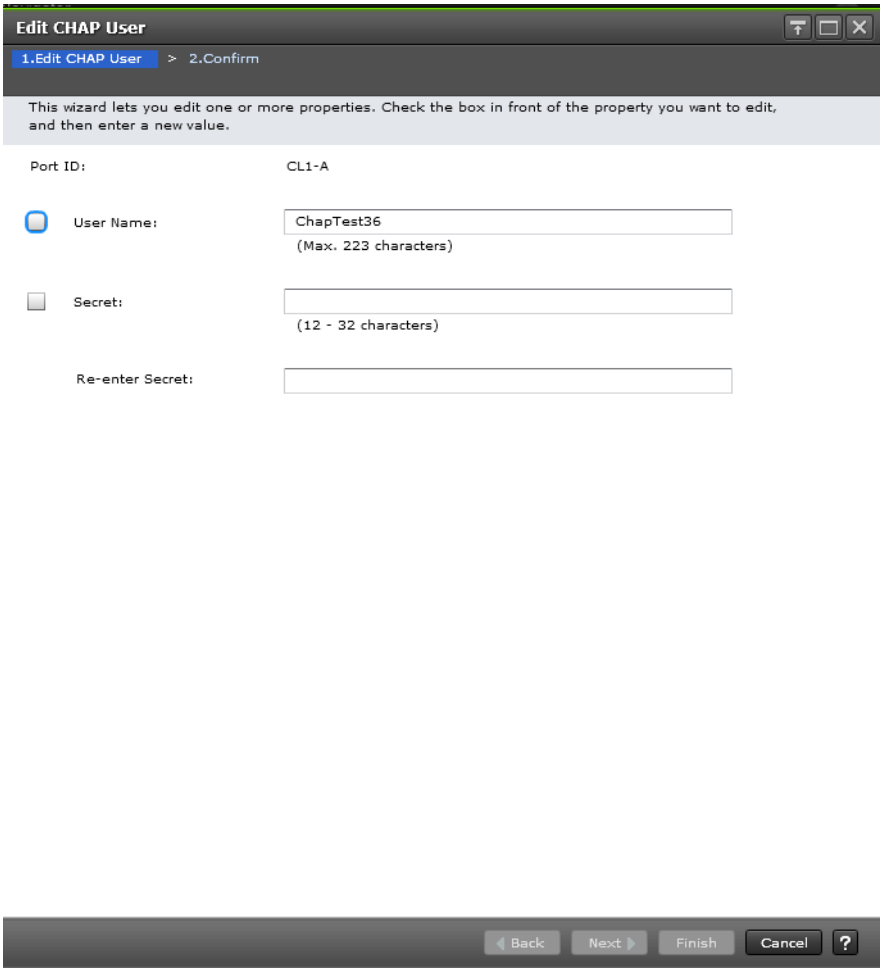
This table lists added CHAP users.

Item	Description
Port ID	Identifier of the port.
User Name	Name of the user.
Secret	Secret: If the secret is specified, the character string of six asterisks (*) appears.
iSCSI Target Alias	iSCSI target alias.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting

Item	Description
	• Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled

Edit CHAP User wizard

Edit CHAP User window

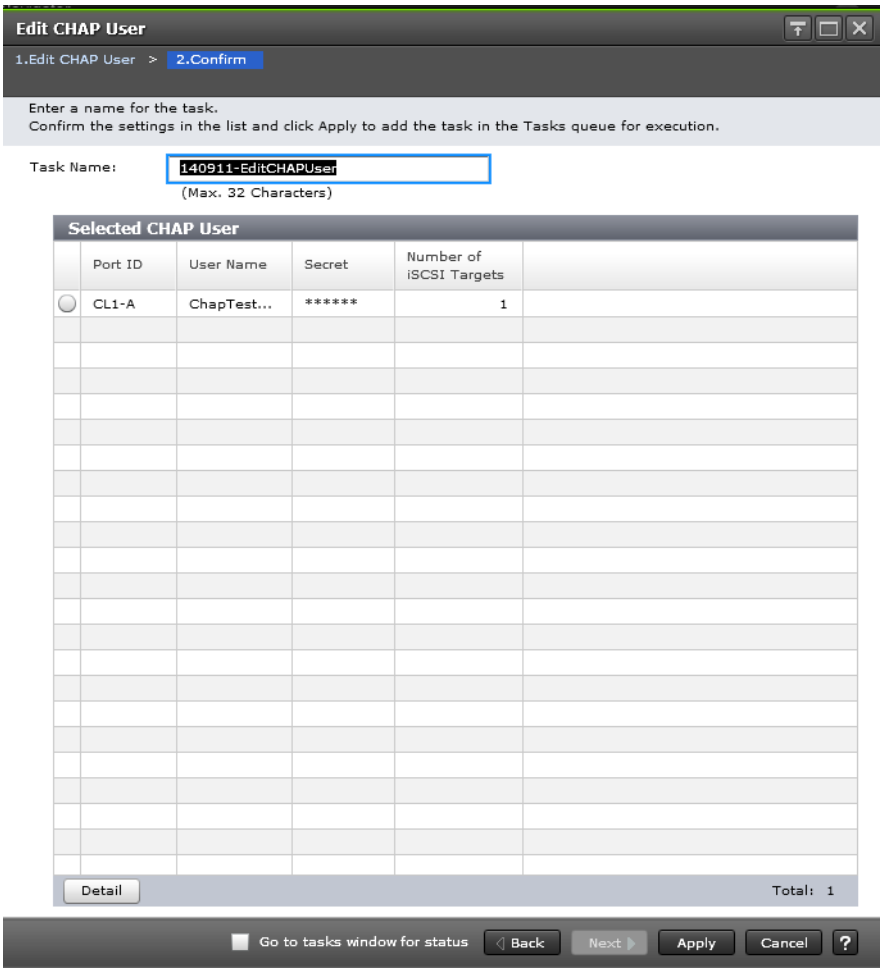


Edit CHAP User

Item	Description
User Name	Specify the user name between 1 to 223 characters. You can use case-sensitive alphanumeric characters, spaces, and the following symbols: . - + @ _ = : [ ] , ~

Item	Description
Secret	Specify the secret to be used for host authentication. Use characters, including alphanumerics, spaces, and the following symbols: . - + @ _ = : / [ ] ~
Re-enter Secret	Specify the secret again for confirmation. If incorrect, an error message appears when clicking Finish.

Edit CHAP User confirm window

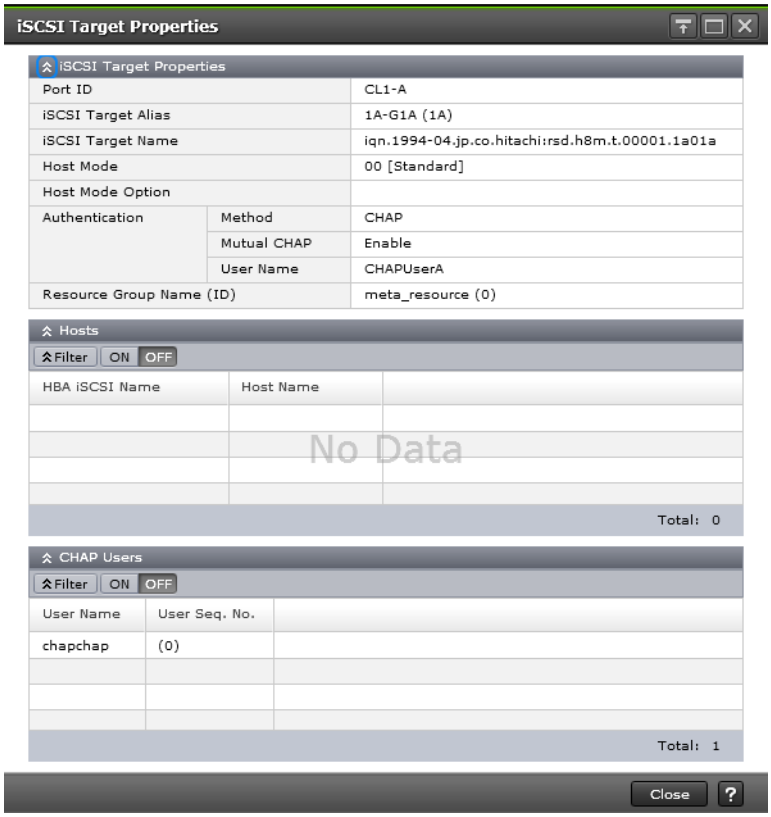


Selected CHAP User table

Item	Description
Port ID	Identifier of the port.
User Name	User name.

Item	Description
Secret	Secret: If the secret is specified, the character string of six asterisks (*) appears.
Number of iSCSI Targets	Number of iSCSI targets.
Detail	Details about the selected the CHAP user.

iSCSI Target Properties window



iSCSI Target Properties table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias and identifier.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Host Mode Option	The number of host mode options that are enabled.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting

Item	Description
	• Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name
Resource Group Name (ID)	Resource group name and identifier of the resource group containing the iSCSI target.

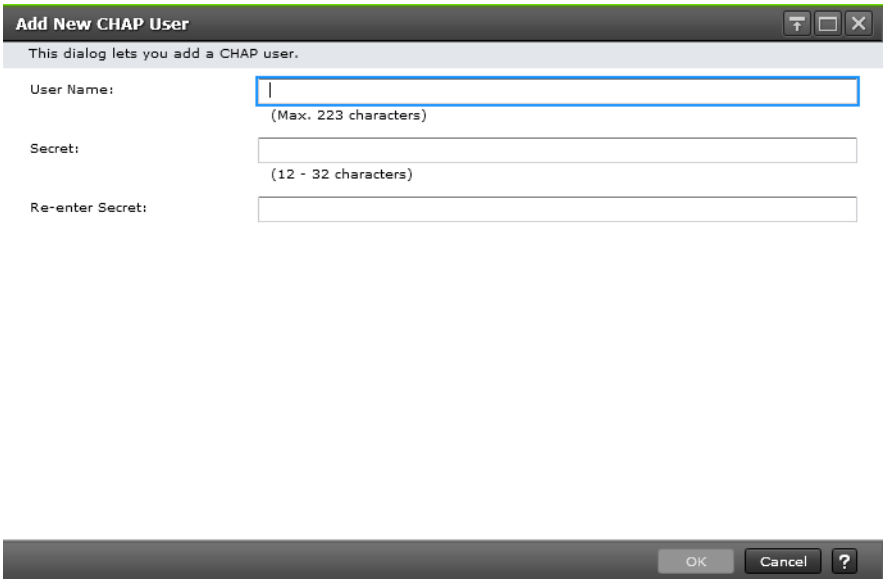
Hosts table

Item	Description
HBA iSCSI Name	HBA iSCSI name.
Host Name	Host name.

CHAP Users table

Item	Description
User Name	Name of the user.
User Seq. No.	User sequence identifier.

Add New CHAP User window

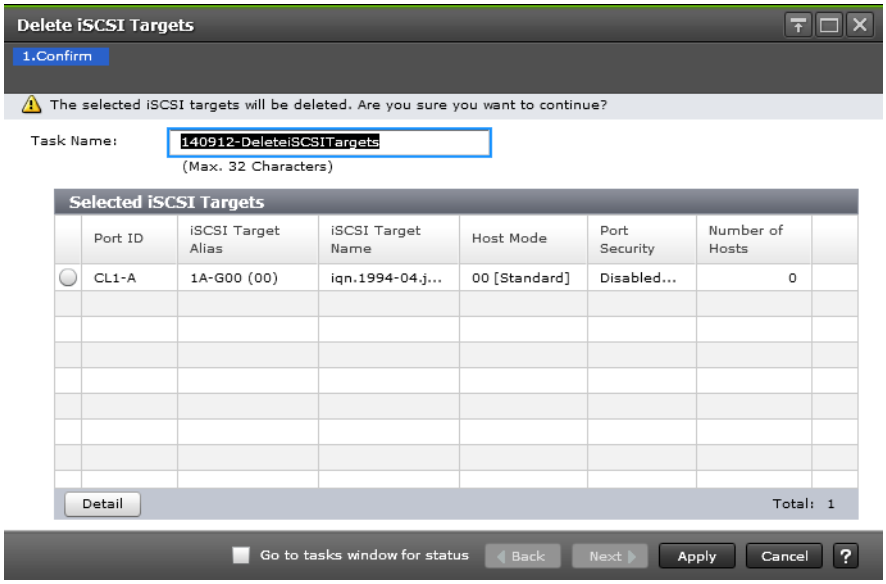


Setting field

Item	Description
User Name	Specify the user name between 1 to 223 characters.

Item	Description
	You can use case-sensitive alphanumeric characters, spaces, and the following symbols: . - + @ _ = : [ ] , ~
Secret	Specify the secret to be used for host authentication. Use characters, including alphanumerics, spaces, and the following symbols: . - + @ _ = : / [ ] ~
Re-enter Secret	Specify the secret again for confirmation. If incorrect, the error message appears when clicking OK.

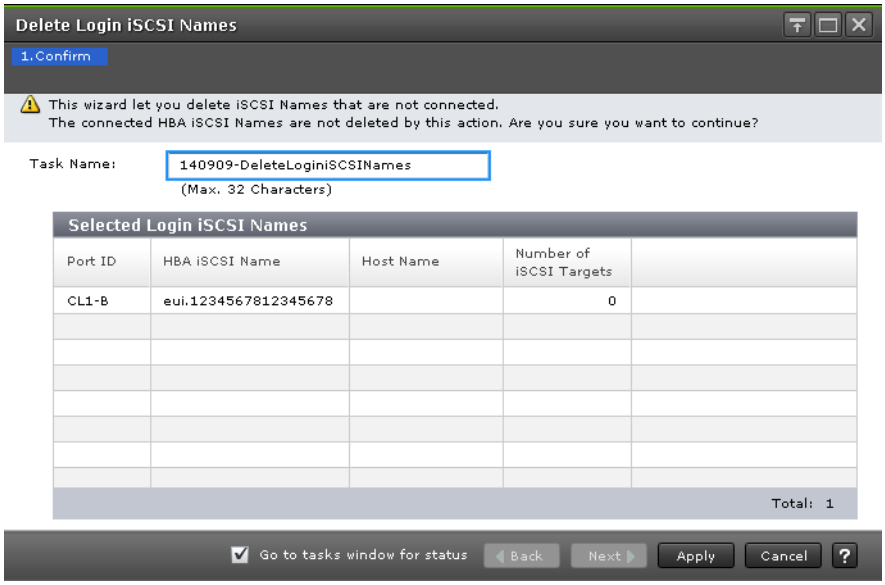
Delete iSCSI Targets window



Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias name and identifier.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Detail	Details about the selected iSCSI target.

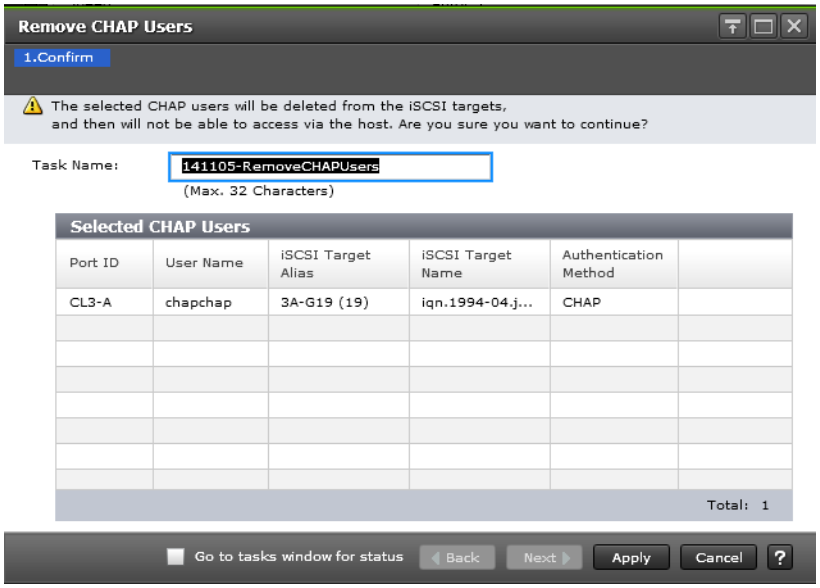
Delete Login iSCSI Names window



Selected Login iSCSI Names table

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI names and their icons.
Host Name	Name of hosts.
Number of iSCSI Targets	Number of iSCSI targets.

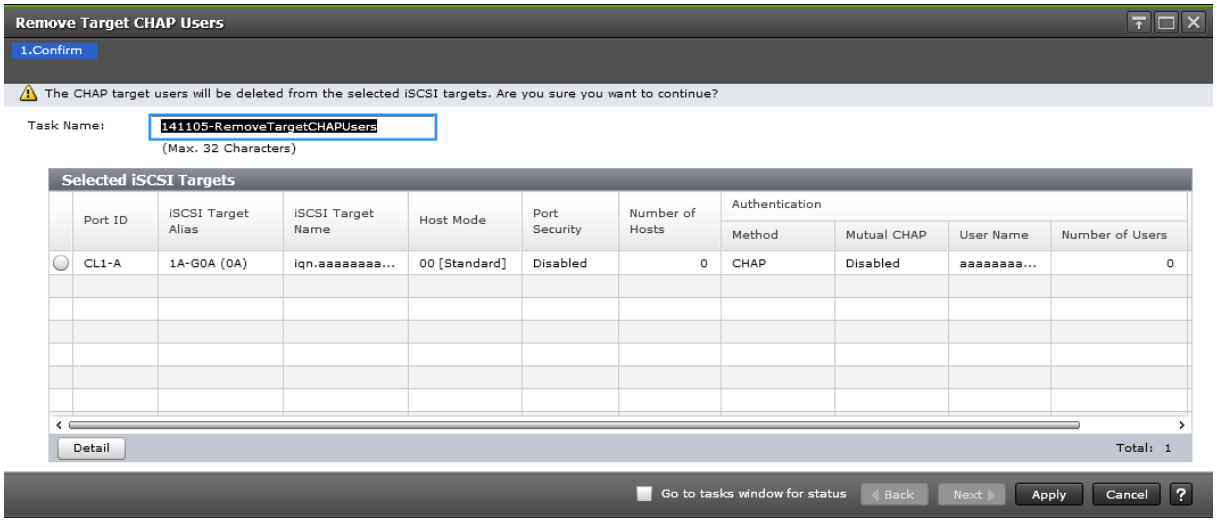
Remove CHAP Users window



Selected CHAP Users table

Item	Description
Port ID	Identifier of the port.
User Name	User name.
iSCSI Target Name	iSCSI target name.
iSCSI Target Alias	iSCSI target alias name and identifier.
Authentication	Number of hosts registered in the iSCSI target.
Detail	Authentication setting information (CHAP, None, or Comply with Host Setting).

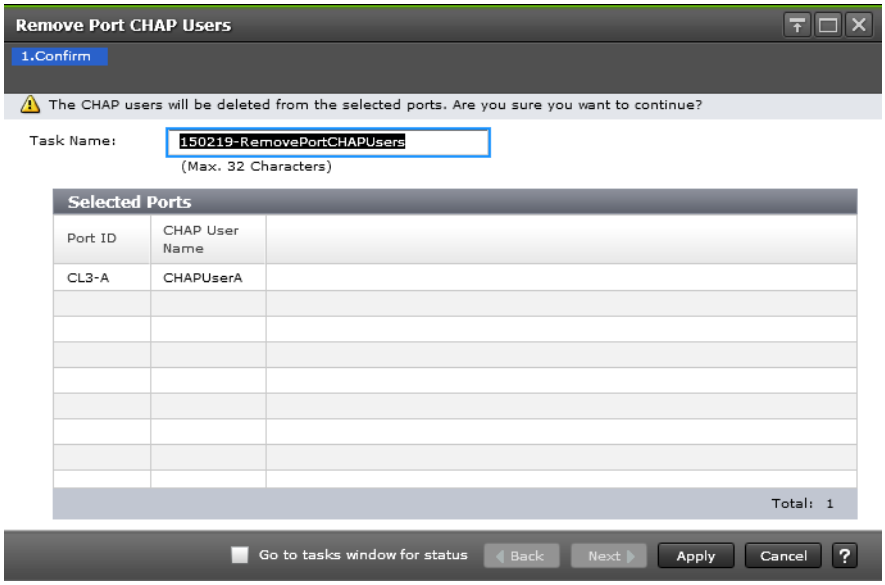
Remove Target CHAP Users window



Selected iSCSI Targets table

Item	Description
Port ID	Identifier of the port.
iSCSI Target Alias	iSCSI target alias name and identifier.
iSCSI Target Name	iSCSI target name.
Host Mode	The host mode of the iSCSI target.
Port Security	LUN security setting (Enabled or Disabled) on the port.
Number of Hosts	Number of hosts registered in the iSCSI target.
Authentication	Information about the authentication. • Method: Authentication method that is CHAP, None, or Comply with Host Setting • Mutual CHAP: Mutual CHAP setting that is Enabled or Disabled • User Name
Detail	When clicking this button with selected a row, the **iSCSI Target Properties** window is displayed.

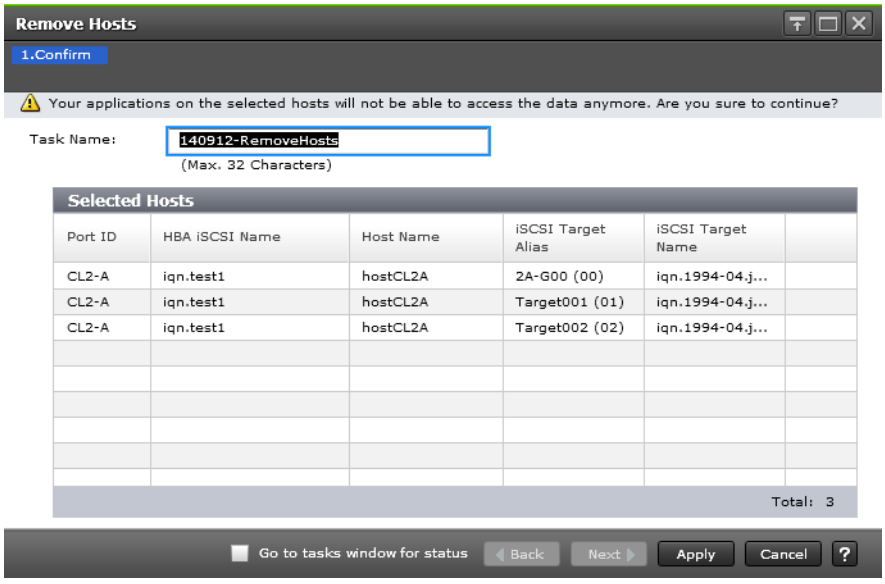
Remove Port CHAP Users window



Selected Ports table

Item	Description
Port ID	Identifier of the port.
CHAP User Name	The CHAP user name set to the port.

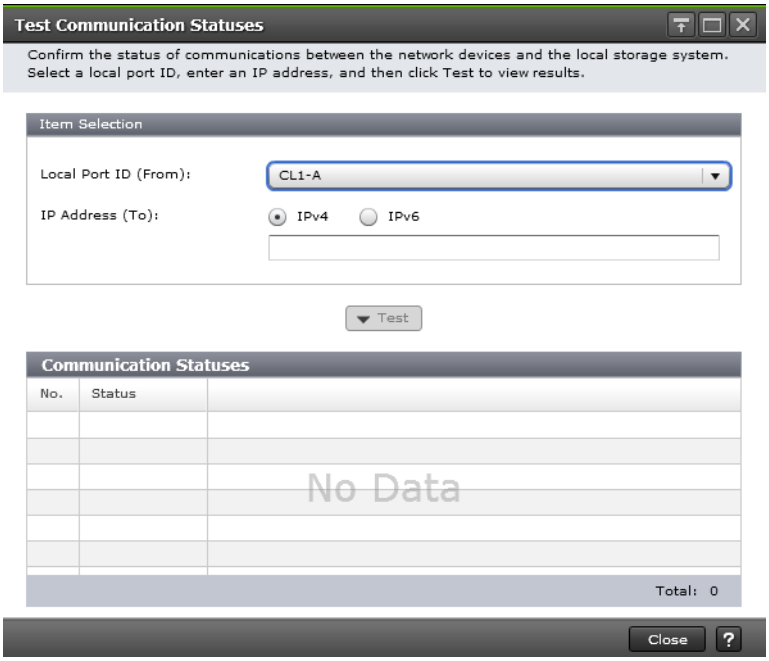
Remove Hosts window



Selected Hosts table

Item	Description
Port ID	Identifier of the port.
HBA iSCSI Name	HBA iSCSI Names.
Host Name	Name of the host.
iSCSI Target Alias	iSCSI target alias name and identifier.
iSCSI Target Name	iSCSI target name

Test Communication Statuses window



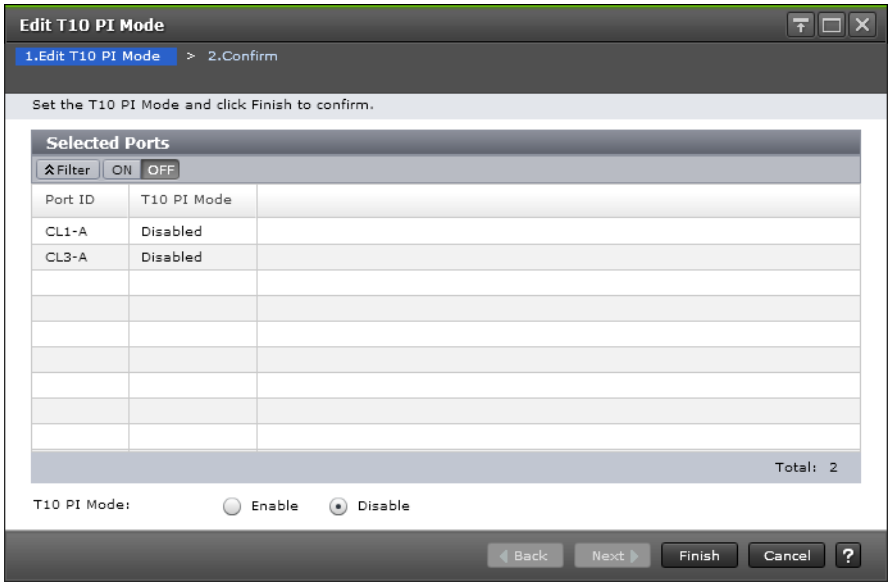
Item Selection

Item	Description
Local Port ID (From)	Port name of the local storage system. Ports for which the iSCSI virtual port mode is enabled are not displayed.
IP Address (To)	Specify an IP address of a device of which the ping command is executed. • IPv4: Select this item if the device is adopted to IPv4. Specify the address in a text box. • IPv6: Select this item if the device is adopted to IPv6. Specify the address in a text box.
Test	Click to execute the ping command.
No.	Number of times of command executions from 1 to 5.

Item	Description
Status	Status of the result of the ping command execution.

Edit T10 PI Mode wizard

Edit T10 PI Mode window



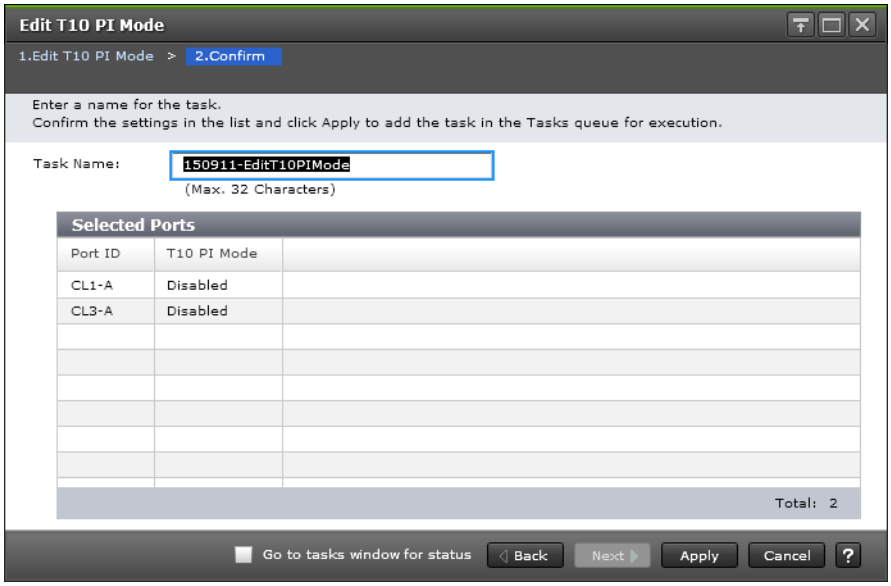
Selected Ports table

Item	Description
Port Name	Port name.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Information setting area

Item	Description
T10 PI Mode	Select the T10 PI mode for the port. • Enabled: T10 PI mode on the port is enabled. • Disabled: T10 PI mode on the port is disabled.

Edit T10 PI Mode confirmation window



Selected Ports table

Item	Description
Port Name	Port name.
T10 PI Mode	The port's T10 PI Mode setting (Enabled or Disabled).

Notices

This software product includes the following redistributable software:

- LZ4 Library

LZ4 Library

This software product includes LZ4 Library.

LZ4 Library

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Glossary

A

ALUA

See *asymmetric logical unit access*.

asymmetric access

A method of defining a preferred path for sending and receiving data when multiple alternate paths are used between a server and storage systems, such as a cross-path configuration for global-active device. To use, ALUA must be enabled.

asymmetric logical unit access (ALUA)

Asymmetric logical unit access functionality of SCSI. When multiple alternate paths are used to connect storage systems, or a server and one or more storage systems, you can define a preferred path in a storage system, and issue I/O requests from the server to storage systems. If a failure occurs in a preferred path, an alternate path is used. See also *asymmetric access*.

audit log

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

B

back-end director (BED)

The hardware component that controls the transfer of data between the drives and cache. A BED feature consists of a pair of boards. A BED is also referred to as a disk board (DKB).

BED

See *back-end director*.

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, usually measured in bytes (MB, GB, TB, and so on).

capacity saving

The data deduplication and data compression functions provided by the storage system controllers.

CCI

Command Control Interface

CLPR

See *cache logical partition (CLPR)*.

cluster

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

command device

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

controller

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

copy pair

A pair of volumes in which one volume contains original data and the other volume contains the copy of the original. Copy operations can be

synchronous or asynchronous, and the volumes of the copy pair can be located in the same storage system (local copy) or in different storage systems (remote copy).

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

custom volume (CV)

A custom-size volume whose size is defined by the user using Virtual LVI/Virtual LUN.

CV

See *custom volume*.

CVS

custom volume size

D

data drive

A physical data storage device that can be either a hard disk drive (HDD) or a flash drive (also called a solid-state device).

DC

data center

deduplication system data volume

The volume used to manage data duplication in a pool. The deduplication system data volume is created when you enable deduplication on a pool.

device

A physical or logical unit with a specific function.

device emulation

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

disk array

Disk array, or just array, is a complete storage system, including the control and logic devices, storage devices (HDD, SSD), connecting cables, and racks

disk controller (DKC)

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

DKC

See *disk controller (DKC)*.

DKCMAIN

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

DSD volume

Used in Hitachi Command Suite to identify a *deduplication system data volume*.

dump

A collection of data that is saved to a file when an error or crash occurs. The data is used by support personnel to determine the cause of the error or crash.

Dump tool

Downloads Device Manager - Storage Navigator configuration information onto recording media for backup and troubleshooting purposes.

Dynamic Provisioning (HDP)

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

E

emulation

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

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

emulation group

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

external volume

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

F

FC

Fibre Channel; FlashCopy

FC-AL

fibre-channel arbitrated loop

flash drive

A data drive that uses a solid-state memory device instead of a rotating hard disk.

flash module (FMD)

A high speed data storage device that includes a custom flash controller and several flash memory sub-modules on a single PCB.

H

HBA

host bus adapter

HDD

hard disk drive

HDT

Hitachi Dynamic Tiering

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

internal volume

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

J

JNL

journal

journal volume

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

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

L

LDEV

logical device

LDKC

See *logical disk controller (LDKC)*.

logical device (LDEV)

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

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

logical disk controller (LDKC)

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

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 and/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 (LV)

See *volume*.

logical volume image (LVI)

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

LU

See *logical unit (LU)*.

LUN

See logical unit number

LV

logical volume

LVI

See *logical volume image*.

M

MF, M/F

mainframe

O

OPEN-V

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

OPEN-x

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

P

P-VOL

This term is used only in the earlier version of the Device Manager - Storage Navigator GUI (still in use) for the primary volume. See *primary volume*.

pair

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

parity group

See *RAID group*.

PDEV

physical device

PG

parity group. See *RAID group*.

physical device

See *device*.

pool

A set of volumes that are reserved for storing pool volumes (pool-VOL), and used by 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.

primary volume (P-VOL)

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

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

See also *secondary volume*.

Q

quick format

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

R

RAID group

A set of RAID disks 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. This allows 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

See *remote control unit*.

RCU target port

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

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.

resync

resynchronize.

S

S-VOL

See *secondary volume* or *source volume*. When used for "secondary volume", "S-VOL" is only seen in the earlier version of the Device Manager - Storage Navigator GUI (still in use).

secondary volume (S-VOL)

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

See also *primary volume*.

service information message (SIM)

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

service processor

The computer in a storage system that hosts the Device Manager - Storage Navigator software and is used to configure and maintain the storage system.

severity level

Applies to service information messages (SIMs) and Device Manager - Storage Navigator error codes.

shredding

See *volume shredding*.

SI

Hitachi ShadowImage

SIM

See *service information message*.

SIz

ShadowImage for Mainframe

size

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

SM

shared memory

SN

Device Manager - Storage Navigator

snapshot

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

SOM

See *system option mode*.

source volume (S-VOL)

Used only in the earlier version of the Device Manager - Storage Navigator GUI (still in use). This is the volume in a mainframe copy pair containing the original data that is duplicated on the target volume (T-VOL). The following Hitachi products use the term source volume: ShadowImage for Mainframe, Dataset Replication, and Compatible FlashCopy®.

In the current version of the GUI, "target volume" and "T-VOL" are replaced with "primary volume".

See also *source volume*.

space

Generally refers to the data storage capacity of a disk drive or flash drive.

SSD

solid-state drive. Also called flash drive.

SSID

See *storage subsystem identifier*.

storage tiers

See *tiered storage*.

SVP

See *service processor*.

syslog

The file on the SVP that includes both syslog and audit log information, such as the date and time.

system option mode (SOM)

Additional operational parameters for the RAID storage systems that enable the storage system to be tailored to unique customer operating requirements. SOMs are set on the service processor.

T

T-VOL

See *target volume*.

T10 PI

See *T10 Protection Information*.

T10 Protection Information (T10 PI)

A code standard defined in SCSI. T10 PI adds 8-byte protection information at every 512 bytes to validate data. By combining T10 PI with Data Integrity Extension (DIX), which enables data protection covering application and operating system, data protection from application to disk drives can be provided.

target port

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

target volume (T-VOL)

The volume in a mainframe copy pair that is the copy of the original data on the source volume (S-VOL). The term is used only in the earlier version of the Device Manager - Storage Navigator GUI (still in use), for the following Hitachi products: ShadowImage for Mainframe, Dataset Replication, and Compatible FlashCopy® V2.

See also *source volume*.

TC

Hitachi TrueCopy

TCz

Hitachi TrueCopy for mainframe

tiered storage

A layered structure of performance levels, or tiers, that matches data access requirements with the appropriate performance tiers. The tiers are:

Tier 1: Static content. Tier 1 is fully supported computing expected to be production quality.

Tier 2: Application logic. Tier 2 platforms are not supported by the security officer and release engineering teams. Tier 2 systems are targeted for Tier 1 support, but are still under development.

Tier 3: Database. Tier 3 platforms are architectures for which hardware is not or will not be available or that are considered legacy systems unlikely to see broad future use.

Tier 4 systems are not supported.

total capacity

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

U

UR

Hitachi Universal Replicator

URz

Hitachi Universal Replicator software for Mainframe

V

V-VOL

virtual volume

VDEV

See *virtual device*.

virtual device (VDEV)

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

Virtual LVI/LUN

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

virtual volume (V-VOL)

A logical volume in a storage system. A V-VOL 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 called DP-VOLs.

VLUN

Hitachi Virtual LUN

VLVI

Hitachi Virtual LVI

VM

volume migration; volume manager

volume (VOL or vol)

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

volume shredding

Deleting the user data on a volume by overwriting all data in the volume with dummy data.

X

XRC

IBM® Extended Remote Copy

Index

F

G

H

I

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