Hitachi Virtual Storage Platform F series, VSP G series, and VSP N series

SVOS 7.4.1

Performance Guide

This document describes and provides instructions for using Hitachi Performance Monitor, Hitachi Server Priority Manager, Hitachi Cache Residency Manager, and Hitachi Virtual Partition Manager to monitor data on your storage system.

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Preface

This document describes and provides instructions for using the VSP G series and VSP F series storage systems.

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

Intended audience

This document is intended for system administrators, Hitachi Vantara Corporation representatives, and authorized service providers.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The Hitachi Device Manager - Storage Navigator software and the System Administrator Guide.
- The Hardware Guide for your storage system.
- Concepts of performance monitoring for enterprise storage arrays.
- CLI software.

Product version

This document revision applies to the following product versions:

- VSP G1000, G1500, VSP F1500: microcode 80-06-2*x* or later
- VSP G200, G400, G600, G800; VSP F400, F600, F800: firmware 83-05-2*x* or later
- VSP N400, N600, N800: firmware 83-06-0*x* or later
- SVOS: 7.4 .1 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 Vantara Support Connect: https://knowledge.hitachivantara.com/Documents.

Changes in this revision

- Added interoperability caution for increasing cache size by adding CPEX in Cautions and restrictions for Virtual Partition Manager (on page 208) .
- Added a note for installing Export Tool on Windows.

Referenced documents

- *Hardware Guide for Hitachi Virtual Storage Platform G1000, G1500, and F1500*, MK-92RD8007
- *Hitachi Device Manager - Storage Navigator Messages*, MK-92RD8017
- *Hitachi ShadowImage® for Mainframe User Guide*, MK-92RD8020
- *Hitachi ShadowImage® User Guide*, MK-92RD8021
- *Hitachi TrueCopy® User Guide*, MK-92RD8019
- *Hitachi Universal Replicator for Mainframe User Guide*, MK-92RD8022
- *Hitachi Universal Replicator User Guide*, MK-92RD8023
- *Hitachi Universal Volume Manager User Guide*, MK-92RD8024
- *Provisioning Guide for Mainframe Systems*, MK-92RD8013
- *Provisioning Guide for Open Systems*, MK-92RD8014
- *Provisioning Guide*, MK-94HM8014
- *System Administrator Guide*, MK-92RD8016
- *System Administrator Guide*, MK-94HM8016

Document conventions

This document uses the following storage system terminology conventions:

Convention	Description
VSP G series	Refers to the following storage systems: ▪ Hitachi Virtual Storage Platform G1x00 ▪ Hitachi Virtual Storage Platform G200 ▪ Hitachi Virtual Storage Platform G400

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

This document uses the following typographic conventions:

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

Convention	Description
< > 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 Vantara Support Connect: https://knowledge.hitachivantara.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 Vantara Support Connect is the destination for technical support of products and solutions sold by Hitachi Vantara. To contact technical support, log on to Hitachi Vantara Support Connect for contact information: https://support.hitachivantara.com/en_us/contact-us.html.

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Thank you!

Chapter 1: Performance management

This chapter provides an overview on performance management of your storage system, and describes the system requirements.

Overview of performance management

Your storage system includes a suite of performance management software products that allow you to monitor and tune storage system performance to improve and optimize storage utilization and performance.

- **Hitachi Performance Monitor**: Enables you to collect and analyze detailed performance and usage statistics for your storage system as well as statistics about workloads on drives and traffic between the hosts and the storage system. You can view the data in lists and on graphs, and you can export the data for analysis in a spreadsheet and other applications.
- **Hitachi Server Priority Manager**: Enables you to control port activity to provide high-priority hosts with higher throughput and prevent production servers from experiencing degraded performance. Server Priority Manager monitors the data being collected by Performance Monitor and applies upper-limit control and threshold control according to user-specified settings.
- (VSP G1x00 and VSP F1500) **Cache Residency Manager**: Enables you to improve host access to frequently accessed data by retaining the data in the storage system's cache memory to make it available at front-end access speeds.
- **Hitachi Virtual Partition Manager**: Virtual Partition Manager enables you to configure logical cache partitions on your storage system. These cache partitions help to maintain performance for high-priority activities by acting as dedicated storage resources that are independently managed and reserved for specific applications.

You can perform performance management operations using Hitachi Device Manager - Storage Navigator and Command Control Interface software. For details about Command Control Interface, see the *Command Control Interface User and Reference Guide*.

System requirements

- **Performance management products**: The following software products are required for performance management operations.
  - Hitachi Performance Monitor
  - Hitachi Server Priority Manager
  - (VSP G1x00 and VSP F1500) Cache Residency Manager
  - Hitachi Virtual Partition Manager
- **Access**: Administrator access for Hitachi Device Manager - Storage Navigator or write access for the performance management software products is required to perform operations. Users without Administrator access or write access can only view the performance management information and settings.
- **License keys**: The license keys for the performance management software products must be installed. For details about installing license keys, see the *System Administrator Guide*.
- **Java**: Java is required for Server Priority Manager and Cache Residency Manager. For details about installing Java and configuring Device Manager - Storage Navigator, see the *System Administrator Guide*.
- **Hitachi Device Manager - Storage Navigator secondary window**: The Hitachi Device Manager - Storage Navigator secondary window must be enabled before you use Server Priority Manager or Cache Residency Manager (VSP G1x00 and VSP F1500). Java and some settings of Hitachi Device Manager - Storage Navigator are required for the Hitachi Device Manager - Storage Navigator secondary window. For details, see the chapter on how to use the Device Manager - Storage Navigator secondary window in the *System Administrator Guide*.
- (VSP G1x00 and VSP F1500) **Cache memory for Cache Residency Manager**: Use of Cache Residency Manager might require additional cache memory in your storage system. For details, see Estimating cache size for Cache Residency Manager (on page 231) .
- **Cache memory for Virtual Partition Manager**: Use of Virtual Partition Manager might require additional cache memory in your storage system.

Chapter 2: Hitachi Performance Monitor operations

This chapter describes performance monitoring and provides instructions for conducting performance monitoring operations using Hitachi Performance Monitor.

Overview of Hitachi Performance Monitor

Hitachi Performance Monitor enables you to monitor your storage system and collect detailed usage and performance statistics. You can view the data in lists and on graphs to identify changes in usage rates and workloads, analyze trends in disk I/O, and detect peak I/O times. For example, if there is a decrease in performance, such as delayed host response times, you can use Performance Monitor to discover the reason for the decrease and determine the actions to take to improve performance.

Performance Monitor collects data about storage system resources such as drives, volumes, and microprocessors as well as statistics about front-end (host I/O) and back-end (drive I/O) workloads. You can perform the following types of monitoring depending on the storage system:

- (VSP G1x00 and VSP F1500) You can perform both short-range monitoring and long-range monitoring. For long-range monitoring, data is collected constantly. For short-range monitoring, the data is collected when the Monitoring Switch is set to Enable, and you specify when and how often the data is collected.
- (VSP Gx00, VSP Fx00, and VSP Nx00) Data is collected when the Monitoring Switch is set to Enable, and you specify when and how often the data is collected.

Using the Performance Monitor data, you can manage and fine-tune the performance of your storage system using the performance management software products.

Data collected by Performance Monitor

Performance Monitor allows you to collect the performance and usage statistics for your storage systems. Based on your storage system the following monitoring can be performed:

- (VSP G1x00 and VSP F1500) All statistics are available for short-range monitoring. Most of the storage system usage statistics are available for long-range monitoring. For details about the performance and usage statistics, see Monitoring data (on page 41) .
- (VSP Gx00, VSP Fx00, and VSP Nx00) All statistics are available for monitoring. When you monitor the storage system, you control when the statistics are collected (in real time or during a speci ied period of time) and how often the statistics are collected (from once per minute to once every 15 minutes).

Short-range monitoring (VSP G1x00 and VSP F1500)

When you perform short-range monitoring of the storage system, you control when the statistics are collected (in real time or during a specified period of time) and how often the statistics are collected (from once per minute to once every 15 minutes). Short-range monitoring occurs in parallel with and does not affect long-range monitoring activities. All performance and usage statistics are available for short-range monitoring.

The sampling interval is the length of time between data collection events for short-range monitoring. The following number of CUs to be monitored determines the options for setting the sampling interval:

- Up to 64 CUs. If there are 64 or fewer CUs to be monitored, you can set the sampling interval from 1 minute to 15 minutes in increments of 1 minute. For example, when the sampling interval is set to 3 minutes, Performance Monitor collects statistics once every 3 minutes.
  - Performance Monitor collects statistics for 1 day when data is collected at 1-minute intervals.
  - Performance Monitor collects statistics for up to 15 days when data is collected at 15-minute intervals.
- More than 64 CUs. If there are more than 64 CUs to be monitored, you can set the sampling interval to 5, 10, or 15 minutes.
  - Performance Monitor collects statistics for one day when data is collected at 5-minute intervals.
  - Performance Monitor collects statistics for up to three days when data is collected at 15-minute intervals.

For short-range monitoring the SVP can store a maximum of 1,440 data collection events if there are 64 or fewer CUs to be monitored. Based on this number and the sampling interval, you can calculate the maximum storing period for the statistics as the sampling interval multiplied by 1,440. For example, if you set the sampling interval to 1 minute, the maximum storing period for the statistics is 1 day (24 hours):

```
1 minute x 1440 = 1440 minutes = 24 hours = 1 day
```

If you set the sampling interval to 15 minutes, the maximum storing period for the statistics is 15 days:

```
15 minutes x 1440 = 21600 minutes = 360 hours = 15 days
```

This maximum storing period is the maximum range of display in the Monitor Performance windows. When you specify one minute for the sampling interval as in the example above, Performance Monitor displays the statistics for a maximum of one day (24 hours) in the lists and graphs. When you specify 15 minutes for the sampling interval, Performance Monitor displays the statistics for a maximum of 15 days in the lists and graphs.

If there are more than 64 CUs to be monitored, SVP can store a maximum of 288 data collection events. Based on this number and the sampling interval, you can calculate the maximum storing period for the statistics as the sampling interval multiplied by 288. For example, if you set the sampling interval to 5 minutes, the maximum storing period for the statistics is 1 day (24 hours):

```
5 minutes x 288 = 1440 minutes = 24 hours = 1 day
```

This maximum storing period is the maximum range of display in the Monitor Performance windows. When you specify one minute for the sampling interval, as in the previous example, Performance Monitor displays the statistics for a maximum of 1 day (24 hours) in the lists and graphs. When you specify 15 minutes for the sampling interval, Performance Monitor displays the statistics for a maximum of three days in the lists and graphs.

Long-range monitoring (VSP G1x00 and VSP F1500)

When you perform long-range monitoring of the storage system, you control when the statistics are collected in real time or during a specified period of time. The long-range monitoring statistics are collected at fixed 15-minute intervals (0, 15, 30, and 45 minutes of every hour) and stored for up to 6 months (186 days). Long-range monitoring occurs in parallel with and does not affect short-range monitoring activities.

You can collect the following statistics in long-range monitoring:

- Usage rates of MPs
- Usage rates of DRRs
- Write-pending statistics
- Access path usage statistics
- Data drive usage statistics
- Data drive access rates

Sampling interval for monitoring (VSP Gx00, VSP Fx00, and VSP Nx00)

The sampling interval is the length of time between data collection events for monitoring. The number of CUs to be monitored determines the options for setting the sampling interval:

- **Up to 32 CUs.** If there are 32 or fewer CUs to be monitored, you can set the sampling interval from 1 to 15 minutes in increments of 1 minute. For example, when the sampling interval is set to 3 minutes, Performance Monitor collects statistics once every 3 minutes.
  - Performance Monitor collects statistics for 1 day when data is collected at 1-minute intervals.
  - Performance Monitor collects statistics for up to 15 days when data is collected at 15-minute intervals.
- **33 or more CUs.** If there are 33 or more CUs to be monitored, you can set the sampling interval to 5, 10 or 15 minutes. The collected data can be stored from 5 to 15 days. The data collecting term varies with each sampling interval.
  - Performance Monitor collects statistics for 5 days when data is collected at 5-minute intervals.
  - Performance Monitor collects statistics for 15 days when data is collected at 15-minute intervals.

Maximum storing period for monitoring (VSP Gx00, VSP Fx00, and VSP Nx00)

For a specified sampling interval, the SVP can store a maximum of 1440 data collection events. Based on this number and the sampling interval, you can calculate the maximum storing period for the statistics as the sampling interval multiplied by 1440. For example, if you set the sampling interval to 1 minute, the maximum storing period for the statistics is 1 day (24 hours):

```
1 minute x 1440 = 1440 minutes = 24 hours = 1 day
```

If you set the sampling interval to 15 minutes, the maximum storing period for the statistics is 15 days:

```
15 minutes x 1440 = 21600 minutes = 360 hours = 15 days
```

This maximum storing period is the maximum range of display in the **Monitor Performance** windows. When you specify 1 minute for the sampling interval as in the example above, Performance Monitor displays the statistics for a maximum of 1 day (24 hours) in the lists and graphs. When you specify 15 minutes for the sampling interval, Performance Monitor displays the statistics for a maximum of 15 days in the lists and graphs.

Performance Monitor data graphs

You can view statistics by short-range intervals (1 to 15 minutes) or long-range intervals (15 minutes) on data graphs (VSP G1x00 and VSP F1500), or by user-speci ied time intervals within a range of 1 to 15 minutes (VSP Gx00, VSP Fx00, and VSP Nx00). All statistics can be viewed (for the storing period corresponding to the sampling interval setting). Usage statistics about storage system resources, which are monitored, can be viewed. When viewing usage statistics about resources, you can specify the range to view and which part of the storing period to display on lists and graphs. (VSP G1x00 and VSP F1500) A few storage system usage statistics are not available for long-range monitoring.

For details about the Performance Monitor data graphs, see About the data graphs (on page 37).

Export Tool for Performance Monitor

The Export Tool software that comes with Performance Monitor allows you to export the monitoring data in a .csv file for analysis, for example, using spreadsheet software or database software. You can also use Export Tool to save and accumulate data over extended periods of time for long-term analysis and future reference.

For details about Export Tool, see Exporting Performance Monitor data (on page 72).

Cautions and restrictions for Performance Monitor

Cautions and restrictions for monitoring

- **Performance monitoring switch**

  When the performance monitoring switch is set to disabled, monitoring data is not collected.

- **Changing the SVP time setting**

  If the SVP time setting is changed while the monitoring switch is enabled, the following monitoring errors can occur:

  - Invalid monitoring data appears.
  - No monitoring data is collected.

  If you have changed the SVP time setting, disable the monitoring switch, and then re-enable the monitoring switch. Next, obtain the monitoring data. For details about the monitoring switch, see Starting monitoring (on page 29).

- **WWN monitoring**

  About the traffic monitoring between host bus adapters and storage system ports in Performance Monitor

  You must configure some settings before the traffic between host bus adapters and storage system ports can be monitored. For details, see Adding new WWNs to monitor (on page 30) , Adding WWNs to ports (on page 31) , and Connecting WWNs to ports (on page 33) .

  Note: When you are using Server Priority Manager in Command Control Interface, you cannot perform the setting required for WWN monitoring.

- **Parity group monitoring**

  To correctly display the performance statistics of a parity group, all volumes belonging to the parity group must be specified as monitoring targets.

- **Storage system maintenance**

  If the storage system is undergoing the following maintenance operations during monitoring, the monitoring data might not be valid:

  - Adding, replacing, or removing cache memory
  - Adding, replacing, or removing data drives
  - Changing the storage system configuration
  - Replacing the microcode or firmware
  - Formatting or quick-formatting logical devices
  - Adding, replacing, or removing MP blade or unit

- **Storage system power-off**

  If the storage system is powered off during monitoring, monitoring stops until the storage system is powered on again. Monitoring resumes when the storage system is powered on again. However, Performance Monitor cannot display information about the period while the storage system is powered off. Therefore, the monitoring data immediately after powering on again might contain extremely large values.

- **microcode or firmware replacement**

  After the microcode or firmware is replaced, monitoring data is not stored until the service engineer releases the SVP from Modify mode. Therefore, inaccurate data might be temporarily displayed.

Cautions and restrictions for usage statistics

- (VSP G1x00 and VSP F1500) **Retention of short-range and long-range usage statistics**

  Usage statistics for the last six months (186 days) are displayed in long-range monitoring, and usage statistics for up to the last 15 days are displayed in short-range monitoring. Usage statistics outside of these ranges are deleted from the SVP. In short range monitoring, results are retained for the last 1 to 15 days depending on the specified sampling interval. If the retention period has passed since a monitoring result was obtained, the previous result has been deleted from the SVP and cannot be displayed.

- (VSP Gx00, VSP Fx00, and VSP Nx00) **Retention of usage statistics**

  Usage statistics for up to the last 15 days are displayed in monitoring. Usage statistics outside of these ranges are deleted from the SVP.

- **Statistics for periods of high I/O workload**

  If the host I/O workload is high, the storage system gives higher priority to I/O processing than to monitoring. If this occurs, some monitoring data might be missing. If monitoring data is missing frequently, use the **Edit Monitoring Switch** window to lengthen the sampling interval. For details, see Starting monitoring (on page 29) .

- (VSP G1x00 and VSP F1500) **Volumes and CU ranges**

  The volumes to be monitored by Performance Monitor are specified by control unit (CU). If the range of used CUs does not match the range of CUs monitored by Performance Monitor, usage statistics might not be collected for some volumes.

- **Reverse resync operations**

  When you run the CCI **`horctakeover`** command, the **`pairresync-swaps`** command for a UR pair, or the BCM **`YKRESYNC REVERSE`** command for a URz pair, the primary and secondary volumes are swapped. You can collect the before-swapped information immediately after you run any of the commands. Invalid monitoring data will be generated for a short time but will be corrected automatically when the monitoring data gets updated. The invalid data will temporarily be generated when the volume used for a secondary volume is used as a primary volume after a UR pair or URz pair is deleted.

- (VSP G1x00 and VSP F1500) When SVP High Availability Feature is installed and the SVP is duplexed, if you switch the master SVP and the standby SVP, the long-range monitoring data is kept, but the short-range monitoring data is deleted. If you ask maintenance personnel to switch the master and standby SVPs for microcode upgrade or other maintenance purposes, execute Export Tool beforehand as necessary, and acquire the short-range monitoring data.

- **Display of monitoring data immediately after monitoring starts or immediately after the sampling interval is changed**

  Monitoring data cannot be displayed within the first two sampling intervals after the monitoring starts or the sampling interval is changed because no monitoring data has accumulated. For instance, if the sampling interval is set or changed to 15 minutes, monitoring data is not accumulated for up to 29 minutes after this setting is made.

- **Display of monitoring data during high SVP workload**

  If the SVP is overloaded, the system might require more time than the sampling interval allows to update the display of monitoring data. If this occurs, a portion of monitoring data is not displayed. For example, suppose that the sampling interval is 1 minute, and the display in the **Performance Management** window is updated at 9:00 and the next update occurs at 9:02. In this case, the window (including the graph) does not display the monitoring result for the period of 9:00 to 9:01. This situation can occur when the following maintenance operations are performed on the storage system or on the Device Manager - Storage Navigator PC:

  - Adding, replacing, or removing cache memory.
  - Adding, replacing, or removing data drives.
  - Changing the storage system configuration.
  - Replacing the microcode or firmware.

- **Pool-VOLs**

  Pool-VOLs of Thin Image, Dynamic Provisioning, and Dynamic Provisioning for Mainframe are not monitored.

- **Margin of error**

  The monitoring data might have a margin of error.

Performance monitoring workflow

1. Determine the resources to be monitored and the data to be collected, and write down the required information, including control unit (CU) numbers and WWNs of host bus adapters.
2. Set the storing period for the monitoring statistics. For instructions, see Setting the storing period for the monitoring data (on page 29).
3. Start performance monitoring. For instructions, see Starting monitoring (on page 29).
4. Add the WWNs that you want to monitor. For instructions, see Monitoring WWNs (on page 30).
5. Add the CUs that you want to monitor. For instructions, see Monitoring CUs (on page 33).
6. Adjust the sampling interval as needed to increase or decrease the maximum storing period of statistics. For instructions, see Changing the sampling interval (on page 36).
7. View the monitoring data on graphs. For details, see Using the Performance Monitor data graphs (on page 37).
8. Export the monitoring data as needed for analysis and for retention of long-term data. For details, see Exporting Performance Monitor data (on page 72).
9. When you want to stop collecting monitor data, stop monitoring by disabling the monitoring switch. For details, see Stopping monitoring (on page 36).

Setting the storing period for the monitoring data

Before you start the monitoring function, you must set the storing period for the monitoring data. The following storing periods can be set based on your storage system:

- (VSP G1x00 and VSP F1500) Short-range data can be collected for up to 15 days, and long-range data can be collected for up to six months (186 days).
- (VSP Gx00, VSP Fx00, and VSP Nx00) Data can be collected for up to 15 days.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. On the **Performance Monitor** window, click **Monitor Performance** to open the **Monitor Performance** window.
3. (VSP G1x00 and VSP F1500) On the **Monitor Performance** window select **Long-Range** or **Short-Range** in the **Data Range** as the periods (ranges) for collecting and storing statistics.
4. Select **Set Range** or **Use Real Time** in the **Time Range** as the periods (ranges) for displaying statistics.

   (VSP G1x00 and VSP F1500) If Long-Range is selected, you can specify only **Set Range**. If Short-Range is selected, you can select **Set Range** or **Use Real Time**.

   (VSP Gx00, VSP Fx00, and VSP Nx00) You can select **Set Range** or **Use Real Time**.
5. Click **Apply** to apply the settings to the storage system.

Starting monitoring

After you have set the storing period for the monitoring data, you can start the monitoring function.

Caution: When you start monitoring a storage system, all of its previous monitoring statistics are deleted. If you want to keep the previous monitoring statistics, first export the desired data using Export Tool and then restart monitoring.

Note: Monitoring data cannot be displayed within the first two sampling intervals after the monitoring starts or the sampling interval is changed because no monitoring data has accumulated. For instance, if the sampling interval is set to 15 minutes, monitoring data is not accumulated for up to 29 minutes after the start of monitoring.

While the statistics information is being collected, the server workload increases and the client process might slow down.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. In the **Performance Monitor** window, click **Edit Monitoring Switch** to open the **Edit Monitoring Switch** window.
3. Click **Enable** in the **Monitoring Switch** field.
4. Select the sampling interval in the **Sample Interval**. This option is activated when you specify **Enable** for Current Status.
5. Click **Finish**.
6. In the **Confirm** window enter your task name in **Task Name**, and click **Apply** to start monitoring.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Monitoring WWNs

This section provides instructions for monitoring WWNs using Hitachi Performance Monitor.

Adding new WWNs to monitor

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Select the **Monitored WWNs** tab, and click **Edit WWN Monitor Mode** to open the **Edit WWN Monitor Mode** window.
3. In the **Edit WWN Monitor Mode** window select the WWNs in the **Unmonitored WWNs** list, and click **Add**.
4. Enter your task name in **Task Name**, and click **Finish**.
5. In the **Confirm** window click **Apply** to apply the settings to the storage system.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Viewing the WWNs that are being monitored

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. In the **Performance Monitor** window select the **Monitored WWNs** tab to see the WWNs that are currently being monitored.

Removing WWNs to monitor

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click the **Monitored WWNs** tab.
3. On the **Monitored WWNs** tab click **Edit WWN Monitor Mode** to open the **Edit WWN Monitor Mode** window.
4. Select the WWNs in the **Monitored WWNs** list that you want to remove, and click **Remove**.
5. Enter your task name in **Task Name**, and click **Finish**.
6. In the **Confirm** window click **Apply**.
7. When the warning message appears, click **OK** to close the message. The settings are applied to the storage system.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Adding WWNs to ports

If you want to monitor WWNs that are not connected to the storage system, you can add them to ports and set them up for monitoring with Performance Monitor.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. In the **Performance Monitor** window click the **Monitored WWNs** tab.
3. On the **Monitored WWNs** tab click **Add New Monitored WWNs** to open the **Add New Monitored WWNs** window.

4. Specify the information for each WWN, as listed in the following table.

Item	Description
HBA WWN (required)	Enter the 16-digit hexadecimal number.
WWN Name (optional)	Enter the unique name to distinguish the host bus adapter from other adapters. The **WWN Name** (maximum 64 characters) must consist of alphanumeric characters and at least one symbol.
Port (in **Available Ports**)	In the **Available Ports** list select the port connected to the WWN. (VSP G1x00 and VSP F1500) Ports connected to mainframe hosts are not displayed, because they are not supported for Performance Monitor.

5. Click **Add**. The added WWN is displayed in **Selected WWNs**.
6. If you need to remove a WWN from the **Selected WWNs** list, select the WWN and click **Remove**.
7. When you are done adding WWNs, click **Finish**.
8. In the **Confirm** window click **Apply** to apply the settings to the storage system.

Editing the WWN nickname

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click the **Monitored WWNs** tab to see the list of WWNs being monitored.
3. Select the WWN to edit. You can edit only one WWN at a time. If you select multiple WWNs, an error will occur.
4. On the **Monitored WWNs** tab click **Edit WWN** to open the **Edit WWN** window.
5. On the **Edit WWN** window edit the **HBA WWN** and **WWN Name** fields as needed:
   - **HBA WWN**

     A 16-digit hexadecimal number. The value of **HBA WWN** must be unique in the storage system.
   - **WWN Name**

     The nickname distinguishes the host bus adapter from other adapters. The **WWN Name** (maximum 64 digits) must consist of alphanumeric characters and at least one symbol.
6. When you are done editing WWNs, click **Finish**.

7. In the **Confirm** window click **Apply** to apply the settings to the storage system.

Connecting WWNs to ports

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. In the **Performance Monitor** window click the **Monitored WWNs** tab.
3. On the **Monitored WWNs** tab select the WWN to connect to the port.

   Select only one WWN at a time. If you select multiple WWNs, an error occurs.
4. On the **Monitored WWNs** tab click **Add to Ports** to open the **Add to Ports** window.
5. Select the port to connect in **Available Ports**, and then click **Add**.

   The selected WWN and port are added to the **Selected WWNs** list.

   (VSP G1x00 and VSP F1500) Mainframe ports are not displayed because they are not supported for Performance Monitor.
6. If you need to delete a WWN from the **Selected WWNs** list, select the WWN, and then click **Remove**.
7. When you are done selecting the WWNs to connect, click **Finish**.
8. In the **Confirm** window click **Apply** to apply the settings to the storage system.

Deleting unused WWNs from monitoring targets

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click the **Monitored WWNs** tab.
3. On the **Monitored WWNs** tab, click **More Actions** > **Delete Unused WWNs** to open the **Delete Unused WWNs** window.
4. Enter your task name in **Task Name**, and click **Apply**.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Monitoring CUs

This section provides instructions for monitoring control units (CUs) using Hitachi Performance Monitor.

Displaying CUs to monitor

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Open the **Monitored CUs** tab to view the list of CUs.

Adding and removing CUs to monitor

Use the Performance Monitor window to add and remove CUs to monitor.

Note: When you remove a CU from monitoring, the monitoring data for the CU will be deleted. Therefore, export the desired monitoring data before performing this operation. For details, see Exporting Performance Monitor data (on page 72).

Note: To monitor a parity group, specify the CU numbers of all LDEVs belonging to the parity group. Otherwise the parity group is not subjected to monitoring.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Open the **Monitored CUs** tab.
3. On the **Monitored CUs** tab click **Edit CU Monitor Mode** to open the **Edit CU Monitor Mode** window.
4. Add or remove CUs to monitor.

   To add CUs to monitoring target objects, select CUs from the **Unmonitored CUs** field and click **Add**. To remove CUs from monitoring target objects, select CUs from the **Monitored CUs** field and click **Remove**.
5. Click **Finish**.
6. In the **Confirm** window enter your task name in **Task Name**, and click **Apply**.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Selecting CUs to monitor

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Open the **Monitored CUs** tab.
3. On the **Monitored CUs** tab click **Edit CU Monitor Mode** to open the **Edit CU Monitor Mode** window.
4. Click **Select by Parity Groups** in the **Unmonitored CUs** field.

   The **Select by Parity Groups** window opens. The available parity group IDs and number of CUs are displayed.
5. Select the parity group ID from the list and click **Detail**.

   The **Parity Group Properties** window opens. The CUs and the number of LDEVs are displayed.
6. Confirm the properties of the parity group and click **Close**.

   The **Select by Parity Groups** window opens.
7. Select the parity group to be the monitoring target in the **Select by Parity Groups** window and click **OK**.

   CUs in the parity group are selected in the **Unmonitored CUs** field. For information about monitoring these CUs, see Adding and removing CUs to monitor (on page 34).

Confirming the status of CUs to monitor

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and click **Performance Monitor** in the tree.
2. On the **Monitored CUs** tab, click **View CU Matrix**.

   The following CUs are displayed in the **Monitored CUs** window.

   - Monitored CUs
   - Set monitored CUs
   - Release monitored CUs

Changing the sampling interval

You can change the sampling interval for monitoring. For example, if you want to collect statistics over a longer period of time, you can lengthen the sampling interval to increase the storing period.

Note: Monitoring data cannot be displayed within the first two sampling intervals after the monitoring starts or the sampling interval is changed because no monitoring data has accumulated. For instance, if the sampling interval is changed to 15 minutes, monitoring data is not accumulated for up to 29 minutes after the interval was changed.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. In the **Performance Monitor** window, click **Edit Monitoring Switch** to open the **Edit Monitoring Switch** window.
3. Select the desired sampling interval in the **Sample Interval**. This option is available only when the current monitoring status is **Enable**.
4. Click **Finish**.
5. In the **Confirm** window enter your task name in **Task Name**, and click **Apply** to change the sampling interval.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Stopping monitoring

When you no longer need to collect monitoring statistics, you can stop the monitoring function. After you stop monitoring, you should consider exporting the monitoring statistics using Export Tool, because the existing statistics are deleted each time monitoring is restarted.

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click **Edit Monitoring Switch** to open the **Edit Monitoring Switch** window.
3. Click **Disable** in the **Monitoring Switch** field.

   The **Sample Interval** list is grayed out and becomes ineffective.
4. Click **Finish**.

5. In the **Confirm** window, enter your task name in **Task Name**, and click **Apply** to stop monitoring.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Using the Performance Monitor data graphs

About the data graphs

The Hitachi Performance Monitor data graphs are displayed on panels with the graph on the left and the legend for the graph on the right. Hitachi Performance Monitor can display up to four panels with up to four graphs in each panel for a maximum of 16 graphs at the same time.

- You can change the size of each graph panel by clicking the icon in the upper right of the panel.
- You can plot up to 8 sets of data with one graph panel and up to 16 sets of data with four graph panels.
- You can display the value of each data point by placing the cursor on the data point on the graph.
- You can adjust the unit of scale on the vertical axis using the vertical scale selector on the upper left of the graph. For example, you might need to increase the vertical scale to see data with high values.

  In some cases, you might need to adjust the vertical scale to display the data properly. For example, if the scale is too small, a single data line might be so thick that the entire graph is painted in a single color.
- You can display or hide data points on the graph panel by clicking the legend on the right of the graph. Each graph must display at least one set of data, so you cannot hide all of the data.
- When you are viewing data for the MP blade or unit in real time (Time Range is set to Use Real Time), the MP blade or unit names are displayed as text links. Click the text link to display the resources assigned to an MP blade or unit of top 20 in usage rates on the detailed window.

Displaying the monitor data on graphs

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click **Monitor Performance** to open the **Monitor Performance** window.
3. Specify the data range and time period to be displayed on the graphs:
   a. In the **Data Range** field, select the desired data range.

(VSP G1x00 and VSP F1500) **Long-Range** or **Short-Range**. If you want to display real-time data, you must select **Short-Range**.

b. In the **Time Range** field, select **Set Range** to display data from a specific period of time, or select **Use Real Time** to display real-time data as it is being collected.

(VSP G1x00 and VSP F1500) The **Use Real Time** option can only be specified when **Short-Range** is selected.

c. If you selected **Set Range**, specify the starting date and time and ending date and time for the range of data in the **From** and **To** fields.

4. Specify the monitor data to be displayed on the graphs:
   a. In the **Performance Objects** area select items in the **Object** field.

   Select items in the left field and then select detailed items in the right field. Detailed item changes by the items selected in the left field.

   b. Select items in the **Monitor Data** field.

   Select items in the left field and then select detailed items in the right field.

   c. Select the monitor data to be graphed in the **Available Objects** list.
   d. Click **Add** to add the monitor data to the **Selected Objects** list.
   e. If you need to remove monitor data from the **Selected Objects** list, select the object and click **Remove**.
5. Click **Apply** to display the selected monitor data on graphs in the **Monitor Performance** window.

Adding a new graph

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click **Monitor Performance** to open the **Monitor Performance** window.
3. Display the graph panel in the **Monitor Performance** window.

   For details, see Displaying the monitor data on graphs (on page 37).
4. Click **Add Graph** to open the **Add Graph** window.

   If a warning message is displayed when you click the **Add Graph** button, you are already displaying the maximum number of graphs. To add another graph, you must first delete an existing graph. For details, see Deleting a graph from the graph panel (on page 39).
5. Specify the monitor data to be graphed by selecting the objects on the left and adding them to the **Selected Objects** list on the right.

   For details, see Displaying the monitor data on graphs (on page 37).
6. Click **OK** to add the specified graph.

Changing the data displayed on a graph

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click **Monitor Performance** to open the **Monitor Performance** window.
3. Display the graph panel in the **Monitor Performance** window.
   For details, see Displaying the monitor data on graphs (on page 37).
4. Click **Edit Performance Objects** to open the **Edit Performance Objects** window.
5. Edit the monitor data being displayed on the graph by adding objects to and deleting objects from the **Selected Objects** list on the right.
   For details, see Displaying the monitor data on graphs (on page 37).
6. Click **OK** to display the graph with the newly specified monitor data.

Changing the time period displayed on the graph panel

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
2. Click **Monitor Performance** to open the **Monitor Performance** window.
3. Display the graph panel in the **Monitor Performance** window.
   For details, see Displaying the monitor data on graphs (on page 37).
4. Click **Edit Time Range** to open the **Edit Time Range** window.
5. Enter the desired starting date and time in the **From** field. Enter the desired end date and time in the **To** field.
6. Click **OK** to display the graph panel with the newly selected time period.

Deleting a graph from the graph panel

Before you begin

- Required role: Storage Administrator (Performance Management)

Procedure

1. Open the **Performance Monitor** window.
   a. Select **Analytics** in **Explorer**.

b. Select **Performance Monitor** in the tree to open the **Performance Monitor** window.

2. Click **Monitor Performance** to open the **Monitor Performance** window.
3. Display the graph panel in the **Monitor Performance** window.

   For details, see Displaying the monitor data on graphs (on page 37) .
4. Click **Delete Graph** in the lower right, or click the close icon in the upper right corner.
5. When the confirmation message appears, click **OK** to delete the graph.

Chapter 3: Data collected by Hitachi Performance Monitor

Hitachi Performance Monitor collects and displays monitoring data.

Monitoring data

The following table lists the objects that can be monitored and specifies the data that is collected for each monitoring object. You can specify the objects that are displayed in the graphs in the Performance Objects in the Monitor Performance window. When the resource group feature is installed, you can specify the objects to be displayed in the graphs only when the resources that are shown in the necessary resources in the following table are allocated.

The monitoring data for each sampling interval is the average value of the data over the data sampling interval. The sampling interval is as follows:

- (VSP G1x00 and VSP F1500) The sampling interval is 1 to 15 minutes for Short Range and 15 minutes for Long Range.
- (VSP Gx00, VSP Fx00, and VSP Nx00) The sampling interval is 1 to 15 minutes.

The monitoring data shows the information by each resource ID even when the volume is in a virtual storage machine (not by virtual ID). For instructions on viewing the monitoring data, see Using the Performance Monitor data graphs (on page 37) .

Object of monitoring	Monitoring data	Necessary resources
Controller	Usage rates of MPs (%)	None
	(VSP G1x00 and VSP F1500) Usage rates of DRR (%)	None
Cache	Usage rates of cache (%)	None
	Write pending rates (%)	
Access path (VSP G1x00 and VSP F1500)	Usage rates of access path between CHA and cache (%)	None
	Usage rates of access path between DKA and cache (%)	
	Usage rates of access path between MP blade and cache (%)	

Object of monitoring	Monitoring data	Necessary resources
	Usage rates of access path between cache (%)	
Fibre port	Throughput (IOPS)	Port
	Data transfer (Mbps)	
	Response time (ms)	
Mainframe fibre port (VSP G1x00 and VSP F1500)	Throughput (IOPS)	Port
	Data transfer (Mbps)	
	Response time (ms)	
	CMR delay time (ms)	
	Disconnected time (ms)	
	Connected time (ms)	
	HTP port open exchange (count/sec)	
iSCSI Port	Throughput (IOPS)	Port
	Data transfer (Mbps)	
	Response time (ms)	
NAS platform (User LU) (VSP Gx00, Nx00, and VSP Fx00 models)	Throughput (IOPS)	Port
	Data transfer (Mbps)	
	Response time (ms)	
NAS platform (System LU) (VSP Gx00, Nx00, and VSP Fx00 models)	Throughput (IOPS)	Port
	Data transfer (Mbps)	
	Response time (ms)	
WWN	Throughput of WWN (IOPS)	Port
	Data transfer of WWN (Mbps)	
	Response time of WWN (ms)	
	Throughput of port (IOPS)	

Object of monitoring	Monitoring data	Necessary resources
	Data transfer of port (Mbps)	
	Response time of port (ms)	
LDEV (base)	Total throughput (IOPS)	LDEV
	Read throughput (IOPS)	
	Write throughput (IOPS)	
	Cache hit (%)	
	Data transfer (Mbps)	
	Response time (ms)	
	Back transfer (count/sec)	
	Drive usage rate (%)[1]	
	Drive access rate (%)[1]	
	ShadowImage usage rates (%)[1,2]	
LDEV (UR/URz)	Write host I/O throughput (IOPS)	LDEV
	Write host I/O data transfer (Mbps)	
	Initial copy cache hit (%)	
	Initial copy data transfer (Mbps)	
LDEV (TC/TCz/GAD)	RIO (count)	LDEV
	Pair Synchronized (%)	
	Differential track (count)	
	Initial copy throughput (count)	
	Initial copy data transfer (Mbps)	
	Initial copy response time (ms)	
	Update copy throughput (count)	
	Update copy data transfer (Mbps)	
	Update copy response time (ms)	
Parity group	Total throughput (IOPS)	Parity group
	Read throughput (IOPS)	

Object of monitoring	Monitoring data	Necessary resources
	Write throughput (IOPS)	
	Cache hit (%)	
	Data transfer (Mbps)	
	Response time (ms)	
	Back transfer (count/sec)	
	Drive usage rate (%)[1]	
LUN (base)	Total throughput (IOPS)	▪ Host group ▪ LDEV
	Read throughput (IOPS)	
	Write throughput (IOPS)	
	Cache hit (%)	
	Data transfer (Mbps)	
	Response time (ms)	
	Back transfer (count/sec)	
LUN (UR)[3]	Write host I/O throughput (IOPS)	▪ Host group ▪ LDEV
	Write host I/O data transfer (Mbps)	
	Initial copy cache hit (%)	
	Initial copy data transfer (Mbps)	
LUN (TC/GAD)[3]	RIO (count)	▪ Host group ▪ LDEV
	Pair Synchronized (%)	
	Differential track (count)	
	Initial copy throughput (count)	
	Initial copy data transfer (Mbps)	
	Initial copy response time (ms)	
	Update copy throughput (count)	
	Update copy data transfer (Mbps)	
	Update copy response time (ms)	
External storage	Data transfer between the storage system and external storage per logical device (Mbps)	LDEV

Object of monitoring	Monitoring data	Necessary resources
	Response time between the storage system and external storage per logical device (ms)	
	Data transfer between the storage system and external storage per external volume group (Mbps)	Parity group
	Response time between the storage system and external storage per external volume group (ms)	
Entire storage system (TC/TCz/ GAD)	RIO (count)	None
	Pair Synchronized (%)	
	Differential track (count)	
	Initial copy throughput (count)	
	Initial copy data transfer (Mbps)	
	Initial copy response time (ms)	
	Update copy throughput (count)	
	Update copy data transfer (Mbps)	
	Update copy response time (ms)	
Journal (UR/ URz)	Write host I/O throughput (IOPS)	None
	Write host I/O data transfer (Mbps)	
	Initial copy cache hit (%)	
	Initial copy data transfer (Mbps)	
	Master journal throughput (IOPS)	
	Master journal journal (count/sec)	
	Master journal data transfer (Mbps)	
	Master journal response time (ms)	
	Master journal usage data (%)	
	Master journal metadata usage rate (%)	
	Restore journal throughput (IOPS)	
	Restore journal journal (count/sec)	
	Restore journal data transfer (Mbps)	

Object of monitoring	Monitoring data	Necessary resources
	Restore journal response time (ms)	
	Restore journal usage data (%)	
	Restore journal metadata usage rate (%)	
Entire storage system (UR/URz)	Write host I/O throughput (IOPS)	None
	Write host I/O data transfer (Mbps)	
	Initial copy cache hit (%)	
	Initial copy data transfer (Mbps)	
	Master journal throughput (IOPS)	
	Master journal journal (count/sec)	
	Master journal data transfer (Mbps)	
	Master journal response time (ms)	
	Restore journal throughput (IOPS)	
	Restore journal journal (count/sec)	
	Restore journal data transfer (Mbps)	
	Restore journal response time (ms)	

Note:

1. Only information on internal volumes is displayed. Information on external volumes and FICON® DM volumes is not displayed.
2. (VSP G1x00 and VSP F1500) Includes usage rates for ShadowImage for Mainframe.
3. The same value is output to all LUNs mapped to the LDEV.

Usage rates of MPs

Function

The usage rate of the MP shows the usage rate of an MP assigned to a logical device. If a usage rate of an MP is high, I/Os concentrate to an MP. Examine the distribution of I/Os to other MP blade or unit.

Storing period

(VSP G1x00 and VSP F1500) Short-Range (from 1 to 15 minutes) or Long-Range (fixed at 15 minutes) can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Controller	MP	Usage Rate (%)	None

Usage rate of DRRs (VSP G1x00 and VSP F1500)

Function

A data recovery and reconstruction processor (DRR) is a microprocessor (located on the DKAs and CHAs) that is used to generate parity data for RAID 5 or RAID 6 parity groups. The DRR uses the formula "old data + new data + old parity" to generate new parity.

If the monitor data shows high DRR usage overall, perform either of the following operations to distribute the workload for the system:

- Move a volume whose write usage rate is high (especially, sequential write usage rate) from a RAID-5 (or RAID-6) parity group to a RAID-1 parity group.
- Move the data to another storage system.

Use Volume Migration to move a volume. For details on Volume Migration, see the *Hitachi Volume Migration User Guide*.

If the monitor data shows relatively high DRR usage overall, the performance of the system might not be improved even after moving a volume using Volume Migration.

Storing period

Short-Range or Long-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Controller	DRR	Usage Rate (%)	None

Usage rate of cache memory

Function

When you display monitoring results in a short range (VSP G1x00 and VSP F1500) or sampling interval (VSP Gx00, VSP Fx00, and VSP Nx00), the window displays the usage rates about the cache memory for the speci ied period of time.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Cache	None	Usage Rate (%)	None

Write pending rates

Function

The write pending rate indicates the ratio of write pending data to the cache memory capacity. It is expressed as a percentage of the cache memory capacity used for write pending. The **Monitor Performance** window displays the average and the maximum write pending rate for the specified period of time.

Storing period

(VSP G1x00 and VSP F1500) Short-Range or Long-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Cache	None	Write Pending Rate (%)	None

Storage system throughput

Function

Total throughput is the sum of I/Os per second. The read throughput is I/Os to the disk per second when the file read processing is performed. The write throughput is I/Os to the disk per second when the file write processing is performed.

Throughput in the following modes can be displayed:

- Sequential access mode
- Random access mode
- (VSP G1x00 and VSP F1500) Cache fast write (CFW) mode
- Total value in the above-mentioned modes

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Fibre port[1]	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Throughput (IOPS)	None
Mainframe fibre port[1] (VSP G1x00 and VSP F1500)	None	Throughput (IOPS)	None

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
iSCSI Port[1]	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Throughput (IOPS)	None
NAS Platform (User LU)[1] (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Throughput (IOPS)	None
NAS Platform (System LU)[1] (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Throughput (IOPS)	None
WWN[1]	WWN	Throughput (IOPS)	None
	Port	Throughput (IOPS)	None
Logical device[1]	Base	Total Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Read Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Write Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
	TC/TCz/GAD	Initial copy	Throughput (count)[2]
		Update copy	Throughput (count)[2]
	UR/URz	Write Host I/O	Throughput (IOPS)

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Parity Group[1]	None	Total Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Read Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Write Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
LUN[3]	Base	Total Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Read Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
		Write Throughput (IOPS)	▪ Total ▪ Sequential ▪ Random ▪ (VSP G1x00 and VSP F1500) CFW
	TC/GAD	Initial copy	Throughput (count)[2]
		Update copy	Throughput (count)[2]

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
	UR	Write host I/O	Throughput (IOPS)
Journal	UR/URz	Write host I/O	Throughput (IOPS)
		Master journal	Throughput (IOPS)
		Restore journal	Throughput (IOPS)
Entire Storage System	TC/TCz/GAD	Initial copy	Throughput (count)[2]
		Update copy	Throughput (count)[2]
	UR/URz	Write host I/O	Throughput (IOPS)
		Master journal	Throughput (IOPS)
		Restore journal	Throughput (IOPS)

Note:

1. Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.
2. The total number of accesses is displayed.
3. The same value is output to all LUNs mapped to the LDEV.

Data transfer rate

Function

The amount of data transferred from the host server per second. The data transfer rate for both read data and write data can be monitored.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Fibre port*	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Data Trans. (Mbps)	None
Mainframe fibre port* (VSP G1x00 and VSP F1500)	None	Data Trans. (Mbps)	Total
			Read
			Write
iSCSI Port*	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Data Trans. (Mbps)	None
NAS Platform (User LU)* (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Data Trans. (Mbps)	None
NAS Platform (System LU)* (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Data Trans. (Mbps)	None
WWN*	WWN	Data Trans. (Mbps)	None
	Port	Data Trans. (Mbps)	None
Logical device*	Base	Data Trans. (Mbps)	Total
			Read
			Write
	TC/TCz/GAD	Initial Copy	Data Trans. (Mbps)
		Update Copy	Data Trans. (Mbps)
	UR/URz	Write Host I/O	Data Trans. (Mbps)
		Initial Copy	Data Trans. (Mbps)
Parity Group*	None	Data Trans. (Mbps)	Total

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
			Read
			Write
LUN*	Base	Data Trans. (Mbps)	Total
			Read
			Write
	TC/GAD	Initial Copy	Data Trans. (Mbps)
		Update Copy	Data Trans. (Mbps)
	UR	Write Host I/O	Data Trans. (Mbps)
		Initial Copy	Data Trans. (Mbps)
External Storage	Parity Group	Data Trans. (Mbps)	Total
			Read
			Write
	Logical Device	Data Trans. (Mbps)	Total
			Read
			Write
Journal	UR/URz	Write host I/O	Data Trans. (Mbps)
		Initial copy	Data Trans. (Mbps)
		Master journal	Data Trans. (Mbps)
		Restore journal	Data Trans. (Mbps)
Entire Storage System	TC/TCz/GAD	Initial copy	Data Trans. (Mbps)
		Update copy	Data Trans. (Mbps)
	UR/URz	Write host I/O	Data Trans. (Mbps)
		Initial copy	Data Trans. (Mbps)
		Master journal	Data Trans. (Mbps)
		Restore journal	Data Trans. (Mbps)
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Usage rates of access paths (VSP G1x00 and VSP F1500)

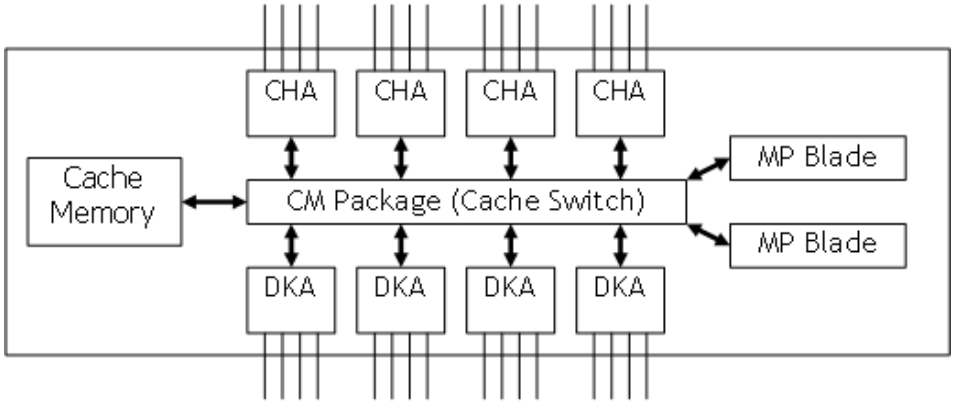
Function

The access paths are the paths through which data and commands are transferred within a storage system. As shown in the following figure, the channel adapters (CHAs) (also called front-end directors) in the storage system control the transfer of data between the hosts and the cache memory, and the disk adapters (DKAs) (also called back-end directors) control the transfer of data between the cache memory and the data drives, as shown below. Data transfer does not occur between the channel adapters and disk adapters. Data is transferred through the CM package (cache switch) to the cache memory.

When hosts issue commands, the commands are transferred through the channel adapters to the shared memory (SM). The content of the shared memory is checked by the disk adapters.

Performance Monitor tracks and displays the usage rate for the following access paths.

- Access paths between channel adapters and the CM package (CHA cache)
- Access paths between disk adapters and the CM package (DKA cache)
- Access paths between the MP blade and the CM package (MP blade cache)
- Access paths in the CM package (cache)



Storing period

Short-Range or Long-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Access path	CHA cache	Usage Rate (%)	None

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
	DKA cache	Usage Rate (%)	None
	MP blade cache	Usage Rate (%)	None
	Cache	Usage Rate (%)	None

Response times

Function

Time (in milliseconds) for replying from an external volume group when I/O accesses are made from your storage system to the external volume group. The average response time in the period specified at Monitoring Term is displayed.

Items that can be monitored response times are ports, WWNs, LDEVs, parity groups, LUNs, and external storages (parity groups and LDEVs).

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Fibre port*	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Response Time (ms)	None
Mainframe fibre port* (VSP G1x00 and VSP F1500)	None	Response Time (ms)	None

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
iSCSI Port*	None (VSP G1x00 and VSP F1500) Target and Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Response Time (ms)	None
NAS Platform (User LU)* (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Data Trans. (Mbps)	None
NAS Platform (System LU)* (VSP Gx00, VSP Fx00, and VSP Nx00)	Target	Data Trans. (Mbps)	None
WWN*	WWN	Response Time (ms)	None
	Port	Response Time (ms)	None
Logical device*	Base	Response Time (ms)	Total
			Read
			Write
	TC/TCz/GAD	Initial Copy	Response Time (ms)
		Update Copy	Response Time (ms)
Parity group*	None	Response Time (ms)	Total
			Read
			Write
LUN*	Base	Response Time (ms)	Total
			Read
			Write
	TC/GAD	Initial Copy	Response Time (ms)
		Update Copy	Response Time (ms)
External Storage	Parity Group	Response Time (ms)	Total
			Read

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
			Write
	Logical Device	Response Time (ms)	Total
			Read
			Write
Journal	UR/URz	Master Journal	Response Time (ms)
		Restore Journal	Response Time (ms)
Entire Storage System	TC/TCz/GAD	Initial Copy	Response Time (ms)
		Update Copy	Response Time (ms)
	UR/URz	Master Journal	Response Time (ms)
		Restore Journal	Response Time (ms)
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

CMR delay time (VSP G1x00 and VSP F1500)

Function

When I/O access from the storage system is made to the monitoring object port, command response (CMR) delay time shows the time (in milliseconds) from the I/O access to the return of a command response from the port.

Storing period

Short-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Mainframe fibre port*	None	CMR delay Time (ms)	None

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Disconnected time (VSP G1x00 and VSP F1500)

Function

When I/O access is made from the storage system to the monitoring object port, Disconnected time shows the time (in milliseconds) during which processing is interrupted because of I/O processing to the data drives.

Storing period

Short-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Mainframe fibre port*	None	Disconnected Time (ms)	None
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Connected time (VSP G1x00 and VSP F1500)

Function

Connected time shows the time (in milliseconds) obtained by subtracting the CMR delay time and the disconnected time from the response time.

Storing period

Short-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Mainframe fibre port*	None	Connected Time (ms)	None
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

HTP port open exchanges (VSP G1x00 and VSP F1500)

Function

HTP port open exchanges shows the number of open exchanges for the monitoring object port. The number of open exchanges is the average number of active I/O accesses at the monitoring object port.

Storing period

Short-Range can be specified.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Mainframe fibre port*	None	HTP Port Open Exchanges (count/sec)	None
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Cache hit rates

Function

The cache hit rate is a rate that the input or output data of the disk exists in the cache. The cache hit rate is displayed for the sequential access mode, the random access mode, the cache fast write (CFW) mode (VSP G1x00 and VSP F1500), and the entire these modes.

- Read hit ratio

  For a read I/O, when the requested data is already in cache, the operation is classified as a read hit. For example, if ten read requests have been made from hosts to devices in a given time period and the read data was already on the cache memory three times out of ten, the read hit ratio for that time period is 30 percent. A higher read hit ratio implies higher processing speed because fewer data transfers are made between devices and the cache memory.

- Write hit ratio

  For a write I/O, when the requested data is already in cache, the operation is classified as a write hit. For example, if ten write requests were made from hosts to devices in a given time period and the write data was already on the cache memory three cases out of ten, the write hit ratio for that time period is 30 percent. A higher write hit ratio implies higher processing speed because fewer data transfers are made between devices and the cache memory.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	Base	Cache Hit (%)	▪ Read (Total) ▪ Read (Sequential) ▪ Read (Random) ▪ (VSP G1x00 and VSP F1500) Read (CFW) ▪ Write (Total) ▪ Write (Sequential)

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
			▪ Write (Random) ▪ (VSP G1x00 and VSP F1500) Write (CFW)
	UR/URz	Initial Copy	Cache Hit (%)
Parity Group*	None	Cache Hit (%)	▪ Read (Total) ▪ Read (Sequential) ▪ Read (Random) ▪ (VSP G1x00 and VSP F1500) Read (CFW) ▪ Write (Total) ▪ Write (Sequential) ▪ Write (Random) ▪ (VSP G1x00 and VSP F1500) Write (CFW)
LUN*	Base	Cache Hit (%)	▪ Read (Total) ▪ Read (Sequential) ▪ Read (Random) ▪ (VSP G1x00 and VSP F1500) Read (CFW) ▪ Write (Total) ▪ Write (Sequential) ▪ Write (Random) ▪ (VSP G1x00 and VSP F1500) Write (CFW)
	UR	Initial Copy	Cache Hit (%)

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Entire Storage System	UR/URz	Initial Copy	Cache Hit (%)
Journal	UR/URz	Initial Copy	Cache Hit (%)
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Back-end performance

Function

The back-end transfer can be monitored. The back-end transfer is the number of data transfers between the cache memory and the data drive. The graph contains following information.

- Cache to Drive

  The number of data transfers from the cache memory to data drives.

- Drive to Cache Sequential

  The number of data transfers from data drives to the cache memory in sequential access mode

- Drive to Cache Random

  The number of data transfers from data drives to the cache memory in random access mode

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	Base	Back Trans. (count/sec)	Total

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
			Cache to Drive
			Drive to Cache (Sequential)
			Drive to Cache (Random)
Parity Group*	None	Back Trans. (count/sec)	Total
			Cache to Drive
			Drive to Cache (Sequential)
			Drive to Cache (Random)
LUN*	Base	Back Trans. (count/sec)	Total
			Cache to Drive
			Drive to Cache (Sequential)
			Drive to Cache (Random)
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Drive usage rates

Function

The usage rates of the data drive of each LDEV or parity group can be displayed.

Storing period

(VSP G1x00 and VSP F1500) Short-Range or Long-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	Base	Drive Usage Rate (%)	None
Parity Group*	None	Drive Usage Rate (%)	None
*Only information on internal volumes is displayed. Information about external volumes, FICON® DM volumes, and virtual volumes such as DP-VOL and Thin Image V-VOLs is not displayed.			

Data drive access rates

Function

The data drive access rate shows the access rate of each data drive.

The rate of the file reading Read (Sequential) or the file writing Write (Sequential) processing of the data drive in the sequential access mode is displayed.

The rate of file reading Read (Random) or file writing Write (Random) processing of the data drive in the random access mode is displayed.

Storing period

(VSP G1x00 and VSP F1500) Long-Range or Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical device*	Base	Drive Access Rate (%)	Read (Sequential)
			Read (Random)
			Write (Sequential)
			Write (Random)

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
*Only information on internal volumes is displayed. Information about external volumes, FICON® DM volumes, and virtual volumes such as DP-VOL and Thin Image V-VOLs is not displayed.			

ShadowImage usage statistics

Function

The access rate of volume by ShadowImage and ShadowImage for Mainframe can be displayed by the percentage of the processing of the program to all processing of the physical drives, for each volume. This value is found by dividing access time to physical drives by the program by all access time to physical drives.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical device[1]	Base	ShadowImage (%)[2]	None

Note:

1. Only information on internal volumes is displayed. Information about external volumes, FICON® DM volumes, and virtual volumes such as DP-VOL and Thin Image V-VOLs is not displayed.
2. (VSP G1x00 and VSP F1500) Information for ShadowImage and ShadowImage for Mainframe is displayed.

Remote I/O (RIO)

Function

Information about LDEV performance is shown through the total number of remote I/Os from P-VOL to S-VOL for TrueCopy, TrueCopy for Mainframe, and global-active device pairs.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	TC/TCz/GAD	RIO (count)	Total
			Write
			Error
LUN*	TC/GAD	RIO (count)	Total
			Write
			Error
Entire Storage System	TC/TCz/GAD	RIO (count)	Total
			Write
			Error
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Pair Synchronized

Function

The synchronization rate between P-VOL and S-VOL is shown as (%) for TrueCopy, TrueCopy for Mainframe, and global-active device pairs.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	TC/TCz/GAD	Pair Synchronized (%)	None
LUN*	TC/GAD	Pair Synchronized (%)	None
Entire Storage System	TC/TCz/GAD	Pair Synchronized (%)	None
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Differential Track

Function

The synchronization rate between P-VOL and S-VOL is shown through the number of differential tracks (the number of tracks not transmitted from P-VOL to S-VOL) for TrueCopy, TrueCopy for Mainframe, and global-active device pairs.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Logical Device*	TC/TCz/GAD	Differential track (count)	None
LUN*	TC/GAD	Differential track (count)	None

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Entire Storage System	TC/TCz/GAD	Differential track (count)	None
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Number of Journals

Function

The total number of journals transferred from the master journal volume to the restore journal volume is shown.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Journal	UR/URz	Master Journal	Journal (count/sec)
		Restore Journal	Journal (count/sec)
Entire Storage System	UR/URz	Master Journal	Journal (count/sec)
		Restore Journal	Journal (count/sec)

Data Usage Rate

Function

The current journal data usage rate (%) is shown, with the journal volume data space assumed to be 100%.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be speci ied.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Journal	UR/URz	Master Journal	Data Usage Rate (%)
		Restore Journal	Data Usage Rate (%)

Metadata Usage Rate

Function

The metadata usage rate of the current journal is shown, with journal volume metadata space assumed to be 100%.

Storing period

(VSP G1x00 and VSP F1500) Short-Range can be specified.

(VSP Gx00, VSP Fx00, and VSP Nx00) Sample Interval can be speci ied from 1 to 15 minutes.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Journal	UR/URz	Master Journal	Metadata Usage Rate (%)
		Restore Journal	Metadata Usage Rate (%)

Detailed information of resources on top 20 usage rates (VSP G1x00 and VSP F1500)

Function

You can view resources of the 20 most-used MP blades. The system puts in order of use 20 MP blades based on rates collected during the most recent usage period. You cannot specify a particular period.

Storing period

Only the Short-Range real time monitoring data can be supported.

Selection of monitoring objects

Select the desired monitoring objects in the Performance Objects field.

Item on left side of Object field	Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field
Controller	MP	Usage Rate (%)	None

Viewing MP blade resource details

To view the resources assigned to an individual MP blade, click the link to the name of the MP blade in the right panel of the Monitor window. The MP Properties window lists the 20 most-used resources by blade name.

Chapter 4: Exporting Performance Monitor data

You can use Export Tool to export Hitachi Performance Monitor data for your storage system to the spreadsheet application and other applications.

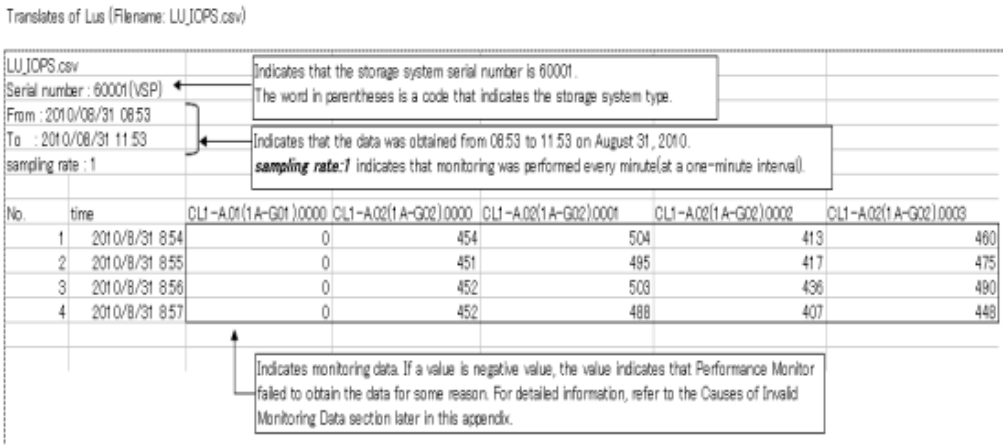
About Export Tool

Use Export Tool to export the monitoring data (statistics) shown in the **Monitor Performance** window to text files. After exporting monitoring data to text files, you can import that data into desktop publishing applications, such as Microsoft Word, or into the spreadsheet application or database applications for analysis. You can also use Export Tool to export monitoring data on remote copy operations performed by the following:

- TrueCopy
- Universal Replicator
- Global-active device
- (VSP G1x00 and VSP F1500) TrueCopy for Mainframe
- (VSP G1x00 and VSP F1500) Universal Replicator for Mainframe

Example of a text file

The following example is of a text file imported into spreadsheet software.



Note: In this `LU_IOPS.csv` file, the last four digits of a table column heading (such as 0001 and 0002) indicate a LUN. For example, the heading CL1-A. 00(1A-G00).0001 indicates the port CL1-A, the host group ID 00, the host group name 1A-G00, and the LUN 0001.

If you export monitoring data about concatenated parity groups, the resulting CSV file does not contain column headings for the concatenated parity groups. For example, if you export monitoring data about a concatenated parity group named 1-3[1-4], you cannot find 1-3[1-4] in column headings. To locate monitoring data about 1-3[1-4], locate the 1-3 column or the 1-4 column. Either of these columns contains monitoring data about 1-3[1-4].

Preparing to use Export Tool

Export Tool limitation

Running multiple instances of Export Tool simultaneously is not supported. If you run multiple instances, the SVP can become overloaded and a timeout error can occur.

Requirements for Export Tool

The following components are required to use Export Tool (for more information, see the *System Administrator Guide* of your storage system):

- **Windows computer or a UNIX computer**

  You can only run Export Tool on Windows computers and UNIX computers that can run Device Manager - Storage Navigator.

  Note: If a firewall exists between the Device Manager - Storage Navigator computer and the SVP, see Chapter 2 of the *System Administrator Guide* of your storage system. In the section “Setting up TCP/IP for a firewall”, the RMI port numbers listed are the only direct communication settings required for Export Tool.

- **Java Runtime Environment (JRE)**

  To use Export Tool, you must have the JRE software on your Windows computer or UNIX computer. If your computer runs Device Manager - Storage Navigator, the required JRE version is already installed, and you can install Export Tool. Both Export Tool and Device Manager - Storage Navigator use the same JRE version. For the required JRE version, see the chapter on how to use the Device Manager - Storage Navigator secondary window in the *System Administrator Guide*.

- **User ID for exclusive use of Export Tool**

  Before you can use Export Tool, you must create a user ID for exclusive use of Export Tool. Assign only the Storage Administrator (Performance Management) role to the user ID for Export Tool. You should not assign any roles other than the Storage Administrator (Performance Management) role to this user ID. The user who is assigned to the Storage Administrator (Performance Management) role can perform the following:

  - Save the monitoring data into files
  - Change the sampling interval
  - Start or stop monitoring by using the **`set`** subcommand

  For details on creating the user ID, see *System Administrator Guide* of your storage system.

- **Export Tool program**

  CD-ROM Disc 2, which is named Host PP, contains Export Tool. For information about how to install Export Tool, see Installing Export Tool (on page 74). For the Export Tool version, see the `Readme.txt` file stored in the software product media.

  (VSP G1x00 and VSP F1500) If the version of the DKCMAIN program is 80-03-01-00/00 or later and the version of Export Tool is 80-03-01/00 or later, the reinstallation of Export Tool is not mandatory.

  (VSP Gx00, VSP Fx00 models) Reinstallation of Export Tool is not mandatory if the Device Manager - Storage Navigator program and Export Tool version are:

  - VSP G200: 83-02-00-20/XX or later
  - VSP G400, G600, VSP F400, F600: 83-02-00-40/XX or later
  - VSP G800, VSP F800: 83-02-00-60/XX or later

  Caution: (VSP G1x00 and VSP F1500) Remove Export Tool if the installed Export Tool version is earlier than 80-03-01/00.

  Caution: (VSP Gx00 models and VSP Fx00 models) If the installed Export Tool version is earlier than 83-02-00-20/XX (for VSP G200), 83-02-00-40/XX (for VSP G400, G600, VSP F400, F600), or 83-02-00-60/XX (for VSP G800, VSP F800), remove Export Tool first.

  To remove it, delete the directory which was created when Export Tool was installed. When you delete the directory, monitoring data acquired by Export Tool, log data, and the file you edited will be deleted. If you need the monitoring data, log data, and the files you edited, save them in a separate directory before removing Export Tool.

Installing Export Tool

On Windows

The Export Tool program is a Java class file and is located in the `export\lib` folder.

Caution: The files edited by the user are overwritten if Export Tool is reinstalled. Save these files in a separate folder in advance.

Procedure

1. Log on with administrator privileges.
2. Create a new folder for the Export Tool application (for example, `C:\Program Files\monitor`). If the folder already exists, skip this step.
3. Insert the Export Tool CD-ROM into the CD drive.
4. Locate the `\program\monitor\win` folder on the CD-ROM, and copy the self-extracting file `export.exe` from the CD-ROM into the new folder you just created.
5. Double-click `export.exe` to start the installation. Export Tool is installed into the installation directory, and a new folder named “export” is created.

Note: You should delete `runUnix.bat` and `delUnix.bat` from the export folder because these files are no longer needed.

Note: If you execute `export.exe`, Windows might display "This program might not have installed correctly" even though the export tool has been installed correctly. In this case, click "This program installed correctly". If the installation fails, followed by this message, execute `export.exe` again.

On UNIX

The Export Tool program is a Java class file and is located in the `lib` directory.

Caution: The files edited by the user are overwritten if Export Tool is reinstalled. Save these files in a separate folder in advance.

Note: You should delete `runWin.bat` and `delWin.bat` from the installation directory because these files are no longer needed.

Procedure

1. Log on as a superuser.

   You do not need to remove a previous installation of Export Tool. The new installation overwrites the older program.
2. Create a new directory for the Export Tool program (for example, `/monitor`).
3. Mount the Export Tool CD-ROM.
4. Go to the `/program/monitor/UNIX` directory on the CD-ROM, and copy the `export.tar` file to the new directory you just created.
5. Decompress the `export.tar` file on your computer. Export Tool is installed into the installation directory.

Using Export Tool

After installing Export Tool, you must prepare a command file and a batch file before you can export any monitoring data. This section explains how to prepare a command file and a batch file, and then how to run Export Tool.

Preparing a command file

To run Export Tool, you must write scripts for exporting monitoring data. When writing scripts, you must write several subcommands in a command file. When you run Export Tool, the subcommands in the command file run sequentially, and then the monitoring data is saved in files.

When you install Export Tool, the `command.txt` file is stored in the installation directory. This file contains sample scripts for your command file. You should customize scripts in `command.txt` according to your needs. For detailed information about subcommand syntax, see Export Tool command reference (on page 93) .

A semicolon (;) indicates the beginning of a comment. Characters from a semicolon to the end of the line are comments.

Example of a command file

(VSP G1x00 and VSP F1500)

```
svpip 158.214.135.57          ; Specifies IP address of SVP
login expusr passwd           ; Logs user into the SVP
show                          ; Outputs storing period to standard
                              ; output
group PhyPG Long              ; Specifies type of data to be
                              ; exported and type of
                              ; storing period
group RemoteCopy              ; Specifies type of data to be
                              ; exported
shortrange 201305010850:201305010910
                              ; Specifies term of data to be
                              ; exported for data stored
                              ; in short range
longrange 201304301430:201305011430
                              ; Specifies term of data to be
                              ; exported for data stored
                              ; in long range
outpath out                   ; Specifies directory in which files
                              ; will be saved
option compress               ; Specifies whether to
                              ; compress files
apply                         ; Executes processing for saving
                              ; monitoring data in files
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
ip 158.214.135.57:1099          ; Specifies the IP address of
                                 ; the SVP and the connection port number
dkcsn 123456                     ; Specifies the target DKC
                                 ; serial number
login expusr                     ; Logs the user into the storage system
show                             ; Outputs the storing period in
                                 ; the storage system to standard output
group PhyPG                      ; Specifies the type of data to
                                 ; be exported and the storing
                                 ; period
group RemoteCopy                 ; Specifies the type of data to
                                 ; be exported
range 200610010850:200610010910  ; Specifies the range in
                                 ; which files will be saved
outpath out                      ; Specifies the directory in
                                 ; which files will be saved
option compress                  ; Specifies whether to
                                 ; compress files
apply                            ; Executes processing for
                                 ; saving monitoring data in
                                 ; files
```

The scripts in this command file are explained as follows:

- (VSP G1x00 and VSP F1500) `svpip 158.214.135.57`

  This script specifies that you are logging into the SVP whose IP address is `158.214.135.57`. You must log on to the SVP when using Export Tool.

  The **`svpip`** subcommand specifies the IP address of the SVP. You must include the **`svpip`** subcommand in your command file. For detailed information about the **`svpip`** subcommand, see svpip (VSP G1x00 and VSP F1500) (on page 97) .

  Export Tool creates a directory with the name specified by the **`svpip`** subcommand under the following directory:

  - For Windows: export\lib
  - For UNIX: export\lib

  If the value specified by the **`svpip`** subcommand is an IP address, a hexadecimal value is specified as the directory name. Periods (.) and colons (:) cannot be used. If the value is a host name, the IP address of the specified server is specified as the directory name.

  The following table provides examples of directory names to be created.

Value specified by the **`svpip`** subcommand	Directory name
Value for the **`svpip`** subcommand is `svpip 158.214.135.57` (for IPv4)	9ED68739
Value for the **`svpip`** subcommand is `svpip 0000:0000:0020:00B4:0000:0000:9ED6:874` (for IPv6)	00000000002000B400 0000009ED68740
Value for the **`svpip`** subcommand is `svpip host01` (when the IP address of host01 is 158.214.135.57)	9ED68739

- (VSP Gx00, VSP Fx00, and VSP Nx00) `ip 158.214.135.57:1099`

  This script specifies that you are logging into the SVP whose IP address is 158.214.135.57 and that 1099 (the default port of RMIIFRegist) is the port number to connect to the SVP. You must log on to the storage system connected to the SVP when using Export Tool.

  The **`ip`** subcommand specifies the SVP to which you wish to connect. You must include the **`ip`** subcommand in your command file.

  For detailed information about the **`ip`** subcommand, see ip (VSP Gx00, VSP Fx00, and VSP Nx00) (on page 96) .

  For Export Tool, a directory is created with a value name specified by the **`ip`** subcommand under the following directory:

  - For Windows: export\lib
  - For UNIX: export\lib

  When the value specified by the **`ip`** subcommand is an IP address, a hexadecimal value is specified as the directory name. Periods (.) and colons (:) are not included. When it is a host name, the IP address of the specified server is specified as the directory name. The following table provides examples of the directory names.

Value specified by the `ip` subcommand	Directory name
Value for the **`ip`** subcommand is `ip 158.214.135.57` (for IPv4)	9ED68739
Value for the **`ip`** subcommand is `ip 0000:0000:0020:00B4:0000:0000:9ED6:874` (for IPv6)	00000000002000B4000000009ED68740
Value for the **`ip`** subcommand is `ip host01` (when the IP address of host01 is 158.214.135.57)	9ED68739

- (VSP Gx00, VSP Fx00, and VSP Nx00) `dkcsn 123456`

  This script specifies the serial number of the system from which monitored data will be acquired. This subcommand specifies the system to provide the monitored data. Make sure to notate the **`dkcsn`** subcommand in the command file. For detailed information about the **`dkcsn`** subcommand, see in dkcsn (VSP Gx00, VSP Fx00, and VSP Nx00) (on page 98) .

- `login expusr passwd`

  This script specifies that you provide the user ID **`expusr`** and the password **`passwd`** to log in to the storage system.

  The **`login`** subcommand logs the specified user into the storage system. You must include the **`login`** subcommand in your command file. For detailed information about the **`login`** subcommand, see login (on page 100) .

  > **Caution:** When you write the **`login`** subcommand in your command file, you must specify a user ID that is used exclusively for running Export Tool. See Requirements for Export Tool (on page 73) for reference.

- `show`

  The **`show`** subcommand checks the SVP to find the period of monitoring data stored in the SVP and the data collection interval (called sampling interval in Performance Monitor), and then outputs them to the standard output (for example, the command prompt) and the log file.

  - (VSP G1x00 and VSP F1500) Performance Monitor collects statistics by the two types of storing periods: short range and long range. The **`show`** subcommand displays the storing periods and the sampling intervals for these two types of monitoring data.

    The following is an example of information that the **`show`** subcommand outputs:

    ```
    Short Range     From: 2013/05/01 01:00  -  To: 2013/05/01 15:00
     Interval: 1min.
    Long Range      From: 2013/04/01 00:00  -  To: 2013/05/01 15:00
     Interval: 15min.
    ```

    `Short Range` indicates the storing period and sampling interval of the monitoring data stored in short range. `Long Range` indicates those of the monitoring data stored in long range. In the previous example, the monitoring data in short range is stored every 1 minute in the term of 1:00-15:00 on May 1, 2013. Also, the monitoring data in long range is stored every 15 minutes in the term of April 1, 2013, 0:00 through May 1, 2013, 15:00. When you run Export Tool, you can export monitoring data within these periods into files.

    All of the monitoring items are stored in short range, but a part of monitoring items is stored in both short range and long range. For details on monitoring items that can be stored in long range, see longrange (VSP G1x00 and VSP F1500) (on page 127).

  - (VSP Gx00, VSP Fx00, and VSP Nx00)

    The following is an example of information that the **`show`** subcommand outputs:

    ```
    Range From: 2006/10/01 01:00  -  To: 2006/10/01 15:00
     Interval: 1min.
    ```

    In this example, the monitoring data is stored every 1 minute in the term of 1:00 - 15:00 on October 1, 2006. When you run Export Tool, you can export monitoring data into the file.

  The use of the **`show`** subcommand is not mandatory, but you should include the **`show`** subcommand in your command file. If an error occurs when you run Export Tool, you might be able to find the error cause by checking the log file for information issued by the **`show`** subcommand. For detailed information about the **`show`** subcommand, see show (on page 101).

- `group PhyPG Long` and `group RemoteCopy`

  The **`group`** subcommand specifies the type of data that you want to export. Specify an operand following **`group`** to define the type of data to be exported. Basically, monitoring data stored in short range is exported. But you can direct the export of monitoring data stored in long range when you specify some of the operands (VSP G1x00 and VSP F1500).

  (VSP G1x00 and VSP F1500) The example script `group PhyPG Long` specifies to export usage statistics about parity groups in long range. Also, the script `group RemoteCopy` specifies to export statistics about remote copy operations by TrueCopy and TrueCopy for Mainframe and monitoring data by global-active device in short range. You can describe multiple lines of the **`group`** subcommand to export multiple monitoring items at the same time.

  (VSP Gx00, VSP Fx00, and VSP Nx00) The example script `group PhyPG` speci ies to export usage statistics about parity groups. Also, the script `group RemoteCopy` specifies to export statistics about remote copy operations by TrueCopy and global-active device. You can describe multiple lines of the **`group`** subcommand to export multiple monitoring items at the same time.

  For detailed information about the **`group`** subcommand, see group (on page 102) .

- (VSP G1x00 and VSP F1500) `shortrange 201305010850:201310010910` and `longrange 201304301430:201305011430`

  The **shortrange** subcommand and the **longrange** subcommand specify the term of monitoring data to be exported. Use these subcommands when you want to narrow the export-target term within the stored data. You can specify both subcommands at the same time. The difference between these subcommands is as follows:

  - The **shortrange** subcommand is valid for monitoring data in short range. You can use this subcommand to narrow the export-target term for all of the monitoring items you can specify by the **group** subcommand.

    Specify a term within "`Short Range From` XXX `To` XXX" which is output by the **show** subcommand.

  - The **longrange** subcommand is valid for monitoring data in long range. You can use this subcommand only when you specify the **PhyPG**, **PhyLDEV**, **PhyProc**, or **PhyCMPK** operand with the `Long` option in the **group** subcommand. (The items that can be saved by these operands are the monitoring data displayed on the Physical tab of the Performance Management window with selecting **longrange**.)

    Specify a term within "`Long Range From` XXX `To` XXX" which is output by the **show** subcommand.

  In the sample file in Preparing a command file (on page 76), the script shortrange 201305010850:201305010910 specifies the term 8:50-9:10 on May 1, 2013. This script is applied to the **group RemoteCopy** subcommand in this example. When you run Export Tool, it will export the statistics about remote copy operations by TrueCopy and TrueCopy for Mainframe and monitoring data by global-active device in the term specified by the **shortrange** subcommand.

  Also, in Preparing a command file (on page 76), the script longrange 201304301430:201305011430 specifies the term from April 30, 2013, 14:30 to May 1, 2013, 14:30. This script is applied to the **group PhyPG Long** subcommand in this example. When you run Export Tool, it will export the usage statistics about parity groups in the term specified by the **longrange** subcommand.

  If you run Export Tool without specifying the **shortrange** or **longrange** subcommand, the monitoring data in the entire storing period (data in the period displayed by the **show** subcommand) will be exported.

  - For detailed information about the **shortrange** subcommand, see shortrange (VSP G1x00 and VSP F1500) (on page 124).
  - For detailed information about the **longrange** subcommand, see longrange (VSP G1x00 and VSP F1500) (on page 127).

- (VSP Gx00, VSP Fx00, and VSP Nx00)`range 200610010850:200610010910`

  The **`range`** subcommand specifies the term of monitoring data to be exported. Use these subcommands when you want to narrow the export-target term within the stored data.

  You can use this subcommand to narrow the export-target term for all of the monitoring items you can specify by the **`group`** subcommand.

  Specify a term within `Range From XXX To XXX` which is output by the **`show`** subcommand.

  In the sample file given above, the script range 200610010850:200610010910 specifies the term 8:50-9:10 on October 1, 2006. This script is applied to the **`group RemoteCopy`** subcommand in this example. When you run Export Tool, it will export the statistics about remote copy operations by TrueCopy and global-active device in the term specified by the **`range`** subcommand.

  If you run Export Tool without specifying the **`range`** subcommand, the monitoring data in the whole storing period (data in the period displayed by the **`show`** subcommand) will be exported. For detailed information about the **`range`** subcommand, see range (VSP Gx00, VSP Fx00, and VSP Nx00) (on page 129) .

- `outpath out`

  This script specifies that files will be saved in the directory named **`out`** in the current directory.

  The **`outpath`** subcommand specifies the directory in which files will be saved. For detailed information about the **`outpath`** subcommand, see outpath (on page 132) .

- `option compress`

  This script specifies that Export Tool will compress monitoring data in ZIP files.

  The **`option`** subcommand specifies whether to save files in ZIP format or in CSV format. For more information, see option (on page 133) .

- `apply`

  The **`apply`** subcommand saves monitoring data in files. For detailed information about the **`apply`** command, see apply (on page 134) .

Preparing a batch file

Use a batch file to run Export Tool, which starts and saves monitoring data in files when you run the batch file.

The installation directory for Export Tool contains four default batch files: `runWin.bat`, `runUnix.bat`, `delWin.bat`, and `delUnix.bat`. If your computer runs Windows, use `runWin.bat` and `delWin.bat`. If your computer runs UNIX, use `runUnix.bat` and `delUnix.bat`.

The following examples illustrate scripts in `runWin.bat` and `runUnix.bat` batch files. These batch files include a command line that runs a Java command. When you run the batch file, the Java command runs the subcommands specified in the command file and then saves monitoring data in files.

Example batch file for Windows computers (`runWin.bat`):

```
java -classpath "./lib/JSanExportLoader.jar"
-Del.tool.Xmx=536870912 -Dmd.command=command.txt
-Del.logpath=log -Dmd.rmitimeout=20
sanproject.getexptool.RJElMain<CR+LF>
pause<CR+LF>
```

Example batch file for UNIX computers (`runUnix.bat`):

```
#! /bin/sh<LF>
java -classpath "./lib/JSanExportLoader.jar"
-Del.tool.Xmx=536870912 -Dmd.command=command.txt
-Del.logpath=log -Dmd.rmitimeout=20
sanproject.getexptool.RJElMain<LF>
```

In the previous scripts, <CR+LF> and <LF> indicate the end of a command line.

If the computer running Export Tool communicates directly with the SVP, you usually do not need to change scripts in `runWin.bat` and `runUnix.bat`. However, you might need to edit the Java command script in a text editor in some occasions, for example:

- If the name of your command file is not `command.txt`
- If you moved your command file to a different directory
- If you do not want to save in the log directory
- If you want to name log files as you like

If the computer that runs Export Tool communicates with the SVP through a proxy host, edit the Java command script in a text editor to specify the host name (or the IP address) and the port number of the proxy host. For example, if the host name is Jupiter and the port number is 8080, the resulting command script would be as shown in the following examples:

Example of specifying a proxy host on Windows (`runWin.bat`):

```
java -classpath "./lib/JSanExportLoader.jar"
-Dhttp.proxyHost=Jupiter -Dhttp.proxyPort=8080
-Del.tool.Xmx=536870912 -Dmd.command=command.txt
-Dmd.logpath=log -Dmd.rmitimeout=20 sanproject.getexptool.RJElMain<CR+LF>
pause<CR+LF>
```

Example of specifying a proxy host on UNIX (`runUnix.bat`):

```
#! /bin/sh<LF>
java -classpath "./lib/JSanExportLoader.jar"
-Dhttp.proxyHost=Jupiter -Dhttp.proxyPort=8080
-Del.tool.Xmx=536870912
-Dmd.command=command.txt
-Dmd.logpath=log -Dmd.rmitimeout=20 sanproject.getexptool.RJElMain<LF>
```

In the preceding scripts, <CR+LF> and <LF> indicate the end of a command line.

If the IP address of the proxy host is 158.211.122.124 and the port number is 8080, the resulting command script is as follows:

Example batch file for Windows computers (`runWin.bat`):

```
java -classpath "./lib/JSanExportLoader.jar"
-Dhttp.proxyHost=158.211.122.124
-Dhttp.proxyPort=8080 -Del.tool.Xmx=536870912
-Dmd.command=command.txt
-Dmd.logpath=log -Dmd.rmitimeout=20 sanproject.getexptool.RJElMain<CR+LF>
pause<CR+LF>
```

Example batch file for UNIX computers (`runUnix.bat`):

```
#! /bin/sh<LF>
java -classpath "./lib/JSanExportLoader.jar"
-Dhttp.proxyHost=158.211.122.124
-Dhttp.proxyPort=8080 -Del.tool.Xmx=536870912
-Dmd.command=command.txt
-Dmd.logpath=log -Dmd.rmitimeout=20 sanproject.getexptool.RJElMain<LF>
```

In the above scripts, <CR+LF> and <LF> indicate the end of a command line.

The following examples illustrate scripts in `delWin.bat` and `delUnix.bat` files. These batch files include a command line that runs a Java command. When you run the batch file, the Java command is run, and the directories created by Export Tool, and the files in the directories are deleted.

Example batch file for Windows computers (`delWin.bat`):

```
java -classpath "./lib/JSanExportLoader.jar"
-Dmd.command=command.txt
-Del.logpath=log
-Del.mode=delete sanproject.getexptool.RJElMain<CR+LF>
```

Example batch file for UNIX computers (`delUnix.bat`):

```
#! /bin/sh<LF>
java -classpath "./lib/JSanExportLoader.jar"
-Dmd.command=command.txt
-Del.logpath=log
-Del.mode=delete sanproject.getexptool.RJElMain<LF>
```

For detailed information about syntax of the Java command, see Java (on page 137) .

Running Export Tool

Running a batch file

To save monitoring data in files, launch Export Tool by running the batch file.

From a system running Windows, double-click the batch file to run it.

```
c:\WINDOWS> cd c:\export
c:\export> runWin.bat
```

Dots (...) appear on the screen until the system finishes exporting data. If an internal error occurs, an exclamation mark (!) appears and then Export Tool restarts automatically.

Example of command prompt outputs from Export Tool:

(VSP G1x00 and VSP F1500)

```
[ 2] svpip 158.214.135.57
[ 3] login User = expusr, Passwd = [****************]
   :
   :
[ 6] group Port
   :
   :
[20] apply
Start gathering port data
Target = 16, Total = 16
+----+----+----+----+----+----+----+----+----+----+
.........................!
.............................
End gathering port data
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
Loading ExportTool...
Export tool start [Version 80-xx-xx/xx]
command file = c:\export\command.txt
[ 2] ip 158.214.135.57:1099
[ 3] dkcsn 123456
[ 4] login User = expusr, Passwd = [****************]
   :
   :
[ 6] group Port
   :
   :
[20] apply
Start gathering port data
Target = 16, Total = 16
+----+----+----+----+----+----+----+----+----+----+
.........................!
```

```
.................................
End gathering port data
```

It might take time after Loading ExportTool is displayed in the command prompt and before Export tool start [Version 80-*xx*-*xx*/*xx*] is displayed. The time elapsed between the two messages varies depending on the communication environment of the computer executing Export Tool and SVP. The following table shows the approximate time period.

Communication speed between a computer and SVP	Line usage rate (%)	Approximate time
1 Gbps	0.1	1 minute
	0.5	12 seconds
100 Mbps	0.2	5 minutes
	1	1 minute

By default, the system compresses monitoring data files into a ZIP-format archive file. When you want to view the monitoring data, you can decompress and extract the CSV files from the ZIP archive. If the operating system on your computer does not include a way to extract files from a ZIP archive, you must obtain software to view the data.

When Export Tool is running, if an internal error listed in the Errors in the Export Tool table occurs, an exclamation mark (!) appears, and then Export Tool tries to export again. By default, Export Tool retries three times. If export processing does not end after three retries, or an internal error that is not listed in the table occurs, no retries are performed. In this case, close the command prompt, and then run Export Tool again.

Note that the maximum number of retries can be changed by the **`retry`** subcommand. For details about the **`retry`** subcommand, see retry (on page 99) .

When Export Tool processing is completed, the directories and files created by Export Tool are deleted automatically. If Export processing stops abnormally, the following directories and files are not deleted:

(VSP G1x00 and VSP F1500)

```
export/lib/SVP-value
JSanExport.jar
JSanRmiApiEx.jar
JSanRmiApiSx.jar
JSanRmiServerEx.jar
JSanRmiServerSx.jar
JSanRmiServerUx.jar
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
export/lib/ip-value
JSanExport.jar
JSanRmiApiSx.jar
```

```
JSanRmiServerUx.jar
SanRmiApi.jar
```

To delete the remaining directories and files, run a batch file. If your computer runs Windows, run `delWin.bat`. If your computer runs UNIX, use `delUnix.bat`.

Caution: Do not run `delWin.bat` or `delUnix.bat` while obtaining monitoring data by running Export Tool.

Note: If you change the ip value (VSP Gx00, VSP Fx00, and VSP Nx00) or svpip value (VSP G1x00 and VSP F1500) in `command.txt` before running `delWin.bat` or `delUnix.bat`, the directories and files created by Export Tool are not deleted. In this case, delete them manually in the lib directory.

Note: You can change the default method of exporting files to an uncompressed format. However, the resulting files could be significantly larger and take longer to compile. For more information, see option (on page 133).

For a complete list of files to be saved by Export Tool, see Using Export Tool (on page 76).

File formats

If you specify the `nocompress` operand for the **`option`** subcommand, Export Tool saves files in CSV format instead of ZIP format (For detailed information, see option (on page 133).) When files are saved in CSV format instead of ZIP format, the file saving process could take longer and the resulting files could be larger.

Processing time

Files saved by Export Tool are often very large. The total file size can be as large as 2 GB. Therefore, you might need a lot of time to complete the exporting process. If you want to export statistics spanning a long period of time, you should run Export Tool multiple times for shorter periods, rather than run it one time to export the entire time span as a single large file. For example, if you want to export statistics spanning 24 hours, run the tool eight times to export statistics in three-hour increments.

The following table provides lists time estimates for exporting monitoring data files using different operands in the **`group`** subcommand.

Operand for the group subcommand	Estimated time	Description
Port	5 minutes	This estimate assumes that Export Tool is saving 24 hours of statistics for 128 ports.*

Operand for the group subcommand	Estimated time	Description
PortWWN	5 minutes	This estimate assumes that Export Tool is saving 24 hours of statistics for 128 ports.*
LDEV	60 minutes	This estimate assumes that: ▪ Export Tool is saving 24 hours of statistics for 8,192 volumes.* ▪ Export Tool is used eight times. Each time Export Tool is used, the tool obtains statistics for a 3-hour period.
LU	60 minutes	This estimate assumes that: ▪ Export Tool is saving 24 hours of statistics for 12,288 LUs.* ▪ Export Tool is used eight times. Each time Export Tool is used, the tool obtains statistics for a 3-hour period.
* For a 1-minute interval, the number of hours for the data that is stored is proportional to the interval. For example, for a 2-minute interval, data for 48 hours can be stored. **Note:** ▪ The estimated time that includes the transfer time of the network might take a lot of time, depending on the transmission speed of the network. ▪ To shorten the acquisition time, specify the option of the **group** command to narrow acquisition objects. For details about the **group** command, see group (on page 102) .		

Termination code

If you want to use a reference to a termination code in your batch file, perform the following actions:

- To use such a reference in a Windows batch file, write %**errorlevel**% in the batch file.
- To use such a reference in a UNIX Bourne shell script, write $? in the shell script.
- To use such a reference in a UNIX C shell script, write $**status** in the shell script.

A reference to a termination code is used in the following example of a Windows batch file. If this batch file runs and Export Tool returns the termination code 1 or 3, the command prompt displays a message that indicates the **set** subcommand fails.

```
java -classpath "./lib/JSanExportLoader.jar"
-Del.tool.Xmx=536870912 -Dmd.command=command.txt
-Dmd.logpath=log sanproject.getexptool.RJElMain<CR+LF>
if %errorlevel%==1 echo THE SET SUBCOMMAND FAILED<CR+LF>
if %errorlevel%==3 echo THE SET SUBCOMMAND FAILED<CR+LF>
pause<CR+LF>
```

In the previous script, <CR+LF> indicates the end of a command line.

Log files

When Export Tool runs, it creates a log file on your computer. Therefore, if you run Export Tool repeatedly, the size of free space on your computer will be reduced. To secure free space on your computer, it is important that you delete log files regularly. For information about the directory containing log files, see Java (on page 137) .

Export Tool returns a termination code when Export Tool finishes as listed in the following table:

Termination code	Description
0	Export Tool finished successfully.
1	An error occurred when the **set** subcommand (see set (on page 135)) is run, because an attempt to switch to Modify mode failed. Some other user might have been logged on in Modify mode.
2	Export Tool stops. The following are possible causes: ▪ A command file has been corrupted or could not be read. ▪ An error occurred when a command was parsed. ▪ Maintenance or a configuration change is performed on the SVP. For details about isolating other causes of stops, see Troubleshooting Export Tool for Performance Monitor (on page 247) .
3	An error occurred due to more than one reason. For example, an attempt to switch to Modify mode failed when the **set** subcommand (see set (on page 135)) is run. Some other user might have been logged on in Modify mode.
4	The Storage Administrator (Performance Management) role is not assigned to the user ID.

Termination code	Description
101	An error occurred during the preparation process for running Export Tool. For details on the error, see the displayed message and the table in Messages issued by Export Tool (on page 250) .

Error handling

When an internal error occurs during export processing, an exclamation mark (!) indicates the error. By default, Export Tool makes up to three more attempts at processing. You can change the maximum number of retries by using the **`retry`** subcommand. For detailed information about the **`retry`** subcommand, see retry (on page 99) .

If export processing does not finish within three retries or if an internal error occurs other than those listed in the following table, Export Tool stops. If Export Tool stops, quit the command prompt, and then run the tool again.

For more information, see Troubleshooting Export Tool for Performance Monitor (on page 247) .

Errors returned by Export Tool

Error message ID	Description
0001 1001	A timeout error occurred.
0001 4001	An error occurred during the SVP processing.
0001 5400	Because the SVP is busy, the monitoring data cannot be obtained.
0001 5508	An administrator is changing a system environment file.
0002 2016	The array is refreshing, or the settings by the user are registered.
0002 5510	The storage system is in internal process, or some other user is changing configuration.
0002 6502	Now processing.
0002 9000	Another user has locked the file.
0003 2016	A service engineer is accessing the storage system in Modify mode.
0003 2033	The SVP is not ready yet, or an internal processing is being run.
0003 3006	An error occurred during the SVP processing.
0405 6012	An error occurred during the SVP processing.
0405 8003	The storage system status is invalid.

Error message ID	Description
5205 2003	An internal process is being run, or maintenance is in progress.
5205 2033	The SVP is updating the statistics data.
5305 2033	The SVP is updating the statistics data.
5305 8002	The storage system status is invalid.

Export Tool command reference

This section provides the syntax of the Export Tool subcommands that you can write in your command file and the command that you should use in your batch file. Subcommand list (on page 95) lists and provides links to the subcommands explained in this section. The Java command is explained in Java (on page 137) .

Export Tool command syntax

This section explains the syntax of the Export Tool subcommands that you can write in your command file. This section also explains the syntax of the Java command that you should use in your batch file.

- Conventions (on page 93)
- Syntax descriptions (on page 94)
- Writing a script in the command file (on page 95)
- Viewing the online help for subcommands (on page 95)

Conventions

Convention	Description
bold	Indicates characters that you must type exactly as they are shown.
italics	Indicates a type of an operand. You do not need to type characters in italics exactly as they are shown.
[ ]	Indicates one or more operands that you can omit. If two or more operands are enclosed by these square brackets and are delimited by vertical bars (|), you can select one of the operands.

Convention	Description
{ }	Indicates that you must select one operand from the operands enclosed by the braces. Two or more operands are enclosed by the braces and are delimited by vertical bars (|).
...	Indicates that a previously used operand can be repeated.
|	Vertical bar delimiter, indicating you can select one of the operands enclosed in square brackets.

Syntax descriptions

This syntax...	Indicates you can write this script...
connect *ip-address*	connect 123.01.22.33
destination [*directory*]	destination destination c:\temp
compress [yes|no]	compress compress yes compress no
answer {yes|no}	answer yes answer no
ports [*name*][...]	ports ports port-1 ports port-1 port-2

Writing a script in the command file

When you write a script in your command file, be aware of the following:

- Ensure that only one subcommand is used in one line.
- Empty lines in any command file will be ignored.
- Use a semicolon (;) if you want to insert a comment in your command file. If you enter a semicolon in one line, the remaining characters in that line will be regarded as a comment.

  Following are examples of comments in a command file:

  (VSP G1x00 and VSP F1500)

```
;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;    COMMAND FILE: command.txt    ;;;;
;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;
svpip 158.214.135.57         ; IP address of the SVP
login expusr "passwd"        ; Log onto the SVP
```

  (VSP Gx00, VSP Fx00, and VSP Nx00)

```
;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;    COMMAND FILE: command.txt    ;;;;
;;;;;;;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;
ip 158.214.135.57:51990      ; IP address of the SVP
dkcsn 123456                 ; Serial No of the DKC
login expusr "passwd"        ; Log into the SVP
```

Viewing the online help for subcommands

You can display the online help to view the syntax of subcommands when you are working at the command prompt. To be able to view the online help, you must use the **`help`** subcommand of Export Tool. For more information about how to use the **`help`** subcommand, see help (on page 137) .

Subcommand list

Subcommand	Function
svpip (VSP G1x00 and VSP F1500) (on page 97) (VSP G1x00 and VSP F1500) ip (VSP Gx00, Nx00, and VSP Fx00 models) (on page 96) (VSP Gx00, VSP Fx00, and VSP Nx00)	Specifies the IP address of SVP to be logged in.

Subcommand	Function
dkcsn (VSP Gx00, Nx00, and VSP Fx00 models) (on page 98) (VSP Gx00, VSP Fx00, and VSP Nx00)	Specifies the serial number of the system which will be used for monitoring data.
retry (on page 99)	Makes settings on retries of export processing.
login (on page 100)	Logs the specified user into SVP.
show (on page 101)	Checks SVP to find the period of monitoring data stored in SVP and the data collection interval (sampling interval), and then outputs them to the standard output and the log file.
group (on page 102)	Specifies the type of data that you want to export.
range (VSP Gx00, Nx00, and VSP Fx00 models) (on page 129) (VSP Gx00, VSP Fx00, and VSP Nx00)	Specifies the term of monitoring data to be exported.
shortrange (VSP G1x00 and VSP F1500) (on page 124) (VSP G1x00 and VSP F1500)	Specifies the term of monitoring data to be exported for short-range monitoring data.
longrange (VSP G1x00 and VSP F1500) (on page 127) (VSP G1x00 and VSP F1500)	Specifies the term of monitoring data to be exported for long-range monitoring data.
outpath (on page 132)	Specifies the directory in which files should be saved.
option (on page 133)	Specifies whether to save files in ZIP format or in CSV format.
apply (on page 134)	Saves monitoring data in files.
set (on page 135)	Starts or ends monitoring of the storage system, and specifies the sampling interval.
help (on page 137)	Displays the online help for subcommands.
Java (on page 137)	Starts Export Tool and writes monitoring data into files.

ip (VSP Gx00, VSP Fx00, and VSP Nx00)

Description

This subcommand specifies the IP address or the host name of the SVP and the connection port number (the port number of RMIIFRegist). For settings that are affected by changes of port numbers for the SVP, see the *System Administrator Guide*

Syntax

ip {*ip-address*|*host-name*}[:*port-no*]

Operands

Operand	Description
ip-address	Specifies the IP address of SVP. If SVP is managed with IPv6 (Internet Protocol Version 6), you must specify the *IP-address* operand to match the format of IPv6.
host-name	Specifies the host name of SVP. Alphanumeric characters, hyphen, and period can be specified. Underscore (_) cannot be specified. The host name can include a hyphen but must be enclosed by double quotation marks (").
port-no	Specifies the port number of RMIIFRegist for the SVP. Only a number can be specified as a port number. Connect using 1099 when not specifying the port number.

Example

The following example specifies the IP address of the SVP in IPv4 as 158.214.127.170 and the port number as 1099.

```
ip 158.214.127.170:1099
```

The following example specifies the IP address of the SVP in IPv6 as 2001:0DB8:0:CD30:123:4567:89AB:CDEF and the port number as 1099.

```
ip [2001:0DB8:0:CD30:123:4567:89AB:CDEF]:1099
```

svpip (VSP G1x00 and VSP F1500)

Description

This subcommand specifies the IP address or the host name of SVP.

Syntax

svpip {*ip-address*|*host-name*}

Operands

Operand	Description
ip-address	Specifies the IP address of SVP. If SVP is managed with IPv6 (Internet Protocol Version 6), you must specify the *IP-address* operand to match the format of IPv6. If Export Tool runs on Windows XP, the interface identifier (for example, "%5") must be added to the end of the specified IP address.
host-name	Specifies the host name of SVP. Alphanumeric characters, hyphen, and period can be specified. Underscore (_) cannot be specified. The host name can include a hyphen but must be enclosed by double quotation marks (").

Example

The following example specifies the IP address of SVP as 158.214.127.170.

```
svpip 158.214.127.170
```

dkcsn (VSP Gx00, VSP Fx00, and VSP Nx00)

Description

This subcommand specifies the serial number of the system which you use for monitoring data.

Syntax

dkcsn *serial-no*

Operands

Operand	Description
serial-no	Specifies the serial number of the system from which to take monitoring data.

Example

The following example specifies the serial number of the system as 123456.

```
dkcsn 123456
```

retry

Description

This subcommand makes settings on retries of export processing.

When an internal error occurs during export processing, Export Tool stops processing and then retries export processing. By default, Export Tool can retry processing up to three times, but you can change the maximum number of retries by using the **retry** subcommand.

By default, the interval between one retry and the next retry is two minutes. You can change the interval by using the **retry** subcommand.

The **retry** subcommand must run before the **login** subcommand runs.

Syntax

retry [**time=***m*] [**count=***n*]

Operands

Operand	Description
time=*m*	Specifies the interval between retries in minutes, where m is a value within the range of 1 to 59. If this operand is omitted, the interval between retries is two minutes.
count=*n*	Specifies the maximum number of retries. If n is 0, the number of retries is unlimited. If this operand is omitted, the maximum number of retries is 3.

Example

If the following command file is used, the interval between retries is 5 minutes and the maximum number of retries is 10.

(VSP G1x00 and VSP F1500)

```
svpip 158.214.135.57
retry time=5 count=10
login expusr passwd
show
group Port
short-range 201304010850:201304010910
outpath
outoption compress
apply
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
ip 158.214.135.57
dkcsn 123456
retry time=5 count=10
login expusr passwd
show
group Port
range 200604010850:200604010910
outpath out
option compress
apply
```

login

Description

This subcommand uses a user ID and a password to log the specified user in to the storage system.

(VSP G1x00 and VSP F1500) The **`svpip`** subcommand must run before the **`login`** subcommand runs.

(VSP Gx00, VSP Fx00, and VSP Nx00) The **`ip`** subcommand must specify the SVP which manages the storage system to log into before the **`login`** subcommand runs.

The **`login`** subcommand fails if monitoring data does not exist in SVP.

Syntax

`login` *userid password*

Operands

Operand	Description
userid	(VSP G1x00 and VSP F1500) Specifies the user ID for SVP. (VSP Gx00, VSP Fx00, and VSP Nx00) Speci ies the exclusive user ID for Export Tool. If the user ID includes any non-alphanumeric character, the user ID must be enclosed by double quotation marks ("). Be sure to specify a user ID that is used exclusively with Export Tool. For detailed information, see Requirements for Export Tool (on page 73).
password	(VSP G1x00 and VSP F1500) Speci ies the password of the user. (VSP Gx00, VSP Fx00, and VSP Nx00) Speci ies the exclusive password of the user for Export Tool.

Operand	Description
	If the password includes any non-alphanumeric character, the password ID must be enclosed by double quotation marks (").

Example

This example logs the user **expusr** into the storage system connected to the SVP whose IP address is 158.214.127.170. The password is **pswd**.

(VSP G1x00 and VSP F1500)

```
svpip 158.214.127.170 login expuser pswd
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
ip 158.214.127.170 login expuser pswd
```

show

Description

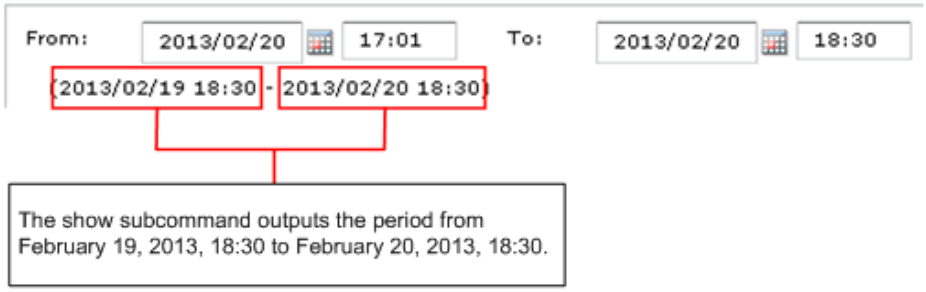
This subcommand outputs the following information to the standard output (for example, to the command prompt):

- The period during which monitoring data was collected onto SVP (storing period).
- The interval at which the monitoring data was collected (sampling interval).

(VSP G1x00 and VSP F1500) Performance Monitor collects statistics by the two types of storing periods: in short range and in long range. In short-range monitoring, the monitoring data between 1 day and 15 days is stored in SVP, and in long-range monitoring the monitoring data up to 6 months is stored in SVP. For details about the two storing periods, see shortrange (VSP G1x00 and VSP F1500) (on page 124) and longrange (VSP G1x00 and VSP F1500) (on page 127).

(VSP Gx00, VSP Fx00, and VSP Nx00) Performance Monitor collects data between 1 and 15 days in the SVP.

Storing periods output by the **show** subcommand are the same as the information displayed in the Monitoring Term area of the **Monitor Performance** window.



You need to log into the SVP or storage system with the **login** subcommand before the **show** subcommand runs.

Syntax

show

Output (VSP G1x00 and VSP F1500)

The **show** subcommand displays the storing period and the sampling interval for these two types of monitoring data: in short range and in long range. For example, the **show** subcommand outputs the following information:

```
Short Range     From: 2013/05/01 01:00  -  To: 2013/05/01 15:00
 Interval: 1min.
Long Range      From: 2013/04/01 00:00  -  To: 2013/05/01 15:00
 Interval: 15min.
```

`Short Range` indicates the storing period and sampling interval of the monitoring data stored in short range. `Long Range` indicates those of the monitoring data stored in long range. When you run Export Tool, you can export the monitoring data within these periods into files. If you use the **shortrange** or **longrange** subcommand additionally, you can narrow the term of data to be exported (see shortrange (VSP G1x00 and VSP F1500) (on page 124) or longrange (VSP G1x00 and VSP F1500) (on page 127)).

`From` indicates the starting time for collecting monitoring data. `To` indicates the ending time for collecting monitoring data.

`Interval` indicates the interval at which the monitoring data was collected (sampling interval). For example, `Interval 15min.` indicates that monitoring data was collected at 15-minute intervals.

Output (VSP Gx00, VSP Fx00, and VSP Nx00)

The **show** subcommand displays the storing period and the sampling interval for the monitoring data. For example, the **show** subcommand outputs the following information:

```
Range     From: 2006/10/01 01:00  -  To: 2006/10/01 15:00
 Interval: 1min.
```

`From` indicates the starting time for collecting monitoring data. `To` indicates the ending time for collecting monitoring data.

`Interval` indicates the interval at which the monitoring data was collected (sampling interval). For example, `Interval 15min.` indicates that monitoring data was collected at 15-minute intervals.

group

Description

The **group** subcommand specifies the type of monitoring data that you want to export. This command uses an operand (for example, `PhyPG` and `PhyLDEV` above) to specify a type of monitoring data.

The following table shows the monitoring data that can be saved into files by each operand, and the saved ZIP files. For details on the monitoring data saved in these files, see the tables listed in the See column.

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
PhyPG	Select Parity Groups from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about parity groups	PhyPG_dat.ZIP [1]	Resource usage and write-pending rate statistics (on page 143)
PhyLDEV	Select Logical Device/Base from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about volumes	PhyLDEV_dat.ZIP [1]	
PhyExG		Usage conditions about external volume groups	PhyExG_dat.ZIP	
PhyExLDEV		Usage conditions about external volumes	PhyExLDEV_dat/PHY_ExLDEV_XXXX.ZIP [2]	
PhyProc	Select Controller from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about MPs and data recovery and reconstruction processors	PhyProc_dat.ZIP [1]	
PhyCMPK (VSP G1x00 and VSP F1500) PhyMPU (VSP Gx00, Nx00, and VSP Fx00 models)	Select Access Path from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about the following: ▪ write pending rate ▪ cache ▪ (VSP G1x00 and VSP F1500) access paths	PhyCMPK_dat.ZIP [1] (VSP G1x00 and VSP F1500) PhyMPU_dat.ZIP (VSP Gx00, VSP Fx00, and VSP Nx00)	

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
PG	Select Parity Group from Object list in Performance Objects field in Monitor Performance window.	Statistics about parity groups, external volume groups	PG_dat.ZIP	Parity group and external volume group statistics (on page 146)
LDEV	Select Logical Device from Object list in Performance Objects field in Monitor Performance window.	Statistics about volumes in parity groups, in external volume groups	LDEV_dat/ LDEV_XXXXX.ZIP[3]	Statistics for volumes in parity/ external volume groups (on page 148)
LDEVEach OfCU	Select Logical Device/Base from Object list in Performance Objects field in Monitor Performance window.	Statistics about volumes in parity groups or in external volume groups (for volumes controlled by a particular CU)	LDEVEachOfCU_dat/LDEV_XXXXX.ZIP [3]	Volumes in parity groups or external volume groups (at volumes controlled by a particular CU) (on page 150)
Port	Select Fibre Port from Object list in Performance Objects field in Monitor Performance window.	Statistics about ports	Port_dat.ZIP	Port statistics (on page 153)
MFPort (VSP G1x00 and VSP F1500)	Select Fibre Port from Object list in Performance Objects field in Monitor Performance window.	Mainframe fibre ports	MF_Port_dat.ZIP	Port statistics (on page 153)

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
PortWWN	Select WWN from Object list in Performance Objects field in Monitor Performance window.	Statistics about host bus adapters connected to ports	PortWWN_dat.ZIP	Host bus adapters connected to ports statistics (on page 154)
LU	Select LUN/Base from Object list in Performance Objects field in Monitor Performance window.	Statistics about LUs	LU_dat.ZIP	Volumes (LU) statistics (on page 154)
PPCGWWN	Select WWN from Object list in Performance Objects field in Monitor Performance window.	All host bus adapters that are connected to ports	PPCGWWN_dat.ZIP	All host bus adapters connected to ports (on page 156)
RemoteCopy	Select Entire Storage System TC/TCMF/GAD from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by TrueCopy and TrueCopy for Mainframe and monitoring data by global-active device (in complete volumes)	RemoteCopy_dat.ZIP	Remote copy operations by TC/TCz and monitoring data by GAD (whole volumes) (on page 157)

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
RCLU	Select LUN TC/GAD from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by TrueCopy and monitoring data by global-active device (for each volume (LU)). (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume.	RCLU_dat.ZIP	Remote copy operations by TC and monitoring data by GAD (for each volume (LU)) (on page 158)
RCLDEV	Select Logical Device TC/ TCMF/GAD from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by TrueCopy and TrueCopy for Mainframe and monitoring data by global-active device (for volumes controlled by a particular CU)	RCLDEV_dat/ RCLDEV_XXXXX.ZIP [4]	Remote copy by TC/TCz and monitoring data by GAD (volumes controlled by a particular CU) (on page 159)
Universal Replicator	Select Entire Storage System UR/URMF from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by Universal Replicator and Universal Replicator for Mainframe (for entire volumes)	UniversalReplicator.ZIP	Remote copy by UR and URz (whole volumes) (on page 161)
URJNL	Select Journal from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by Universal Replicator and Universal Replicator for Mainframe (for journals)	URJNL_dat.ZIP	Remote copy by UR and URz (at journals) (on page 161)

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
URLU	Select LUN from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by Universal Replicator (for each volume (LU)). (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume.	URLU_dat.ZIP	Remote copy by UR (for each volume (LU)) (on page 163)
URLDEV	Select Logical Device UR/URMF from Object list in Performance Objects field in Monitor Performance window	Statistics about remote copy operations by Universal Replicator and Universal Replicator for Mainframe (for volumes controlled by a particular CU)	URLDEV_dat/ URLDEV_XXXXX.ZIP [5]	Remote copy by UR and URz (at volumes controlled by a particular CU) (on page 164)
PhyMPPK	Select MPPK from Object list in Performance Objects field in Monitor Performance window.	MP usage rate of each resource allocated to MP blade or unit	PhyMPPK_dat.ZIP	MP blades (VSP G1x00 and VSP F1500) (on page 156)

Notes:

1. (VSP G1x00 and VSP F1500) When you specify the `PhyPG`, `PhyLDEV`, `PhyProc`, or `PhyCMPK` operand, you can select the storing period of the monitoring data to be exported from short range or long range. When you specify other operands, the monitoring data in short range is exported.
2. A ZIP file name beginning with `PhyExLDEV_`.
3. A ZIP file name beginning with `LDEV_`.
4. A ZIP file name beginning with `RCLDEV_`.
5. A ZIP file name beginning with `URLDEV_`.

You can use the group subcommand more than one time in a command file. For example, you can write the following script:

```
group PortWWN CL1-A:CL1-B
group RemoteCopy
```

If an operand is used more than one time in a command file, the last operand takes effect. In the example below, the first **group** subcommand does not take effect, but the second **group** subcommand takes effect:

```
group PortWWN CL1-A:CL1-B
group PortWWN CL2-A:CL2-B
```

Syntax

(VSP G1x00 and VSP F1500)

```
group {PhyPG [Short|Long] [parity-group-id]:[parity-group-id]][ …]|
        PhyLDEV [Short|Long] [parity-group-id]:[parity-group-id]][ …]|
        PhyExG [[exg-id]:[exg-id]][ …]|
        PhyExLDEV [exg-id]:[exg-id]][ …]|
        PhyProc [Short|Long]|
     PhyCMPK [Short|Long]|
        PG [[parity-group-id|exg-id|Migration-Volume-group-id]:
        [parity-group-id|exg-id|Migration-Volume-group-id]][ …]|
        LDEV [[[parity-group-id|exg-id|Migration-Volume-group-id]:
        [parity-group-id|exg-id|Migration-Volume-group-id]][.…]|
     LDEVEachOfCU[[[LDKC-CU-id]:[LDKC-CU-
id]][ …]|internal|virtual]|
internal|virtual]|
     Port [[port-name]:[port-name]][...]|
     MFPort [[port-name]:[port-name]][...]|
     PortWWN [port-name]:[port-name]][...]|
     LU[[port-name.host-group-id]:[port-name.host-group-id]][ …]|
     PPCGWWN[[monitor-target-name:monitor-target-name]][ …]|
     RemoteCopy|
     RCLU [[port-name.host-group-id]:[port-name.host-group-id]][ …]|
     RCLDEV[[LDKC-CU-id]:[LDKC-CU-id]][ …]|
     UniversalReplicator |
     URJNL[[JNL-group-id]:[JNL-group-id]][ …]|
     URLU [[port-name.host-group-id]:[port-name.host-group-id]][ …]|
     URLDEV[[LDKC-CU-id]:[LDKC-CU-id]][ …]|
        PhyMPPK
        }
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
group {PhyPG[parity-group-id]:[parity-group-id]][ …]|
        PhyLDEV  [parity-group-id]:[parity-group-id]][ …]|
```

```
        PhyExG [[exg-id]:[exg-id]][ …]|
        PhyExLDEV [exg-id]:[exg-id]][ …]|
        PhyProc |
             PG [[parity-group-id|exg-id]:
        [parity-group-id|exg-id]][ …]|
        LDEV [[[parity-group-id|exg-id]:
        [parity-group-id|exg-id]][ …]|
     LDEVEachOfCU[[[LDKC-CU-id]:[LDKC-CU-id]][ …]|internal|virtual]|
internal|virtual]|
     Port [[port-name]:[port-name]][ …]|
     PortWWN [port-name]:[port-name]][ …]|
     LU[[port-name.host-group-id]:
     [port-name.host-group-id]][ …]|
     PPCGWWN[[monitor-target-name:monitor-target-name]][ …]|
     RemoteCopy|
     RCLU [[port-name.host-group-id]:
     [port-name.host-group-id]][ …]|
     RCLDEV[[LDKC-CU-id]:[LDKC-CU-id]][ …]|
     UniversalReplicator |
     URJNL[[JNL-group-id]:[JNL-group-id]][ …]|
     URLU [[port-name.host-group-id]:
     [port-name.host-group-id]][ …]|
     URLDEV [[LDKC-CU-id]:[LDKC-CU-id]][ …]|
        }
```

Operands

Operand	Description
PhyPG [**Short**|**Long**] [[*parity-group-id*]:[*parity-group-id*]][...] (VSP G1x00 and VSP F1500) **PhyPG** [[*parity-group-id*]:[*parity-group-id*]][...] (VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand to export statistics about parity group usage rates, which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PhyPG_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). (VSP G1x00 and VSP F1500) You can use the `Short` or `Long` option to select the storing period of the monitoring data to be exported. If you specify `Short`, the exported file will contain statistics in a short range for up to 15 days. If you specify `Long`, the exported file will contain statistics in a long range for up to six months (for example, up to 186 days). If neither `Short` nor `Long` is specified, statistics in both the short and long range are exported. (VSP Gx00, VSP Fx00, and VSP Nx00) The exported ile will contain statistics for up to 15 days.

Operand	Description
	When you specify variable *parity-group-id*, you can narrow the range of parity groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. Ensure that the *parity-group-id* value on the left of the colon is smaller than the *parity-group-id* value on the right of the colon. For example, you can specify `PhyPG 1-1:1-5`, but you cannot specify `PhyPG 1-5:1-1`. Also, you can specify `PhyPG 1-5:2-1`, but you cannot specify `PhyPG 2-1:1-5`. If the parity group ID is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the parity group ID is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified parity group ID is selected. If *parity-group-id* is not specified, the monitoring data of all parity groups will be exported.
PhyLDEV [**Short**|**Long**] [[*parity-group-id*]:[*parity-group-id*]][...] (VSP G1x00 and VSP F1500) **PhyLDEV** [[*parity-group-id*]:*[parity-group-id*]][...] (VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand when you want to export statistics about volume usage rates, which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PhyLDEV_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). (VSP G1x00 and VSP F1500) You can use the `Short` or `Long` option to select the storing period of the monitoring data to be exported. If you specify `Short`, the exported file will contain statistics in short range for up to 15 days. If you specify `Long`, the exported file will contain statistics in long range for up to six months (for example, up to 186 days). If neither `Short` nor `Long` is specified, statistics in both the short and long range are exported. (VSP Gx00, VSP Fx00, and VSP Nx00) The exported ile will contain statistics for up to 15 days. When you specify variable *parity-group-id*, you can narrow the range of parity groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. Ensure that the *parity-group-id* value on the left of the colon is smaller than the *parity-group-id* value on the right of the colon. For example, you can specify `PhyLDEV 1-1:1-5`, but you cannot specify `PhyLDEV 1-5:1-1`. Also, you can specify `PhyLDEV 1-5:2-1`, but you cannot specify `PhyLDEV 2-1:1-5`.

Operand	Description
	If the parity group ID is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the parity group ID is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified parity group ID is selected. If *parity-group-id* is not specified, the monitoring data of all volumes will be exported.
PhyExG [[*exg-id*]:[*exg-id*]][...]	Use this operand when you want to export statistics about external volume groups, which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PhyExG_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). When you specify variable *exg-id*, you can narrow the range of external volume groups whose monitoring data are to be exported. *exg-id* is an ID of an external volume group. The colon (:) indicates a range. For example, `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. Ensure that the *exg-id* value on the left of the colon is smaller than the *exg-id* value on the right of the colon. For example, you can specify `PhyExG E1-1:E1-5`, but you cannot specify `PhyExG E1-5:E1-1`. Also, you can specify `PhyExG E1-5:E2-1`, but you cannot specify `PhyExG E2-1:E1-5`. If *exg-id* is not specified, the monitoring data of all external volume groups will be exported.
PhyExLDEV [[*exg-id*]:[*exg-id*]][...]	Use this operand when you want to export statistics about volumes in external volume groups, which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PhyExLDEV_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). When you specify variable *exg-id*, you can narrow the range of external volume groups whose monitoring data are to be exported. *exg-id* is an ID of an external volume group. The colon (:) indicates a range. For example, `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. Ensure that the *exg-id* value on the left of the colon is smaller than the *exg-id* value on the right of the colon. For example, you can specify `PhyExLDEV E1-1:E1-5`, but you cannot specify `PhyExLDEV E1-5:E1-1`. Also, you can specify `PhyExLDEV E1-5:E2-1`, but you cannot specify `PhyExLDEV E2-1:E1-5`.

Operand	Description
	If *exg-id* is not specified, the monitoring data of all external volumes will be exported.
PhyProc [**Short**|**Long**] (VSP G1x00 and VSP F1500) **PhyProc** (VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand when you want to export the following statistics, which are displayed in the **Monitor Performance** window: ▪ Usage rates of MPs ▪ (VSP G1x00 and VSP F1500) Usage rates of DRRs (data recovery and reconstruction processors) When statistics are exported to a ZIP file, the file name will be `PhyProc_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). (VSP G1x00 and VSP F1500) You can use the `Short` or `Long` option to select the storing period of the monitoring data to be exported. If you specify `Short`, the exported file will contain statistics in short range for up to 15 days. If you specify `Long`, the exported file will contain statistics in long range for up to six months (for example, up to 186 days). If neither `Short` nor `Long` is specified, statistics in both the short and long range are exported. (VSP Gx00, VSP Fx00, and VSP Nx00) The exported ile will contain statistics for up to 15 days.
PhyCMPK [**Short**|**Long**] (VSP G1x00 and VSP F1500)	Use this operand when you want to export the following statistics, which are displayed in the **Monitor Performance**window: ▪ Usage rates of access paths between channel adapters and cache memories ▪ Usage rates of access paths between disk adapters and cache memories ▪ Usage rates of access paths between MP blades and cache switches ▪ Usage rates of access paths between cache switches and cache memories ▪ Usage rates of cache memories ▪ Size of the allocated cache memories When statistics are exported to a ZIP file, the file name will be `PhyCMPK_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143).

Operand	Description
	You can use the `Short` or `Long` option to select the storing period of the monitoring data to be exported. If you specify `Short`, the exported file will contain statistics in short range for up to 15 days. If you specify `Long`, the exported file will contain statistics in long range for up to six months (for example, up to 186 days). If neither `Short` nor `Long` is specified, statistics in both the short and long range are exported.
PhyMPU (VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand when you want to save the following information displayed in the **Monitor Performance** window to a file: ▪ Cache memory usage statistics ▪ Amount of allocated cache memory ▪ Write pending rate When statistics are exported to a ZIP file, the file name will be `PhyMPU_dat.zip`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). The exported file will contain statistics for up to 15 days.
PG [[*parity-group-id*|*exg-id*|*Migration-Volume-group-id*]: [*parity-group-id*|*exg-id*|*Migration-Volume-group-id*]][...] (VSP G1x00 and VSP F1500)	Use this operand when you want to export statistics about parity groups, external volume groups, or migration volume groups which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PG_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143). When you specify variables *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* you can narrow the range of parity groups, external volume groups, or migration volume groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. *exg-id* is an ID of an external volume group. *Migration-Volume-group-id* is a migration volume group ID. You can check to which group each LDEV belongs in the **Logical Devices** window. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. M1-1:M5-1 indicates migration volume groups from M1-1 to M5-1. Ensure that the *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* value on the left of the colon is smaller than the *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* value on the right of the colon. For example, you can specify `PG 1-1:1-5`, but you cannot specify `PG 1-5:1-1`. Also, you can specify `PG 1-5:2-1`, but you cannot specify `PG 2-1:1-5`.

Operand	Description
	If the parity group ID is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the parity group ID is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified parity group ID is selected. If none of *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* are specified, the statistics of all parity groups, external volume groups, and migration volume groups will be exported.
PG [[*parity-group-id*|*exg-id*]: [*parity-group-id*|*exg-id*][...](VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand when you want to export statistics about parity groups or external volume groups which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, the file name will be `PG_dat.ZIP`. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 143) . When you specify variables *parity-group-id*, or *exg-id* you can narrow the range of parity groups, or external volume groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. *exg-id* is an ID of an external volume group. You can check to which group each LDEV belongs in the **Logical Devices** window. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. Ensure that the *parity-group-id*, or *exg-id* value on the left of the colon is smaller than the *parity-group-id*, or *exg-id* value on the right of the colon. For example, you can specify `PG 1-1:1-5`, but you cannot specify `PG 1-5:1-1`. Also, you can specify `PG 1-5:2-1`, but you cannot specify `PG 2-1:1-5`. If the parity group ID is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the parity group ID is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified parity group ID is selected. If neither *parity-group-id*, nor *exg-id* is specified, the statistics of all parity groups and external volume groups will be exported.

Operand	Description
LDEV [[[*parity-group-id*|*exg-id*|*Migration-Volume-group-id*]: [*parity-group-id*|*exg-id*|*Migration-Volume-group-id*]][...] | internal| virtual]| (VSP G1x00 and VSP F1500)	Use this operand when you want to export statistics about volumes, which are displayed in the Monitor Performance window. When statistics are exported to a ZIP file, multiple ZIP files whose names are beginning with `LDEV_` will be output. For details on the statistics exported by this operand, see Port statistics (on page 153). When you specify variables *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* you can narrow the range of parity groups, external volume groups, or migration volume groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. *exg-id* is an ID of an external volume group. *Migration-volume-group-id* is a migration volume group ID. You can check to which group each LDEV belongs in the Logical Devices window. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. M1-1:M5-1 indicates migration volume groups from M1-1 to M5-1. Ensure that the *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* value on the left of the colon is smaller than the *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* value on the right of the colon. For example, you can specify `LDEV 1-1:1-5`, but you cannot specify `LDEV 1-5:1-1`. Also, you can specify `LDEV 1-5:2-1`, but you cannot specify `LDEV 2-1:1-5`. If the parity group ID is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the parity group ID is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified parity group ID is selected. If internal is specified, you can save statistics about volumes in the parity group. If virtual is specified, you can save statistics about volumes in the external volume group or migration volume group. If none of *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* are specified, the statistics of all parity groups, external volume groups, and migration volume groups will be saved to a file. If none of *parity-group-id*, *exg-id*, *Migration-Volume-group-id*, *internal*, or *virtual* is specified as the LDEV operand, data that can be saved when internal or virtual is specified is saved. One of the following values can be specified: ▪ *parity-group-id*, *exg-id*, or *Migration-Volume-group-id* ▪ internal ▪ virtual

Operand	Description
LDEV [[*[parity-group-id*|*exg-id*]: [*parity-group-id*||*exg-id*]][...] | internal| virtual]|(VSP Gx00, VSP Fx00, and VSP Nx00)	Use this operand when you want to export statistics about volumes, which are displayed in the **Monitor Performance** window. When statistics are exported to a ZIP file, multiple ZIP files whose names are beginning with `LDEV_` will be output. For details on the statistics exported by this operand, see Port statistics (on page 153) . When you specify variables *parity-group-id*, or *exg-id* , you can narrow the range of parity groups, or external volume groups whose monitoring data are to be exported. *parity-group-id* is a parity group ID. *exg-id* is an ID of an external volume group. You can check to which group each LDEV belongs in the **Logical Devices** window. The colon (:) indicates a range. For example, `1-1:1-5` indicates parity groups from 1-1 to 1-5. `E1-1:E1-5` indicates external volume groups from E1-1 to E1-5. Ensure that the *parity-group-id*, or *exg-id* value on the left of the colon is smaller than the *parity-group-id*, or *exg-id* value on the right of the colon. For example, you can specify `LDEV 1-1:1-5`, but you cannot specify `LDEV 1-5:1-1`. Also, you can specify `LDEV 1-5:2-1`, but you cannot specify `LDEV 2-1:1-5`. If the *parity-group-id* is specified only on the right of the colon, all the IDs up to the ID specified on the right will be selected. If the *parity-group-id* is specified only on the left of the colon, the ID specified on the left and all the IDs following it will be selected. If the same ID is specified on both the left and right of the colon, only the specified *parity-group-id* is selected. If internal is specified, you can save statistics about volumes in the parity group. If virtual is specified, you can save statistics about volumes in the external volume group. If neither *parity-group-id*, nor *exg-id* is specified, the statistics of all parity groups and external volumes will be saved to a file. If none of *parity-group-id*, *exg-id*, *internal*, or *virtual* is specified as the LDEV operand, data that can be saved when internal or virtual is specified is saved. Either one of the following values can be specified: ▪ *parity-group-id*, or *exg-id* ▪ internal ▪ virtual

Operand	Description
LDEVEachOfCU [[[*LDKC-CU-id*]:[*LDKC-CU-id*]][...] | internal | virtual]	Use this operand when you want to export statistics about volumes which are displayed in the **Monitoring Performance** window. By using this operand, you can export monitoring data about volumes controlled by a particular CU. When statistics are exported to a ZIP file, multiple ZIP files whose names are beginning with `LDEV_` will be output. For details on the statistics exported by this operand, see Volumes in parity groups or external volume groups (at volumes controlled by a particular CU) (on page 150). When you specify variable *LDKC-CU-id*, you can narrow the range of LDKC:CUs that control the volumes whose monitoring data are to be exported. *LDKC-CU-id* is an ID of a LDKC:CU. The colon (:) indicates a range. For example, `000:105` indicates LDKC:CUs from 00:00 to 01:05. Ensure that the *LDKC-CU-id* value on the left of the colon is smaller than the *LDKC-CU-id* value on the right of the colon. For example, you can specify `LDEVEachOfCU 000:105`, but you cannot specify `LDEVEachOfCU 105:000`. If internal is specified, you can export statistics about volumes in the parity group. If virtual is specified, you can export statistics about volumes in the external volume or V-VOL. If none of *LDKC-CU-id*, *internal*, or *virtual* is specified as the `LDEVEachOfCU` operand, data that can be saved when internal or virtual is specified is saved.
Port [[*port-name*]:[*port-name*]][...]	Use this operand when you want to export port statistics, which are displayed in the **Monitor Performance** window. When statistics are exported in a ZIP file, the file name will be `Port_dat.ZIP`. For details on the statistics exported by this operand, see Port statistics (on page 153). When you specify variable *port-name*, you can specify a range of ports for which data is saved using the format *port-name:port-name*. For example, `CL3-a:CL3-c` indicates ports from CL3-a to CL3-c. Ensure that the *port-name* value on the left of the colon is smaller than the *port-name* value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which value is smaller than which value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r For example, you can specify `Port CL1-C:CL2-A`, but you cannot specify `Port CL2-A:CL1-C`. Also, you can specify `Port CL3-a:CL3-c`, but you cannot specify `Port CL3-c:CL3-a`. If *port-name* is not specified, the monitoring data of all ports will be exported.

Operand	Description
MFPort [[*port-name*]:[*port-name*]][...] (VSP G1x00 and VSP F1500)	Use this operand when you want to save monitoring data for mainframe fibre ports displayed on the Performance Monitor window. When statistics are exported to a ZIP file, the file name is `MF_Port_dat.ZIP`. For details on the statistics exported by this operand, see Port statistics (on page 153). When you specify variable *port-name*, you can narrow a range of ports for which data is saved using the format *port-name:port-name*. For example, `CL1-C.01:CL1-C.03` indicates the range from host group #01 of port CL1-C to host group #03 of port CL1-C. Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which *port-name* value is smaller than which *port-name* value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ...<CL4-r For example, you can specify CL1-C:CL2-A, but you cannot specify CL2-A:CL1-C. Also, you can specify CL3-a:CL3-c, but you cannot specify CL3-c:CL3-a. If *port-name* is not specified, the monitoring data of all volumes is exported.
PortWWN [[*port-name*]:[*port-name*]] [...]	Use this operand when you want to export statistics about host bus adapters (WWNs) connected to ports, which are displayed in the **Monitor Performance** window. When statistics are exported in a ZIP file, the file name will be `PortWWN_dat.ZIP`. For details on the statistics exported by this operand, see Port statistics (on page 153). When you specify variable *port-name*, you can narrow a range of ports for which data is saved using the format *port-name:port-name*. For example, `CL3-a:CL3-c` indicates ports from CL3-a to CL3-c. Ensure that the *port-name* value on the left of the colon is smaller than the *port-name* value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which value is smaller than which value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r For example, you can specify `PortWWN CL1-C:CL2-A`, but you cannot specify `PortWWN CL2-A:CL1-C`. Also, you can specify `PortWWN CL3-a:CL3-c`, but you cannot specify `PortWWN CL3-c:CL3-a`. If *port-name* is not specified, the monitoring data of all host bus adapters will be exported.

Operand	Description
LU [[*port-name.host-group-id*]:[*port-name.host-group-id*]][...]	Use this operand when you want to export statistics about LU paths, which are displayed in the **Monitor Performance** window. When statistics are exported in a ZIP file, the file name will be `LU_dat.ZIP`. For details on the statistics exported by this operand, see Volumes (LU) statistics (on page 154). When you specify variable *port-name.host-group-id*, you can narrow the range of LU paths whose monitoring data are to be exported. *port-name* is a port name. *host-group-id* is the ID of a host group (that is, a host storage domain). The host group (host storage domain) ID must be a hexadecimal numeral. The colon (:) indicates a range. For example, `CL1-C.01:CL1-C.03` indicates the range from the host group #01 of the CL1-C port to the host group #03 of the CL1-C port. Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which *port-name* value is smaller than which *port-name* value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r For example, you can specify `LU CL1-C.01:CL2-A.01`, but you cannot specify `LU CL2-A.01:CL1-C.01`. Also, you can specify `LU CL1-C.01:CL1-C.03`, but you cannot specify `LU CL1-C.03:CL1-C.01`. If *port-name.host-group-id* is not specified, the monitoring data of all LU paths will be exported.
PPCGWWN [[*monitor-target-name*]:[*monitor-target-name*]] [...]	Use this operand when you want to export statistics about all host bus adapters connected to ports, which are displayed in the **Monitor Performance** window. When statistics are exported in a ZIP file, the file name will be `PPCGWWN_dat.ZIP`. For details on the statistics exported by this operand, see All host bus adapters connected to ports (on page 156). When you specify variable *monitor-target-name*, you can narrow the range of monitoring target groups whose monitoring data are to be exported. *monitor-target-name* is the name of an monitoring target group. If the name includes any non-alphanumeric character, the name must be enclosed by double quotation marks ("). The colon (:) indicates a range. For example, `Grp01:Grp03` indicates a range of SPM groups from Grp01 to Grp03.

Operand	Description
	Ensure that the *monitor-target-name* value on the left of the colon is smaller than the *monitor-target-name* value on the right of the colon. Numerals are smaller than letters and lowercase letters are smaller than uppercase letters. In the following formulas, values are arranged so that smaller values are on the left and larger values are on the right: ▪ 0 < 1 < 2 < ...< 9 < a < b < ...< z < A < B < ... < Z ▪ cygnus < raid < Cancer < Pisces < RAID < RAID5 If *monitor-target-name* is not specified, the monitoring data of all host bus adapters will be exported.
RemoteCopy	Use this operand when you want to export statistics about remote copy operations of TrueCopy, TrueCopy for Mainframe, and global-active device. By using this operand, you can export monitoring data about remote copy operations performed by TC, TCz, and GAD in the whole volumes. When statistics are exported to a ZIP file, the file name will be `RemoteCopy_dat.ZIP`. For details on the statistics exported by this operand, see Remote copy operations by TC/TCz and monitoring data by GAD (whole volumes) (on page 157).
RCLU [[*port-name.host-group-id*]:[*port-name.host-group-id*]][...]	Use this operand when you want to export statistics about remote copy operations of TrueCopy and global-active device. By using this operand, you can export monitoring data about remote copy operations performed by TC and GAD at each volume (LU). When statistics are exported to a ZIP file, the file name will be `RCLU_dat.ZIP`. (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume. For details on the statistics exported by this operand, see Remote copy operations by TC and monitoring data by GAD (for each volume (LU)) (on page 158). When you specify variable *port-name.host-group-id*, you can narrow the range of LU paths whose monitoring data are to be exported, where *port-name* is a port name and *host-group-id* is the ID of a host group. The host group ID must be a hexadecimal numeral. The colon (:) indicates a range. For example, `CL1-C.01:CL1-C.03` indicates the range from the host group #01 of the CL1-C port to the host group #03 of the CL1-C port. Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which *port-name* value is smaller than which *port-name* value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r

Operand	Description
	For example, you can specify `RCLU CL1-C.01:CL2-A.01`, but you cannot specify `RCLU CL2-A.01:CL1-C.01`. Also, you can specify `RCLU CL1-C.01:CL1-C.03`, but you cannot specify `RCLU CL1-C.03:CL1-C.01`. If *port-name.host-group-id* is not specified, the monitoring data of all volumes (LUs) will be exported.
RCLDEV [[*LDKC-CU-id*]:[*LDKC-CU-id*]] [...] |	Use this operand when you want to export statistics about remote copy operations of TrueCopy, TrueCopy for Mainframe, and global-active device. By using this operand, you can export monitoring data about remote copy operations performed by TC, TCz, and GAD at volumes controlled by each CU. When statistics are exported to a ZIP file, multiple ZIP files whose names are beginning with `RCLDEV_` will be output. For details on the statistics exported by this operand, see Remote copy by TC/TCz and monitoring data by GAD (volumes controlled by a particular CU) (on page 159). When you specify variable *LDKC-CU-id*, you can narrow the range of LDKC:CUs that control the volumes whose monitoring data are to be exported. *LDKC-CU-id* is an ID of an LDKC:CU. The colon (:) indicates a range. For example, `000:105` indicates LDKC:CUs from 00:00 to 01:05. Ensure that the *LDKC-CU-id* value on the left of the colon is smaller than the *LDKC-CU-id* value on the right of the colon. For example, you can specify `RCLDEV 000:105`, but you cannot specify `RCLDEV 105:000`. If *LDKC-CU-id* is not specified, the monitoring data of all volumes will be exported.
UniversalReplicator	Use this operand when you want to export statistics about remote copy operations of UR and URz. By using this operand, you can export monitoring data about remote copy operations performed by Universal Replicator and Universal Replicator for Mainframe in the whole volume. When statistics are exported to a ZIP file, the file name will be `UniversalReplicator.zip`. For details on the statistics exported by this operand, see Remote copy by UR and URz (whole volumes) (on page 161).
URJNL [[*JNL-group-id*]:[*JNL-group-id*]][...]	Use this operand when you want to export statistics about remote copy operations of UR and URz. By using this operand, you can export monitoring data about remote copy operations performed by Universal Replicatorand Universal Replicator for Mainframe at each journal. When statistics are exported to a ZIP file, the file name will be `URJNL_dat.ZIP`. For details on the statistics exported by this operand, see Remote copy by UR and URz (at journals) (on page 161).

Operand	Description
	When you specify variable *JNL-group-id*, you can narrow the range of journals whose monitoring data are to be exported. *JNL-group-id* is a journal number. The colon (:) indicates a range. For example, `00:05` indicates journals from 00 to 05. Ensure that the *JNL-group-id* value on the left of the colon is smaller than the *JNL-group-id* value on the right of the colon. For example, you can specify `URJNL 00:05`, but you cannot specify `URJNL 05:00`. If *JNL-group-id* is not specified, the monitoring data of all journal volumes will be exported.
URLU [[*port-name.host-group-id*]:[*port-name.host-group-id*]][...]	Use this operand when you want to export statistics about remote copy operations of UR. By using this operand, you can export monitoring data about UR remote copy operations at each volume (LU). When statistics are exported to a ZIP file, the file name will be `URLU_dat.ZIP`. (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume. For details on the statistics exported by this operand, see Remote copy by UR (for each volume (LU)) (on page 163). When you specify variable *port-name.host-group-id*, you can narrow the range of LU paths whose monitoring data are to be exported, where *port-name* is a port name and *host-group-id* is the ID of a host group. The host group ID must be a hexadecimal numeral. The colon (:) indicates a range. For example, `CL1-C.01:CL1-C.03` indicates the range from the host group #01 of the CL1-C port to the host group #03 of the CL1-C port. Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest *port-name* value is CL1-A and the largest *port-name* value is CL4-r. The following formula illustrates which *port-name* value is smaller than which *port-name* value: CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r For example, you can specify `URLU CL1-C.01:CL2-A.01`, but you cannot specify `URLU CL2-A.01:CL1-C.01`. Also, you can specify `URLU CL1-C.01:CL1-C.03`, but you cannot specify `URLU CL1-C.03:CL1-C.01`. If *port-name.host-group-id* is not specified, the monitoring data of all volumes (LUs) will be exported.

Operand	Description
URLDEV [[*LDKC-CU-id*]: [*LDKC-CU-id*]] [...]	Use this operand when you want to export statistics about remote copy operations which of UR and URz. By using this operand, you can export monitoring data about remote copy operations performed by Universal Replicator and Universal Replicator for Mainframe at volumes controlled by each CU. When statistics are exported to a ZIP file, multiple ZIP files whose names are beginning with `URLDEV_` will be output. For details on the statistics exported by this operand, see Remote copy by UR and URz (at volumes controlled by a particular CU) (on page 164). When you specify variable *LDKC-CU-id*, you can narrow the range of LDKC:CUs that control the volumes whose monitoring data are to be exported. *LDKC-CU-id* is an ID of an LDKC:CU. The colon (:) indicates a range. For example, `000:105` indicates LDKC:CUs from 00:00 to 01:05. Ensure that the *LDKC-CU-id* value on the left of the colon is smaller than the *LDKC-CU-id* value on the right of the colon. For example, you can specify `URLDEV 000:105`, but you cannot specify `URLDEV 105:000`. If *LDKC-CU-id* is not specified, the monitoring data of all volumes will be exported.
PhyMPPK	Use this operand when you want to export statistics about MP usage rate of each resource allocated to MP blade or unit in short range. When statistics are exported to a ZIP file, the filename is `PHY_MPPK.ZIP`. For details on the statistics exported by this operand, see MP blades (VSP G1x00 and VSP F1500) (on page 156).

Examples

The following example exports statistics about host bus adapters:

```
group PortWWN
```

The following example exports statistics about three ports (CL1-A, CL1-B, and CL1-C):

```
group Port CL1-A:CL1-C
```

The following example exports statistics about six ports (CL1-A to CL1-C, and CL2-A to CL2-C)

```
group Port CL1-A:CL1-C CL2-A:CL2-C
```

The following example exports statistics about the parity group 1-3:

```
group PG 1-3:1-3
```

The following example exports statistics about the parity group 1-3 and other parity groups whose ID is larger than 1-3 (for example, 1-4 and 1-5):

```
group PG 1-3:
```

The following example exports statistics about the external volume groups E1-1 to E1-5:

```
group PG E1-1:E1-5
```

The following example exports statistics about the parity group 1-3 and other parity groups whose ID is smaller than 1-3 (for example, 1-1 and 1-2):

```
group LDEV:1-3
```

The following example exports statistics about LU paths for the host group (host storage domain) ID 01 for the port CL1-A:

```
group LU CL1-A.01:CL1-A.01
```

shortrange (VSP G1x00 and VSP F1500)

Description

Use this subcommand to specify a term of monitoring data to be exported into files. Use this subcommand when you want to narrow the export-target term within the stored data.

The **shortrange** subcommand is valid for monitoring data in short range. Short-range monitoring data appears in the Monitor Performance window when Short-Range is selected as the storing period.

All the monitoring items are stored in short range. Therefore, you can use the **shortrange** subcommand whichever operand you specify to the **group** subcommand. If you run Export Tool without specifying the **shortrange** subcommand, the data stored in the whole monitoring term will be exported.

The **login** subcommand must run before the **shortrange** subcommand runs.

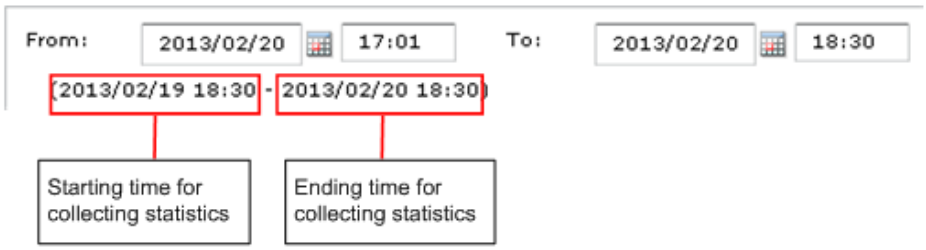
Syntax

shortrange [[*yyyyMMddhhmm*][{+|-}*hhmm*]:[*yyyyMMddhhmm*][{+|-}*hhmm*]]

Operands

The value on the left of the colon (:) specifies the starting time of the period. The value on the right of the colon specifies the ending time of the period. Specify the term within "`Short Range From` XXX `To` XXX" which is output by the **show** subcommand.

If no value is specified on the left of the colon, the starting time for collecting monitoring data is assumed. If no value is specified on the right of the colon, the ending time for collecting monitoring data is assumed. The starting and ending times for collecting monitoring data are displayed in the Monitoring Term area in the Monitor Performance window.



Operand	Description
yyyyMMddhhmm	*yyyyMMdd* indicates the year, the month, and the day. *hhmm* indicates the hour and the minute. If *yyyyMMddhhmm* is omitted on the left of the colon, the starting time for collecting monitoring data is assumed. If *yyyyMMddhhmm* is omitted on the right of the colon, the ending time for collecting monitoring data is assumed. To save monitoring data up to the sampling end time, omit *yyyyMMddhhmm* on the right of the colon. If you specify *yyyyMMddhhmm* on the right of the colon, specify date and time at least 30 minutes earlier than the current time. Otherwise, an Out of range error may occur.
+hhmm	Adds time (*hhmm*) to *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, 201306230000+0130 indicates June 23, 2013. 01:30. Adds time to the starting time for collecting monitoring data, if *yyyyMMddhhmm* is omitted.
-hhmm	Subtracts time (hhmm) from *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, `201306230000-0130` indicates June 22, 2013. 22:30. Subtracts time from the ending time for collecting monitoring data, if *yyyyMMddhhmm* is omitted.

Operand	Description
	If the last two digits of the time on the left or right of the colon (:) are not a multiple of the sampling interval, the time will automatically be changed so that the last two digits is a multiple of the sampling interval. If this change occurs to the time on the left of the colon, the time will be smaller than the original time. If this change occurs to the time on the right of the colon, the time will be larger than the original time. The following are the examples: ▪ If the time on the left is 10:15, the time on the right is 20:30, and the sampling interval is 10 minutes: The time on the left will be changed to 10:10 because the last two digits of the time are not a multiple of 10 minutes. The time on the right will remain unchanged because the last two digits of the time are a multiple of 10 minutes. ▪ If the time on the left is 10:15, the time on the right is 20:30, and the sampling interval is 7 minutes: The time on the left will be changed to 10:14 because the last two digits of the time are not a multiple of 7 minutes. The time on the right will be changed to 20:35 because of the same reason.

Examples

The examples below assume that the:

- Starting time for collecting monitoring data is Jan. 1, 2013, 00:00,
- Ending time for collecting monitoring data is Jan. 2, 2013, 00:00.

`shortrange 201301010930:201301011730`
Export Tool saves monitoring data within the range of Jan. 1, 9:30-17:30.

`shortrange 201301010930:`
Export Tool saves monitoring data within the range of Jan. 1, 9:30 to Jan. 2, 00:00.

`shortrange:201301011730`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-17:30.

`shortrange +0001:`
Export Tool saves monitoring data within the range of Jan. 1, 0:01 to Jan. 2, 00:00.

`shortrange -0001:`
Export Tool saves monitoring data within the range of Jan. 1, 23:59 to Jan. 2, 00:00.

`shortrange:+0001`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-00:01.

`shortrange:-0001`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-23:59.

shortrange +0101:-0101
Export Tool saves monitoring data within the range of Jan. 1, 1:01-22:59.

shortrange 201301010900+0130:201301011700-0130
Export Tool saves monitoring data within the range of Jan. 1, 10:30-15:30.

shortrange 201301010900-0130:201301011700+0130
Export Tool saves monitoring data within the range of Jan. 1, 7:30-18:30.

shortrange 201301010900-0130:
Export Tool saves monitoring data within the range of Jan. 1, 7:30 to Jan. 2, 00:00.

longrange (VSP G1x00 and VSP F1500)

Description

The **longrange** subcommand is used to specify a monitoring term (time range) for collecting monitoring data to be exported into files. Use this subcommand when you want to narrow the export-target term within the stored data.

The **longrange** subcommand is valid for monitoring data in long range. The monitoring data in long range is the contents displayed on the Physical tab of the Performance Management window with selecting **longrange** as the storing period.

The monitoring items whose data can be stored in long range are limited. The following table shows the monitoring items to which the **longrange** subcommand can be applied, and also shows the operands to export those monitoring items.

Monitoring Data	Operands of the group subcommand
Usage statistics about parity groups	PhyPG Long
Usage statistics about volumes	PhyLDEV Long
Usage statistics about MPs and data recovery and reconstruction processors	PhyProc Long
Usage statistics about access paths and write pending rate	PhyCMPK Long

If you run Export Tool without specifying the **longrange** subcommand, the data stored in the whole monitoring term will be exported.

The **login** subcommand must run before the **longrange** subcommand runs.

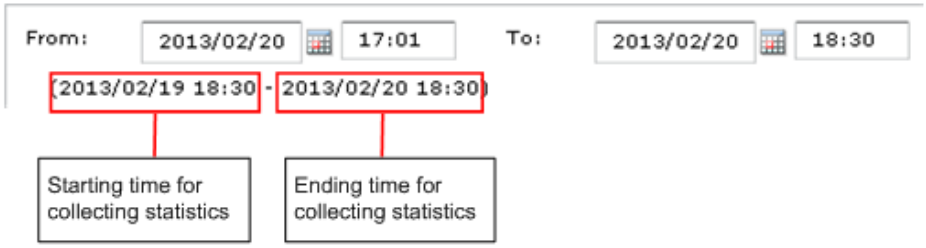
Syntax

longrange [[*yyyyMMddhhmm*][{+|-}*ddhhmm*]:[*yyyyMMddhhmm*][{+|-}*ddhhmm*]]

Operands

The value on the left of the colon (:) specifies the starting time of the period. The value on the right of the colon specifies the ending time of the period. Specify the term within "`Long Range From` XXX `To` XXX" which is output by the **`show`** subcommand.

If no value is specified on the left of the colon, the starting time for collecting monitoring data is assumed. If no value is specified on the right of the colon, the ending time for collecting monitoring data is assumed. The starting and ending times for collecting monitoring data are displayed in the Monitoring Term area in the Monitor Performance window.



Operand	Description
yyyyMMddhhmm	*yyyyMMdd* indicates the year, the month, and the day. *hhmm* indicates the hour and the minute. If *yyyyMMddhhmm* is omitted on the left of the colon, the starting time for collecting monitoring data is assumed. If *yyyyMMddhhmm* is omitted on the right of the colon, the ending time for collecting monitoring data is assumed.
+ddhhmm	Adds time (*ddhhmm*) to *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, `201301120000+010130` indicates Jan. 13, 2013. 01:30. Adds time to the starting time for collecting monitoring data, if *yyyyMMddhhmm* is omitted.
-ddhhmm	Subtracts time (ddhhmm) from *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, `201301120000-010130` indicates Jan. 10, 2013. 22:30. Subtracts time from the ending time for collecting monitoring data, if *yyyyMMddhhmm* is omitted. Ensure that *mm* is 00, 15, 30, or 45. If you do not specify *mm* in this way, the value on the left of the colon (:) will be rounded down to one of the four values. Also, the value on the right of the colon will be rounded up to one of the four values. For example, if you specify `201301010013:201301010048`, the specified value is regarded as `201301010000:201301010100`.

Examples

The examples below assume that:

- the starting time for collecting monitoring data is Jan. 1, 2013, 00:00.
- the ending time for collecting monitoring data is Jan. 2, 2013, 00:00.

`longrange 201301010930:201301011730`
Export Tool saves monitoring data within the range of Jan. 1, 9:30-17:30.

`longrange 201301010930:`
Export Tool saves monitoring data within the range of Jan. 1, 9:30 to Jan. 2, 00:00.

`longrange:201301011730`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-17:30.

`longrange +000015:`
Export Tool saves monitoring data within the range of Jan. 1, 0:15 to Jan. 2, 00:00.

`longrange -000015:`
Export Tool saves monitoring data within the range of Jan. 1, 23:45 to Jan. 2, 00:00.

`longrange:+000015`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-00:15.

`longrange:-000015`
Export Tool saves monitoring data within the range of Jan. 1, 0:00-23:45.

`longrange +000115:-000115`
Export Tool saves monitoring data within the range of Jan. 1, 1:15-22:45.

`longrange 201301010900+000130:201301011700-000130`
Export Tool saves monitoring data within the range of Jan. 1, 10:30-15:30.

`longrange 201301010900-000130:201301011700+000130`
Export Tool saves monitoring data within the range of Jan. 1, 7:30-18:30.

`longrange 201301010900-000130:`
Export Tool saves monitoring data within the range of Jan. 1, 7:30 to Jan. 2, 00:00.

range (VSP Gx00, VSP Fx00, and VSP Nx00)

Description

Use this subcommand to specify a term of monitoring data to be exported into files. Use this subcommand when you want to narrow the export-target term within the stored data.

You need to log into the storage system with the **`login`** subcommand before the **`range`** subcommand runs.

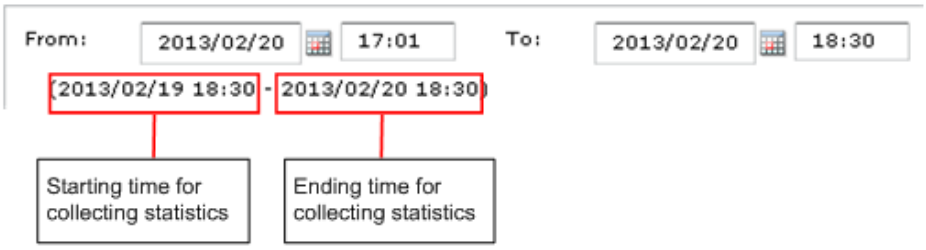
Syntax

`range` [[*yyyyMMddhhmm*][{+|-}*hhmm*]:[*yyyyMMddhhmm*][{+|-}*hhmm*]]

Operands

The value on the left of the colon (:) specifies the starting time of the period. The value on the right of the colon specifies the ending time of the period. Specify the term within "`Range From` XXX `To` XXX" which is output by the **`show`** subcommand.

If no value is specified on the left of the colon, the starting time for collecting monitoring data is assumed. If no value is specified on the right of the colon, the ending time for collecting monitoring data is assumed. The starting and ending times for collecting monitoring data are displayed in the Monitoring Term area in the **Monitor Performance** window.



Operand	Description
yyyyMMddhhmm	*yyyyMMdd* indicates the year, the month, and the day. *hhmm* indicates the hour and the minute. If *yyyyMMddhhmm* is omitted on the left of the colon, the starting time for collecting monitoring data is assumed. If *yyyyMMddhhmm* is omitted on the right of the colon, the ending time for collecting monitoring data is assumed. To save monitoring data up to the sampling end time, omit *yyyyMMddhhmm* on the right of the colon. If you specify *yyyyMMddhhmm* on the right of the colon, specify date and time at least 30 minutes earlier than the current time. Otherwise, an Out of range error may occur.
+hhmm	Adds time (*hhmm*) to *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, 201306230000+0130 indicates June 23, 2013. 01:30. Adds time to the starting time for collecting monitoring data, if *yyyyMMddhhmm* is omitted.
-hhmm	Subtracts time (*hhmm*) from *yyyyMMddhhmm* if *yyyyMMddhhmm* is specified. For example, 201306230000-0130 indicates June 22, 2013. 22:30. Subtracts time from the ending time for collecting monitoring data, if *yyyyMMddhhmm* is omitted.

Operand	Description
	If the last two digit of the time on the left or right of the colon (:) is not a multiple of the sampling interval, the time will automatically be changed so that the last two digits is a multiple of the sampling interval. If this change occurs to the time on the left of the colon, the time will be smaller than the original time. If this change occurs to the time on the right of the colon, the time will be larger than the original time. The following are the examples: ▪ **If the time on the left is 10:15, the time on the right is 20:30, and the sampling interval is 10 minutes:** The time on the left will be changed to 10:10 because the last two digits of the time is not a multiple of 10 minutes. The time on the right will remain unchanged because the last two digits of the time is a multiple of 10 minutes ▪ **If the time on the left is 10:15, the time on the right is 20:30, and the sampling interval is 7 minutes:** The time on the left will be changed to 10:14 because the last two digits of the time is not a multiple of 7 minutes. The time on the right will be changed to 20:35 because of the same reason.

Examples

The following examples assume that:

- The starting time for collecting monitoring data is Jan. 1, 2013, 00:00.
- The ending time for collecting monitoring data is Jan. 2, 2013, 00:00.

```
range 201301010930:201301011730
```

Export Tool saves monitoring data within the range of Jan. 1, 9:30-17:30.

```
range 201301010930:
```

Export Tool saves monitoring data within the range of Jan. 1, 9:30 to Jan. 2, 00:00.

```
range:201301011730
```

Export Tool saves monitoring data within the range of Jan. 1, 0:00-17:30.

```
range +0001:
```

Export Tool saves monitoring data within the range of Jan. 1, 0:01 to Jan. 2, 00:00.

```
range :-0001
```

Export Tool saves monitoring data within the range of Jan. 1, 0:00-23:59.

```
range +0101:-0101
```

Export Tool saves monitoring data within the range of Jan. 1, 1:01-22:59.

```
range 201301010900+0130:201301011700-0130
```

Export Tool saves monitoring data within the range of Jan. 1, 10:30-15:30.

```
range 201301010900-0130:201301011700+0130
```

Export Tool saves monitoring data within the range of Jan. 1, 7:30-18:30.

```
range 201301010900-0130:
```

Export Tool saves monitoring data within the range of Jan. 1, 7:30 to Jan. 2, 00:00.

outpath

Description

The **outpath** subcommand specifies the directory to which monitoring data will be exported.

Syntax

outpath [*path*]

Operands

Operand	Description
path	Specifies the directory in which files will be saved. If the directory includes any non-alphanumeric character, the directory must be enclosed by double quotation marks ("). If you want to specify a back slash (\) in the character string enclosed by double quotation marks, repeat the back slash twice. For example, \\ . If the specified directory does not exist, this subcommand creates a directory that has the specified name. If this operand is omitted, the current directory is assumed.

Examples

The following example saves files in the directory C:\Project\out on a Windows computer:

```
outpath "C:\\Project\\out"
```

The following example saves files in the **out** directory in the current directory:

```
outpath out
```

option

Description

This subcommand specifies the following:

- whether to compress monitoring data in ZIP files
- whether to overwrite or delete existing files and directories when saving monitoring data in files

Syntax

option [**compress**|**nocompress**] [**ask**|**clear**|**noclear**]

Operands

Operand	Description
The two operands below specify whether to compress CSV files into ZIP files. If none of these operands is specified, **compress** is assumed.	
compress	Compresses data in ZIP files. To extract CSV files out of a ZIP file, you will need to decompress the ZIP file.
nocompress	Does not compress data in ZIP files and saves data in CSV files.
The three operands below specify whether to overwrite or delete an existing file or directory when Export Tool saves files. If none of these operands is specified, `ask` is assumed.	
ask	Displays a message that asks whether to delete existing files or directories.
clear	Deletes existing files and directories and then saves monitoring data in files.
noclear	Overwrites existing files and directories.

Example

The following example saves monitoring data in CSV files, not in ZIP files:

```
option nocompress
```

apply

Description

The **`apply`** subcommand saves monitoring data specified by the **`group`** subcommand into files.

(VSP G1x00 and VSP F1500) The **`login`** subcommand must run before the **`apply`** subcommand runs.

(VSP Gx00, VSP Fx00, and VSP Nx00) You need to log into the storage system with the **`login`** subcommand before the **`apply`** subcommand runs.

The **`apply`** subcommand does nothing if the **`group`** subcommand runs.

The settings made by the **`group`** subcommand will be reset when the **`apply`** subcommand finishes.

Syntax

`apply`

set

Description

The **set** subcommand starts or ends monitoring the storage system (for example, starting or ending the collection of performance statistics). The **set** subcommand also specifies the sampling interval (interval of collecting statistics).

If you want to use the **set** subcommand, you must use the **login** subcommand (see login (on page 100) to log on to the storage system). Ensure that the **set** subcommand runs immediately before Export Tool finishes.

Executing the **set** subcommand generates an error in the following conditions:

- Some other user is being logged onto SVP in Modify mode.
- Maintenance operations are being performed at SVP.

If an error occurs, do the following:

- Check with Device Manager - Storage Navigator and so on, and confirm that all users who are logged onto the storage system are not in Modify mode. If any user is logged on in Modify mode, ask the user to switch to View mode.
- Wait until maintenance operations finish at SVP, so that the **set** subcommand can run.

Note: Following are notes of the **set** command.

- Batch files can include script that will run when an error occurs. For information about writing such a script in your batch file, see Notes in Running Export Tool (on page 87) .
- When the **set** subcommand starts or ends the monitoring or changes the sampling interval after the **Monitor Performance** window is started, the contents displayed in the **Monitor Performance** window do not change automatically in conjunction with the **set** subcommand operation. To display the current monitoring status in the **Monitor Performance** window, click Refresh on the menu bar of the Device Manager - Storage Navigator main window.
- If you change the specified sampling interval during a monitoring, the previously collected monitoring data will be deleted.

Syntax

set [switch={*m*|off}]

Operands

Operand	Description
switch={*m*|**off**}	To start monitoring, specify the sampling interval (interval of collecting statistics) of monitoring data at m. Specify a value between 1 and 15 in minutes. (VSP Gx00, VSP Fx00, and VSP Nx00) m is the sampling interval by Performance Monitor. (VSP G1x00 and VSP F1500) The sampling interval in long range is fixed to 15 minutes. m is the sampling interval in short range monitoring by Performance Monitor. To end monitoring, specify `off`. If this operand is omitted, the **`set`** subcommand does not make settings for starting or ending monitoring.

Examples

The following command file saves port statistics and then ends monitoring ports:

(VSP G1x00 and VSP F1500)

```
svpip 158.214.135.57
login expusr passwd
show
group Port
short-range 201304010850:201304010910
apply
set switch=off
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
ip 158.214.135.57
dkcsn 123456
login expusr passwd
show
group Port
range 200604010850:200604010910
apply
set switch=off
```

The following command file starts monitoring remote copy operations. The sampling time interval is 10 minutes:

(VSP G1x00 and VSP F1500)

```
svpip 158.214.135.57 login expusr passwd set switch=10
```

(VSP Gx00, VSP Fx00, and VSP Nx00)

```
ip 158.214.135.57
dkcsn 123456
login expusr passwd
set switch=10
```

help

Description

The **`help`** subcommand displays the online help for subcommands.

If you want to view the online help, you should create a batch file and a command file that are exclusively used for displaying the online help. For detailed information, see the following **Example**.

Syntax

`help`

Example

In this example, a command file (`cmdHelp.txt`) and a batch file (`runHelp.bat`) are created in the `C:\export directory` on a Windows computer:

- Command file (`c:\export\cmdHelp.txt`):

```
help
```

- Batch file (`c:\export\runHelp.bat`):

```
java -classpath "./lib/JSanExportLoader.jar"
-Del.tool.Xmx=536870912 -Dmd.command=cmdHelp.txt
-Dmd.logpath=log sanproject.getexptool.RJElMain<CR+LF>
pause<CR+LF>
```

In the preceding script, <CR+LF> indicates the end of a command line.

In this example, you must do one of the following to view the online help:

- Double-click `runHelp.bat`.
- Go to the `c:\export directory` at the command prompt, enter `runHelp` or `runHelp.bat`, and then press **Enter**.

Java

Description

This command starts Export Tool and exports monitoring data into files. To start Export Tool, write this Java command in your batch file and then run the batch file.

Syntax

`Java -classpath`*class-pathrproperty-parameters***`sanproject.getexptool.RJElMain`**

Operands

Operand	Description
class-path	Specifies the path to the class file of Export Tool. The path must be enclosed in double quotation marks (").
property-parameters	You can specify the following parameters. At minimum you must specify -Dmd.command. ▪ **-Dhttp.proxyHost**= *host-name-of-proxy-host*, or **-Dhttp.proxyHost**=*IP-address-of-proxy-host* Specifies the host name or the IP address of a proxy host. You must specify this parameter if the computer that runs Export Tool communicates with SVP through a proxy host. ▪ **-Dhttp.proxyPort**=*port-number-of-proxy-host* Specifies the port number of a proxy host. You must specify this parameter if the computer that runs Export Tool communicates with SVP through a proxy host. ▪ **-Del.tool.Xmx**=*VM-heap-size-when-ExportTool-starts* (bytes) Specifies the size of memory to be used by JRE when Export Tool is being run. You must specify this parameter. The memory size must be 536870912, as shown in the **Example** below. If an installed memory size is smaller than the recommended size of the PC running Device Manager - Storage Navigator, you must install more memory before executing Export Tool. If an installed memory size is larger than the recommended memory size of the PC running Device Manager - Storage Navigator, you can specify a memory size larger than as shown in the **Example**. However, to prevent lowering of execution speed, you do not set oversized memory size. ▪ **-Dmd.command**=*path-to-command-file* Specifies the path to the command file

Operand	Description
	▪ **-Dmd.logpath**=*path-to-log-file* Specifies the path to log files. A log file will be created whenever Export Tool runs. If this parameter is omitted, log files will be saved in the current directory. ▪ **-Dmd.logfile**=*name-of-log-file* Specifies the name of the log file. If this parameter is omitted, log files are named exportMMddHHmmss.log. MMddHHmmss indicates when Export Tool runs. For example, the log file export0101091010.log contains log information about the Export Tool execution at Jan. 1, 09:10:10. ▪ **-Dmd.rmitimeout**=*timeout(min.)* Specifies the timeout value for communication between Export Tool and the SVP: • Default: 20 minutes • Minimum: 1 minute • Maximum: 1,440 minutes (24 hours) If a request does not come from Export Tool within the timeout period, the SVP determines that execution has stopped and disconnects the session with Export Tool. Therefore, if the machine on which Export Tool is running is slow, Export Tool sessions may be disconnected unexpectedly. To prevent this from occurring, increase the timeout period by entering a larger value in this parameter. ▪ **-Del.logpath**=*log-output-directory-name* Specify the directory to store the log file generated when Export Tool was downloaded. By default, the current directory is set. The initial value for the startup batch file is **`log`**. ▪ **-Del.logfile**=*log-file-name* Specify the name of the log file generated when Export Tool was downloaded. By default, `loaderMMddHHmmss.log` is set. *MM* is the month, *dd* is the date, and *HH* is the hour, *mm* is minutes, and *ss* is seconds. When the default name is used, a new log file is created every time you run Export Tool. As a result, you need to delete log files regularly. The initial value for the startup batch file is not specified.

Operand	Description
	▪ **-Del.mode**=*startup-mode-of-Export-Tool* (all/delete) Specify the startup mode of Export Tool. The following shows startup modes and their behavior. • Mode: all Download Export Tool: Yes Run Export Tool: Yes Delete temporary directories in the lib directory: Yes • Mode: delete Download Export Tool: no Run Export Tool: no Delete temporary directories in the lib directory: Yes ▪ (VSP Gx00, VSP Fx00, and VSP Nx00) **-Del.dlport**=*port-number-used-when-Export-Tool-is-downloaded* Specifies the port number used when Export Tool is downloaded. By default, 51099 is set. When you change the port number (port number key name: RMIClassLoader) of the SVP, you must also change the port number of this operand. For settings that are affected by changes of port numbers for the SVP, see the *System Administrator Guide*.

Examples

The following example assumes that the computer running Export Tool communicates with the SVP through a proxy host. In the following example, the host name of the proxy host is Jupiter, and the port name of the proxy host is 8080:

```
java -classpath "./lib/JSanExportLoader.jar"
-Dhttp.proxyHost=Jupiter -Dhttp.proxyPort=8080 -Del.tool.Xmx=536870912
-Dmd.command=command.txt
-Dmd.rmitimeout=20
-Dmd.logpath=log sanproject.getexptool.RJElMain <CR+LF>
```

In the following example, a log file named `export.log` will be created in the log directory below the current directory when Export Tool runs:

```
java -classpath "./lib/JSanExportLoader.jar"
-Del.tool.Xmx=536870912 -Dmd.command=command.txt -Dmd.logfile=export.log
-Dmd.logpath=log sanproject.getexptool.RJElMain<CR+LF>
```

In the above script, <CR+LF> indicates the end of a command line.

Viewing exported files using Export Tool

Export Tool saves the exported monitoring data into text files in CSV (comma-separated value) format, in which values are delimited by commas. Many spreadsheet applications can be used to open CSV files.

Export Tool by default saves the CSV text files in compressed (ZIP) files. To use a text editor or spreadsheet software to view or edit the monitoring data, first decompress the ZIP files to extract the CSV files. You can also configure Export Tool to save monitoring data in CSV files instead of ZIP files.

Monitoring data exported by Export Tool

The following table shows the correspondence between the Performance Management windows and the monitoring data that can be exported by Export Tool. For details on the data contained in the corresponding ZIP files and CSV files, see the tables indicated in the links in the Monitoring data column.

The monitoring data shows the average value of sampling interval. The following sampling intervals can be set in the Edit Monitoring Switch window :

- (VSP G1x00 and VSP F1500) The sampling intervals are 1 to 15 minutes and 15 minutes for Short Range and Long Range, respectively.
- (VSP Gx00, VSP Fx00, and VSP Nx00) The sampling intervals are 1 to 15 minutes.

GUI operation	Monitoring data
Select Parity Groups from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 143) Parity group and external volume group statistics (on page 146)
Select Logical Devices (Base) from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 143) Statistics for volumes in parity/external volume groups (on page 148) Volumes in parity groups or external volume groups (at volumes controlled by a particular CU) (on page 150)
Select Logical Devices (TC/TCz/GAD) from Object list in Performance Objects field in Monitor Performance window.	Remote copy by TC/TCz and monitoring data by GAD (volumes controlled by a particular CU) (on page 159)
Select Logical Devices (UR/URz) from Object list in Performance Objects field in Monitor Performance window.	Remote copy by UR and URz (at volumes controlled by a particular CU) (on page 164)

GUI operation	Monitoring data
Select Access Path from Object list in Performance Objects field in Monitor Performance window. (VSP G1x00 and VSP F1500)	Resource usage and write-pending rate statistics (on page 143)
Select Cache from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 143)
Select Controller from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 143) MP blades (VSP G1x00 and VSP F1500) (on page 156) (VSP G1x00 and VSP F1500)
Select Fibre Port from Object list in Performance Objects field in Monitor Performance window.	Port statistics (on page 153)
Select iSCSI Port from Object list in Performance Objects field in Monitor Performance window.	Port statistics (on page 153)
Select Mainframe Fibre Port from Object list in Performance Objects field in Monitor Performance window. (VSP G1x00 and VSP F1500)	Port statistics (on page 153)
Select LUN Base from Object list in Performance Objects field in Monitor Performance window.	Volumes (LU) statistics (on page 154)
Select LUN (TC/GAD) from Object list in Performance Objects field in Monitor Performance window.	Remote copy operations by TC and monitoring data by GAD (for each volume (LU)) (on page 158)
Select LUN (UR/URz) from Object list in Performance Objects field in Monitor Performance window.	Remote copy by UR (for each volume (LU)) (on page 163)
Select WWN from Object list in Performance Objects field in Monitor Performance window.	Host bus adapters connected to ports statistics (on page 154) All host bus adapters connected to ports (on page 156)
Select Journal from Object list in Performance Objects field in Monitor Performance window.	Remote copy by UR and URz (at journals) (on page 161)
Select Entire Storage System (TC/TCz/GAD) from Object list in Performance Objects field in Monitor Performance window.	Remote copy operations by TC/TCz and monitoring data by GAD (whole volumes) (on page 157)

GUI operation	Monitoring data
Select Entire Storage System (UR/URz) from Object list in Performance Objects field in Monitor Performance window.	Remote copy by UR and URz (whole volumes) (on page 161)

Resource usage and write-pending rate statistics

The following table shows the file names and types of information in the **Monitor Performance** window that can be saved to files using Export Tool. These files contain statistics about resource usage and write pending rates.

ZIP file	CSV file	Data saved in the file
PhyPG_dat.ZIP	PHY_Long_PG.csv and PHY_Short_PG.csv (VSP G1x00 and VSP F1500) PHY_PG.csv (VSP Gx00, VSP Fx00, and VSP Nx00)	Usage rates for parity groups in long range and short range, respectively Usage rates for parity groups.
PhyLDEV_dat.ZIP	PHY_Long_LDEV_x-y.csv and PHY_Short_LDEV_x-y.csv (VSP G1x00 and VSP F1500) PHY_LDEV_x-y.csv (VSP Gx00, VSP Fx00, and VSP Nx00)	Usage rates for volumes in a parity group in long range and short range, respectively. Usage rates for volumes in a parity group
	PHY_Short_LDEV_SI_x-y.csv (VSP G1x00 and VSP F1500) PHY_LDEV_SI_xy.csv (VSP Gx00, Nx00, and VSP Fx00 models)	Usage rates for ShadowImage and ShadowImage for Mainframe volumes in a parity group in short range Usage rates for ShadowImage volumes in a parity group
PhyExG_dat.ZIP	PHY_ExG_Response.csv	This file includes the average response time for the volume groups including external storage volumes (milliseconds).
	PHY_ExG_Trans.csv	This file includes the amount of transferred data for volume groups including external storage volumes (Kbps).
	PHY_ExG_Read_Response.csv	This file includes the average read response time for the volume groups including external storage volumes (milliseconds).

ZIP file	CSV file	Data saved in the file
	PHY_ExG_Write_Response.csv	This file includes the average write response time for the volume groups including external storage volumes (milliseconds).
	PHY_ExG_Read_Trans.csv	This file includes the amount of read transferred data for volume groups including external storage volumes (Kbps).
	PHY_ExG_Write_Trans.csv	This file includes the amount of write transferred data for volume groups including external storage volumes (Kbps).
PhyExLDEV_dat/PHY_ExLDEV_Response.ZIP	PHY_ExLDEV_Response_x-y.csv	This file includes the average response time for external storage volumes in the volume group x-y (milliseconds).
PhyExLDEV_dat/PHY_ExLDEV_Trans.ZIP	PHY_ExLDEV_Trans_x-y.csv	This file includes the amount of data transferred for external storage volumes in the volume group x-y (Kbps).
PhyExLDEV_dat/PHY_ExLDEV_Read_Response.ZIP	PHY_ExLDEV_Read_Response_x-y.csv	This file includes the average reading response time for external storage volumes in the volume group x-y (milliseconds).
PhyExLDEV_dat/PHY_ExLDEV_Write_Response.ZIP	PHY_ExLDEV_Write_Response_x-y.csv	This file includes the average writing response time for external storage volumes in the volume group x-y (milliseconds).
PhyExLDEV_dat/PHY_ExLDEV_Read_Trans.ZIP	PHY_ExLDEV_Read_Trans_x-y.csv	This file includes the amount of reading data transferred for external storage volumes in the volume group x-y (Kbps).
PhyExLDEV_dat/PHY_ExLDEV_Write_Trans.ZIP	PHY_ExLDEV_Write_Trans_x-y.csv	This file includes the amount of writing data transferred for external storage volumes in the volume group x-y (Kbps).
PhyProc_dat.ZIP (VSP G1x00 and VSP F1500)	PHY_Long_MP.csv	Usage rates for MPs in long range
	PHY_Short_MP.csv	Usage rates for MPs in short range
	PHY_Long_DRR.csv	Usage rates for DRRs (data recovery and reconstruction processors) in long range
	PHY_Short_DRR.csv	Usage rates for DRRs (data recovery and reconstruction processors) in short range

ZIP file	CSV file	Data saved in the file
PhyProc_dat.ZIP (VSP Gx00, Nx00, and VSP Fx00 models)	PHY_MP.csv	Usage rates for MPs
PhyCMPK_dat.ZIP (VSP G1x00 and VSP F1500)	PHY_Long_CHA_CMPK.csv	Usage rates for access paths between channel adapters and CM packages in long range.
	PHY_Long_DKA_CMPK.csv	Usage rates for CM packages in long range .
	PHY_Short_CHA_CMPK.csv	Usage rates for access paths between channel adapters and CM packages in short range.
	PHY_Short_DKA_CMPK.csv	Usage rates for access paths between disk adapters and CM packages in short range.
	PHY_Long_MPPCB_CMPK.csv	Usage rates for access paths between MP blades and CM packages in long range.
	PHY_Short_MPPCB_CMPK.csv	Usage rates for access paths between MP blades and CM packages in short range.
	PHY_Long_CMPK_Cache.csv	Cache usage rates within CM packages in long range.
	PHY_Short_CMPK_Cache.csv	Cache usage rates within CM packages in short range.
	PHY_Long_Write_Pending_Rate.csv	Write pending rates in long range in the entire system.
	PHY_Short_Write_Pending_Rate.csv	Write pending rates in short range in the entire system.
	PHY_Short_Cache_Usage_Rate.csv	Usage rates for cache memory in the entire system.
	PHY_Long_Write_Pending_Rate_z.csv	Write pending rates in long range in each MP blade.
	PHY_Short_Write_Pending_Rate_z.csv	Write pending rates in short range in each MP blade.
	PHY_Short_Cache_Usage_Rate_z.csv	Usage rates for cache memory in each MP blade.
	PHY_Cache_Allocate_z.csv	The allocated size of the cache memory in each MP blade (MB).

ZIP file	CSV file	Data saved in the file
		This value does not correspond with the total capacity of cache because the value is same as the allocated size of the cache memory that is managed by an MP blade.
PhyMPU_dat.ZIP (VSP Gx00, Nx00, and VSP Fx00 models)	PHY_Cache_Usage_Rate.csv	Cache memory usage statistics of the entire system.
	PHY_Write_Pending_Rate.csv	Write pending rate of the entire system.
	PHY_Cache_Usage_Rate_z.csv	Cache memory usage statistics for each MP unit.
	PHY_Write_Pending_Rate_z.csv	Write pending rate for each MP unit.
	PHY_Cache_Allocate_z.csv	Amount (MB) of allocated cache memory for each MP unit. This amount is managed by the processor and therefore does not match the total amount of cache memory.

Notes:

- The letters "x-y" in CSV file names indicate a parity group or external volume group.
- The letter "z" in CSV file names indicate a name of MP blade or unit.
- (VSP G1x00 and VSP F1500) Both long range and short range statistics are stored for resource usage and write pending rates.
- (VSP G1x00 and VSP F1500) You can select Long-Range or Short-Range from Data Range field in the Monitor Performance window

Parity group and external volume group statistics

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about parity groups and external volume groups.

ZIP file	CSV file	Data saved in the file
PG_dat.ZIP	PG_IOPS.csv	Number of read and write operations per second
	PG_TransRate.csv	Size of data transferred per second (Kbps)
	PG_Read_TransRate.csv	Size of read data transferred per second (Kbps)
	PG_Write_TransRate.csv	Size of write data transferred per second (Kbps)

ZIP file	CSV file	Data saved in the file
	PG_Read_IOPS.csv	Number of read operations per second
	PG_Rnd_Read_IOPS.csv	Number of random read operations per second
	PG_CFW_Read_IOPS.csv (VSP G1x00 and VSP F1500)	Number of read operations in "cache-fast-write" mode per second
	PG_Write_IOPS.csv	Number of write operations per second
	PG_Seq_Write_IOPS.csv	Number of sequential write operations per second
	PG_Rnd_Write_IOPS.csv	Number of random write operations per second
	PG_CFW_Write_IOPS.csv (VSP G1x00 and VSP F1500)	Number of write operations in "cache-fast-write" mode per second
	PG_Read_Hit.csv	Read hit ratio
	PG_Seq_Read_Hit.csv	Read hit ratio in sequential access mode
	PG_Rnd_Read_Hit.csv	Read hit ratio in random access mode
	PG_CFW_Read_Hit.csv (VSP G1x00 and VSP F1500)	Read hit ratio in "cache-fast-write" mode
	PG_Write_Hit.csv	Write hit ratio
	PG_Seq_Write_Hit.csv	Write hit ratio in sequential access mode
	PG_Rnd_Write_Hit.csv	Write hit ratio in random access mode
	PG_CFW_Write_Hit.csv (VSP G1x00 and VSP F1500)	Write hit ratio in "cache-fast-write" mode
	PG_BackTrans.csv	Number of data transfer operations between cache memory and data drives (for example, parity groups or external volume groups) per second
	PG_C2D_Trans.csv	Number of data transfer operations from cache memory and data drives (for example, parity groups or external volume groups) per second
	PG_D2CS_Trans.csv	Number of data transfer operations from data drives (for example, parity groups or external volume groups) per second to cache memory in sequential access mode

ZIP file	CSV file	Data saved in the file
	PG_D2CR_Trans.csv	Number of data transfer operations from data drives (for example, parity groups or external volume groups) per second to cache memory in random access mode
	PG_Response.csv	Average response time (microsecond) at parity groups or external volume groups
	PG_Read_Response.csv	Average read response time (microsecond) at parity groups or external volume groups
	PG_Write_Response.csv	Average write response time (microsecond) at parity groups or external volume groups

Note: The parity group number is output in the column header of each performance value in these files.

Statistics for volumes in parity/external volume groups

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about volumes in parity groups or in external volume groups.

ZIP file	CSV file	Data saved in the file
LDEV_dat/LDEV_IOPS.ZIP	LDEV_IOPS_x-y.csv	Number of read and write operations per second
LDEV_dat/ LDEV_TransRate.ZIP	LDEV_TransRate_x-y.csv	Size of data transferred per second (Kbps)
LDEV_dat/ LDEV_Read_TransRate.ZIP	LDEV_Read_TransRate_x-y.csv	Size of read data transferred per second (Kbps)
LDEV_dat/ LDEV_Write_TransRate.ZIP	LDEV_Write_TransRate_x-y.csv	Size of write data transferred per second (Kbps)
LDEV_dat/ LDEV_Read_IOPS.ZIP	LDEV_Read_IOPS_x-y.csv	Number of read operations per second
LDEV_dat/ LDEV_Seq_Read_IOPS.ZIP	LDEV_Seq_Read_IOPS_x-y.csv	Number of sequential read operations per second
LDEV_dat/ LDEV_Rnd_Read_IOPS.ZIP	LDEV_Rnd_Read_IOPS_x-y.csv	Number of random read operations per second

ZIP file	CSV file	Data saved in the file
LDEV_dat/ LDEV_CFW_Read_IOPS.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Read_IOPS_x-y.csv	Number of read operations in "cache-fast-write" mode per second
LDEV_dat/ LDEV_Write_IOPS.ZIP	LDEV_Write_IOPS_x-y.csv	Number of write operations per second
LDEV_dat/ LDEV_Seq_Write_IOPS.ZIP	LDEV_Seq_Write_IOPS_x-y.csv	Number of sequential write operations per second
LDEV_dat/ LDEV_Rnd_Write_IOPS.ZIP	LDEV_Rnd_Write_IOPS_x-y.csv	Number of random write operations per second
LDEV_dat/ LDEV_CFW_Write_IOPS.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Write_IOPS_x-y.csv	Number of write operations in "cache-fast-write" mode per second
LDEV_dat/ LDEV_Read_Hit.ZIP	LDEV_Read_Hit_x-y.csv	Read hit ratio
LDEV_dat/ LDEV_Seq_Read_Hit.ZIP	LDEV_Seq_Read_Hit_x-y.csv	Read hit ratio in sequential access mode
LDEV_dat/ LDEV_Rnd_Read_Hit.ZIP	LDEV_Rnd_Read_Hit_x-y.csv	Read hit ratio in random access mode
LDEV_dat/ LDEV_CFW_Read_Hit. ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Read_Hit_x-y.csv	Read hit ratio in "cache-fast-write" mode
LDEV_dat/ LDEV_Write_Hit.ZIP	LDEV_Write_Hit_x-y.csv	Write hit ratio
LDEV_dat/ LDEV_Seq_Write_Hit.ZIP	LDEV_Seq_Write_Hit_x-y.csv	Write hit ratio in sequential access mode
LDEV_dat/ LDEV_Rnd_Write_Hit.ZIP	LDEV_Rnd_Write_Hit_x-y.csv	Write hit ratio in random access mode
LDEV_dat/ LDEV_CFW_Write_Hit.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Write_Hit_x-y.csv	Write hit ratio in "cache-fast-write" mode
LDEV_dat/ LDEV_BackTrans.ZIP	LDEV_BackTrans_x-y.csv	Number of data transfer operations between cache memory and data drives (for example, volumes) per second

ZIP file	CSV file	Data saved in the file
LDEV_dat/ LDEV_C2D_Trans.ZIP	LDEV_C2D_Trans_x-y.csv	Number of data transfer operations from cache memory and data drives (for example, volumes) per second
LDEV_dat/ LDEV_D2CS_Trans.ZIP	LDEV_D2CS_Trans_x-y.csv	Number of data transfer operations from data drives (for example, volumes) per second to cache memory in sequential access mode
LDEV_dat/ LDEV_D2CR_Trans.ZIP	LDEV_D2CR_Trans_x-y.csv	Number of data transfer operations from data drives (for example, volumes) per second to cache memory in random access mode
LDEV_dat/ LDEV_Response.ZIP	LDEV_Response_x-y.csv	Average response time (microseconds) at volumes
LDEV_dat/ LDEV_Read_Response.ZIP	LDEV_Read_Response_x-y.csv	Average read response time (microseconds) at volumes
LDEV_dat/ LDEV_Write_Response.ZIP	LDEV_Write_Response_x-y.csv	Average write response time (microseconds) at volumes
Note: The letters "x-y" in CSV filenames indicate a parity group. For example, if the filename is LDEV_IOPS_1-2.csv, the file contains the I/O rate for each volume in the parity group 1-2.		

Volumes in parity groups or external volume groups (at volumes controlled by a particular CU)

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about volumes in parity groups or external volume groups (at volumes controlled by a particular CU).

ZIP file	CSV file	Data saved in the file
LDEVEachOfCU_dat/ LDEV_Read_TransRate.ZIP	LDEV_Read_TransRate*xx*.csv	The size of read data transferred per second (Kbps)
LDEVEachOfCU_dat/ LDEV_Write_TransRate.ZIP	LDEV_Write_TransRate*xx*.csv	The size of write data transferred per second (Kbps)
LDEVEachOfCU_dat/ LDEV_Read_Response.ZIP	LDEV_Read_Response*xx*.csv	The average read response time (microseconds) at volumes

ZIP file	CSV file	Data saved in the file
LDEVEachOfCU_dat/ LDEV_Write_Response.ZIP	LDEV_Write_Response*xx*.csv	The average write response time (microseconds) at volumes
LDEVEachOfCU_dat/ LDEV_IOPS.ZIP	LDEV_IOPS*xx*.csv	The number of read and write operations per second
LDEVEachOfCU_dat/ LDEV_TransRate.ZIP	LDEV_TransRate*xx*.csv	The size of data transferred per second (Kbps)
LDEVEachOfCU_dat/ LDEV_Read_IOPS.ZIP	LDEV_Read_IOPS*xx*.csv	The number of read operations per second
LDEVEachOfCU_dat/ LDEV_Seq_Read_IOPS.ZIP	LDEV_Seq_Read_IOPS*xx*.csv	The number of sequential read operations per second
LDEVEachOfCU_dat/ LDEV_Rnd_Read_IOPS.ZIP	LDEV_Rnd_Read_IOPS*xx*.csv	The number of random read operations per second
LDEVEachOfCU_dat/ LDEV_CFW_Read_IOPS.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Read_IOPS*xx*.csv	The number of read operations in "cache-fast-write" mode per second
LDEVEachOfCU_dat/ LDEV_Write_IOPS.ZIP	LDEV_Write_IOPS*xx*.csv	The number of write operations per second
LDEVEachOfCU_dat/ LDEV_Seq_Write_IOPS.ZIP	LDEV_Seq_Write_IOPS*xx*.csv	The number of sequential write operations per second
LDEVEachOfCU_dat/ LDEV_Rnd_Write_IOPS.ZIP	LDEV_Rnd_Write_IOPS*xx*.csv	The number of random write operations per second
LDEVEachOfCU_dat/ LDEV_CFW_Write_IOPS.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Write_IOPS*xx*.csv	The number of write operations in "cache-fast-write" mode per second
LDEVEachOfCU_dat/ LDEV_Read_Hit.ZIP	LDEV_Read_Hit*xx*.csv	The read hit ratio
LDEVEachOfCU_dat/ LDEV_Seq_Read_Hit.ZIP	LDEV_Seq_Read_Hit*xx*.csv	The read hit ratio in sequential access mode
LDEVEachOfCU_dat/ LDEV_Rnd_Read_Hit.ZIP	LDEV_Rnd_Read_Hit*xx*.csv	The read hit ratio in random access mode
LDEVEachOfCU_dat/ LDEV_CFW_Read_Hit.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Read_Hit*xx*.csv	The read hit ratio in "cache-fast-write" mode

ZIP file	CSV file	Data saved in the file
LDEVEachOfCU_dat/ LDEV_Write_Hit.ZIP	LDEV_Write_Hit*xx*.csv	The write hit ratio
LDEVEachOfCU_dat/ LDEV_Seq_Write_Hit.ZIP	LDEV_Seq_Write_Hit*xx*.csv	The write hit ratio in sequential access mode
LDEVEachOfCU_dat/ LDEV_Rnd_Write_Hit.ZIP	LDEV_Rnd_Write_Hit*xx*.csv	The write hit ratio in random access mode
LDEVEachOfCU_dat/ LDEV_CFW_Write_Hit.ZIP (VSP G1x00 and VSP F1500)	LDEV_CFW_Write_Hit*xx*.csv	The write hit ratio in "cache-fast-write" mode
LDEVEachOfCU_dat/ LDEV_BackTrans.ZIP	LDEV_BackTrans*xx*.csv	The number of data transfer operations per second between cache memories and data drives (for example, volumes)
LDEVEachOfCU_dat/ LDEV_C2D_Trans.ZIP	LDEV_C2D_Trans*xx*.csv	The number of data transfer operations per second from cache memories and data drives (for example, volumes)
LDEVEachOfCU_dat/ LDEV_D2CS_Trans.ZIP	LDEV_D2CS_Trans*xx*.csv	The number of data transfer operations per second from data drives (for example, volumes) to cache memories in sequential access mode
LDEVEachOfCU_dat/ LDEV_D2CR_Trans.ZIP	LDEV_D2CR_Trans*xx*.csv	The number of data transfer operations per second from data drives (for example, volumes) to cache memories in random access mode
LDEVEachOfCU_dat/ LDEV_Response.ZIP	LDEV_Response*xx*.csv	The average response time (microseconds) at volumes
Note: The letters "*xx*" in CSV filenames indicate a CU number. For example, if the filename is `LDEV_IOPS _10.csv`, the file contains the I/O rate (per second) of the volumes controlled by the CU whose image number is 10.		

Port statistics

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about ports.

Files with statistics about ports

ZIP file	CSV file	Data saved in the file
Port_dat.ZIP	Port_IOPS.csv	The number of read and write operations per second at ports
	Port_KBPS.csv	The size of data transferred per second at ports (Kbps)
	Port_Response.csv	The average response time (microseconds) at ports
	Port_Initiator_IOPS.csv	The number of read and write operations per second at Initiator/External ports
	Port_Initiator_KBPS.csv	The size of data transferred per second at Initiator/External ports (Kbps)
	Port_Initiator_Response.csv	The average response time (microseconds) at Initiator/External ports

Files with statistics about mainframe ports (VSP G1x00 and VSP F1500)

ZIP file	CSV file	Data saved in the file
MF_Port_dat.ZIP	MF_Port_IOPS.csv	The number of read and write operations per second measured at every port
	MF_Port_Response.csv	Response time per port (in microseconds)
	MF_Port_Read_Write_KBPS.csv	Read/write data transfer amount per port (in Kbps)
	MF_Port_Read_KBPS.csv	Read data transfer amount per port (in Kbps)
	MF_Port_Write_KBPS.csv	Write data transfer amount per port (in Kbps)
	MF_Port_Avr_CMR.csv	Average CMR processing time (in microseconds)
	MF_Port_Avr_DisconnectTime.csv	Average disconnection time (in microseconds)

ZIP file	CSV file	Data saved in the file
	MF_Port_Avr_ConnectTime.csv	Average connection time (in microseconds)
	MF_Port_Avr_OpenExchange.csv	Number of open exchanges per second

Host bus adapters connected to ports statistics

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about host bus adapters connected to ports.

ZIP file	CSV file	Data saved in the file
PortWWN_dat.ZIP	PortWWN_*xx*_IOPS.csv	The I/O rate (that is, the number of read and write operations per second) for HBAs that are connected to a port
	PortWWN_*xx*_KBPS.csv	The size of data transferred per second (Kbps) between a port and the HBAs connected to that port
	PortWWN_*xx*_Response.csv	The average response time (microseconds) between a port and the HBAs connected to that port
Notes: ▪ The letters "*xx*" in CSV filenames indicate a port name. For example, if the filename is `PortWWN_1A_IOPS.csv`, the file contains the I/O rate for each host bus adapter connected to the CL1-A port. ▪ If files are exported to a Windows computer, CSV filenames may end with numbers (for example, `PortWWN_1A_IOPS-1.csv` and `PortWWN_1a_IOPS-2.csv`).		

Volumes (LU) statistics

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about volumes (LUs).

ZIP file	CSV file	Data saved in the file
LU_dat.ZIP	LU_IOPS.csv	The number of read and write operations per second

ZIP file	CSV file	Data saved in the file
	LU_TransRate.csv	The size of data transferred per second (Kbps)
	LU_Read_TransRate.csv	The size of read data transferred per second (Kbps)
	LU_Write_TransRate.csv	The size of write data transferred per second (Kbps)
	LU_Read_Response.csv	The average read response time (microseconds)
	LU_Write_Response.csv	The average write response time (microseconds)
	LU_Seq_Read_IOPS.csv	The number of sequential read operations per second
	LU_Rnd_Read_IOPS.csv	The number of random read operations per second
	LU_Seq_Write_IOPS.csv	The number of sequential write operations per second
	LU_Rnd_Write_IOPS.csv	The number of random write operations per second
	LU_Seq_Read_Hit.csv	The read hit ratio in sequential access mode
	LU_Rnd_Read_Hit.csv	The read hit ratio in random access mode
	LU_Seq_Write_Hit.csv	The write hit ratio in sequential access mode
	LU_Rnd_Write_Hit.csv	The write hit ratio in random access mode
	LU_C2D_Trans.csv	The number of data transfer operations per second from cache memories to data drives (for example, LUs)
	LU_D2CS_Trans.csv	The number of data transfer operations per second from data drives (for example, LUs) to cache memories in sequential access mode
	LU_D2CR_Trans.csv	The number of data transfer operations per second from data drives (for example, LUs) to cache memories in random access mode
	LU_Response.csv	The average response time (microseconds) at volumes (LUs)

All host bus adapters connected to ports

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. These files contain statistics about all host bus adapters connected to ports.

ZIP file	CSV file	Data saved in the file
PPCGWWN_dat.ZIP	PPCGWWN_*xx*_IOPS.csv	I/O rate (that is, the number of read and write operations per second) for HBAs belonging to an SPM group
	PPCGWWN_*xx*_KBPS.csv	Transfer rate (Kbps) for HBAs belonging to an SPM group
	PPCGWWN_*xx*_Response.csv	Average response time (microseconds) for HBAs belonging to an SPM group
	PPCGWWN_NotGrouped_IOPS.csv	I/O rate (that is, the number of read and write operations per second) for HBAs that do not belong to any SPM group
	PPCGWWN_NotGrouped_KBPS.csv	Transfer rate (Kbps) for HBAs that do not belong to any SPM group
	PPCGWWN_NotGrouped_Response.csv	Average response time (microseconds), for HBAs that do not belong to any SPM group

Notes:

- The letters "*xx*" in CSV filenames indicate the name of an SPM group.
- If files are exported to a Windows computer, CSV filenames may end with numbers (for example, `PPCGWWN_mygroup_IOPS-1.csv` and `PPCGWWN_MyGroup_IOPS-2.csv`).

MP blades (VSP G1x00 and VSP F1500)

The following table shows the file names and types of information in the **Monitor Performance** window that can be exported to files using Export Tool. The file contains statistics about usage rates of MPs.

ZIP file	CSV file	Data saved in the file
PhyMPPK_dat.ZIP	PHY_MPPK_x.y.csv	The MP usage rate of each resource allocated to MP blades in short range is output in the following formats: ▪ Performance information of LDEVs Kernel-type *;LDEV;LDEV-number;Usage-rate ▪ Performance information of journals Kernel-type *;JNLG; Journal-number;Usage-rates ▪ Performance information of external volumes Kernel-type *;ExG;External-volume-group-number;Usage-rate You can view up to 100 of the most used items in order of use. Caution: Use performance information as a guide to identify resources that greatly increase the MP usage rate. Adding the performance items together does not equal the total estimated capacity of the MPs. Likewise, this performance information is not appropriate to estimate the usage of a particular resource.
* The kernel type is any one of the following types: Open-Target, Open-Initiator, Open-External, MF-Target, MF-External, BackEnd, or System.		

Remote copy operations by TC/TCz and monitoring data by GAD (whole volumes)

The following table shows the file names and types of information on the Usage Monitor tab in the TC, TCz, and GAD window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (whole volumes) by TrueCopy, TrueCopy for Mainframe, and global-active device.

ZIP file	CSV file	Data saved in the file
RemoteCopy_dat.ZIP	RemoteCopy.csv	The following data in the whole volumes are saved: ▪ The total number of remote I/Os (read and write operations) ▪ The total number of remote write I/Os ▪ The number of errors that occur during remote I/O

ZIP file	CSV file	Data saved in the file
		▪ The number of initial copy remote I/Os ▪ The average response time (milliseconds) for initial copy ▪ The average transfer rate (Kbps) for initial copy remote I/Os ▪ The number of update copy remote I/Os ▪ The average transfer rate (Kbps) for update copy remote I/Os ▪ The average response time (milliseconds) for update copy ▪ The percentage of completion of copy operations (for example, number of synchronized pairs / total number of pairs) ▪ The number of tracks that have not yet been copied by the initial copy or resync copy operation

Remote copy operations by TC and monitoring data by GAD (for each volume (LU))

The following table shows the file names and types of information on the Usage Monitor tab in the TC and GAD window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (for each volume (LU)) by TrueCopy and global-active device. (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume.

ZIP file	CSV file	Data saved in the file
RCLU_dat.ZIP	RCLU_All_RIO.csv	The total number of remote I/Os (read and write operations)
	RCLU_All_Write.csv	The total number of remote write I/Os
	RCLU_RIO_Error.csv	The number of errors that occur during remote I/O
	RCLU_Initial_Copy_RIO.csv	The number of initial copy remote I/Os
	RCLU_Initial_Copy_Transfer.csv	The average transfer rate (Kbps) for initial copy remote I/Os
	RCLU_Initial_Copy_Response.csv	The average response time (milliseconds) for the initial copy of each volume (LU)

ZIP file	CSV file	Data saved in the file
	RCLU_Update_Copy_RIO.csv	The number of update copy remote I/Os
	RCLU_Update_Copy_Transfer.csv	The average transfer rate (Kbps) for update copy remote I/Os
	RCLU_Update_Copy_Response.csv	The average response time (milliseconds) for the update copy of each volume (LU)
	RCLU_Pair_Synchronized.csv	The percentage of completion of copy operations (for example, number of synchronized pairs / total number of pairs)
	RCLU_Out_of_Tracks.csv	The number of tracks that have not yet been copied by the initial copy or resync copy operation

Remote copy by TC/TCz and monitoring data by GAD (volumes controlled by a particular CU)

The following table shows the file names and types of information on the Usage Monitor tab in the TC, TCz, and GAD window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (volumes controlled by a particular CU) by TrueCopy, TrueCopy for Mainframe, and global-active device.

ZIP file	CSV file	Data saved in the file
RCLDEV_dat/ RCLDEV_All_RIO.ZIP	RCLDEV_All_RIO_*xx*.csv	The total number of remote I/Os (read and write operations)
RCLDEV_dat/ RCLDEV_All_Write.ZIP	RCLDEV_All_Write_*xx*.csv	The total number of remote write I/Os
RCLDEV_dat/ RCLDEV_RIO_Error.ZIP	RCLDEV_RIO_Error_*xx*.csv	The number of errors that occur during remote I/O
RCLDEV_dat/ RCLDEV_Initial_Copy_RIO.ZIP	RCLDEV_Initial_Copy_RIO_*xx*.csv	The number of initial copy remote I/Os

ZIP file	CSV file	Data saved in the file
RCLDEV_dat/ RCLDEV_Initial_Copy_Transfer.ZIP	RCLDEV_Initial_Copy_Transfer_*xx*.csv	The average transfer rate (Kbps) for initial copy remote I/Os
RCLDEV_dat/ RCLDEV_Initial_Copy_Response.ZIP	RCLDEV_Initial_Copy_Response_*xx*.csv	The average response time (milliseconds) for initial copy at volumes
RCLDEV_dat/ RCLDEV_Update_Copy_RIO.ZIP	RCLDEV_Update_Copy_RIO_*xx*.csv	The number of update copy remote I/Os
RCLDEV_dat/ RCLDEV_Update_Copy_Transfer.ZIP	RCLDEV_Update_Copy_Transfer_*xx*.csv	The average transfer rate (Kbps) for update copy remote I/Os
RCLDEV_dat/ RCLDEV_Update_Copy_Response.ZIP	RCLDEV_Update_Copy_Response_*xx*.csv	The average response time (milliseconds) for the update copy at volumes
RCLDEV_dat/ RCLDEV_Pair_Synchronized.ZIP	RCLDEV_Pair_Synchronized_*xx*.csv	The percentage of completion of copy operations (for example, number of synchronized pairs / total number of pairs)
RCLDEV_dat/ RCLDEV_Out_of_Tracks.ZIP	RCLDEV_Out_of_Tracks_*xx*.csv	The number of tracks that have not yet been copied by the initial copy or Resync copy operation

Note:

- The letters "*xx*" in CSV filenames indicate a CU number. For example, if the filename is `RCLDEV_All_RIO_10.csv`, the file contains the total number of remote I/Os of the volumes controlled by the CU whose image number is 10.

Remote copy by UR and URz (whole volumes)

The following table shows the file names and types of information on the Usage Monitor tab in the UR and URz window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (whole volumes) by Universal Replicator and Universal Replicator for Mainframe.

ZIP file	CSV file	Data saved in the file
UniversalReplicator_dat.zip	UniversalReplicator.csv	The following data in the whole volumes are saved: ▪ The number of write I/Os per second ▪ The amount of data that are written per second (Kbps) ▪ The initial copy hit rate (percent) ▪ The average transfer rate (Kbps) for initial copy operations ▪ The number of asynchronous remote I/Os per second at the primary storage system* ▪ The number of journals at the primary storage system* ▪ The average transfer rate (Kbps) for journals in the primary storage system* ▪ The remote I/O average response time (milliseconds) on the primary storage system* ▪ The number of asynchronous remote I/Os per second at the secondary storage system* ▪ The number of journals at the secondary storage system* ▪ The average transfer rate (Kbps) for journals in the secondary storage system* ▪ The remote I/O average response time (milliseconds) on the secondary storage system*
* Includes the monitoring data at the time of executing initial copy.		

Remote copy by UR and URz (at journals)

The following table shows the file names and types of information on the Usage Monitor tab in the UR and URz window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (at journals) by Universal Replicator and Universal Replicator for Mainframe.

ZIP file	CSV file	Data saved in the file
URJNL_dat.ZIP	URJNL_Write_Record.csv	The number of write I/Os from the host to the P-VOL per second
	URJNL_Write_Transfer.csv	The average transfer rate (KB/sec) of data transferred from the primary storage system
	URJNL_Initial_Copy_Hit.csv	The cache hit rate (percent) of the P-VOL during initial copy
	URJNL_Initial_Copy_Transfer.csv	The average transfer rate (KB/sec) for data transferred from the primary storage system during initial copy
	URJNL_M-JNL_Asynchronous_RIO.csv	The number of asynchronous remote I/Os* that the primary storage system receives from the secondary storage system per second
	URJNL_M-JNL_Asynchronous_Journal.csv	The total number* of journal data transferred from the primary storage system
	URJNL_M-JNL_Asynchronous_Copy_Transfer.csv	The average transfer rate* (KB/sec) of journal data transferred from ports used by UR and URz in the primary storage system
	URJNL_M-JNL_Asynchronous_Copy_Response.csv	The average time (average RIO response time)* (milliseconds) after the primary storage system receives asynchronous remote I/Os until the primary storage system responds to the secondary storage system
	URJNL_R-JNL_Asynchronous_RIO.csv	The total number* of asynchronous remote I/Os from the secondary storage system
	URJNL_R-JNL_Asynchronous_Journal.csv	The total number* of journal data received in the secondary storage system
	URJNL_R-JNL_Asynchronous_Copy_Transfer.csv	The average transfer rate* (KB/sec) for journal data received in the secondary storage system

ZIP file	CSV file	Data saved in the file
	URJNL_R-JNL_Asynchronous_Copy_Response.csv	The average time (average RIO response time)* (milliseconds) after the secondary storage system sends asynchronous remote I/Os until the secondary storage system receives responses from the primary storage system
	URJNL_M-JNL_Data_Used_Rate.csv	Data usage rate (percent) in an area where journal data of the primary storage system is stored
	URJNL_M-JNL_Meta_Data_Used_Rate.csv	Metadata usage rate (percent) in an area where journal data of the primary storage system is stored
	URJNL_R-JNL_Data_Used_Rate.csv	Data usage rate (percent) in an area where journal data of the secondary storage system is stored
	URJNL_R-JNL_Meta_Data_Used_Rate.csv	Metadata usage rate (percent) in an area where journal data of the secondary storage system is stored
* Monitoring data during initial copy is included.		

Remote copy by UR (for each volume (LU))

The following table shows the file names and types of information on the Usage Monitor tab in the UR window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (for each volume (LU)) by Universal Replicator. (VSP G1x00 and VSP F1500) Note that this data cannot be obtained from a mainfame volume.

ZIP file	CSV file	Data saved in the file
URLU_dat.ZIP	URLU_Read_Record.csv	The number of read I/Os from the host to the P-VOL per second
	URLU_Read_Hit.csv	The cash hit rate when the host reads data from the P-VOL
	URLU_Write_Record.csv	The number of write I/Os from the host to the P-VOL per second

ZIP file	CSV file	Data saved in the file
	URLU_Write_Hit.csv	The cash hit rate when the host writes data to the P-VOL
	URLU_Read_Transfer.csv	The average transfer rate (KB/sec) for data transferred when the host reads data from the P-VOL
	URLU_Write_Transfer.csv	The average transfer rate (KB/sec) for data transferred when the host writes data to the P-VOL
	URLU_Initial_Copy_Hit.csv	The cache hit rate (percent) of the P-VOL during initial copy
	URLU_Initial_Copy_Transfer.csv	The average transfer rate (KB/sec) for data transferred from the primary storage system during initial copy

Remote copy by UR and URz (at volumes controlled by a particular CU)

The following table shows the file names and types of information on the Usage Monitor tab in the UR and URz window that can be exported to files using Export Tool. These files contain statistics about remote copy operations (at volumes controlled by a particular CU) by Universal Replicator and Universal Replicator for Mainframe.

ZIP file	CSV file	Data saved in the file
URLDEV_dat/ URLDEV_Read_Record.ZIP	URLDEV_Read_Record_*xx*.csv	The number of read I/Os from the host to the P-VOL per second for a volume with CU number *xx*
URLDEV_dat/ URLDEV_Read_Hit.ZIP	URLDEV_Read_Hit_*xx*.csv	The cache hit rate when the host reads data from the P-VOL for a volume with CU number *xx*
URLDEV_dat/ URLDEV_Write_Record.ZIP	URLDEV_Write_Record_*xx*.csv	The number of write I/Os from the host to the P-VOL per second for a volume with CU number *xx*
URLDEV_dat/ URLDEV_Write_Hit.ZIP	URLDEV_Write_Hit_*xx*.csv	The cache hit rate when the host writes data to the P-VOL for a volume with CU number *xx*

ZIP file	CSV file	Data saved in the file
URLDEV_dat/ URLDEV_Read_Transfer.ZIP	URLDEV_Read_Transfer_*xx*.csv	The average transfer rate (KB/sec) for data transferred when the host reads data from the P-VOL for a volume with CU number *xx*
URLDEV_dat/ URLDEV_Write_Transfer.ZIP	URLDEV_Write_Transfer_*xx*.csv	The average transfer rate (KB/sec) for data transferred when the host writes data to the P-VOL for a volume with CU number *xx*
URLDEV_dat/ URLDEV_Initial_Copy_Hit.ZIP	URLDEV_Initial_Copy_Hit_*xx*.csv	The cache hit rate of the P-VOL for initial copy (percent), for each volume identified by CU number *xx*
URLDEV_dat/ URLDEV_Initial_Copy_Transfer.ZIP	URLDEV_Initial_Copy_Transfer_*xx*.csv	The average transfer rate (KB/sec) for data transferred from the primary storage system during initial copy for a volume with CU number *xx*
Note: The letters "*xx*" in CSV filenames indicate a CU number. For example, if the filename is `URLDEV_Read_Record_10.csv`, the file contains the number of read I/Os (per second) of the volumes controlled by the CU whose image number is 10.		

Causes of invalid monitoring data

If the value of monitoring data in CSV files is less than 0 (zero), consider the following causes:

Invalid values of monitoring data	Probable causes
The monitoring data in the CSV file includes (-1).	The value (-1) indicates that Performance Monitor failed to obtain monitoring data. Probable reasons are: ▪ Performance Monitor attempted to obtain statistics when an operation for restarting the storage system is in progress. ▪ Performance Monitor attempted to obtain statistics when a heavy workload is imposed on the storage system.

Invalid values of monitoring data	Probable causes
	▪ There is no volume in a parity group. ▪ Just after the CUs to be monitored were added, Export Tool failed to save files that contain monitoring data for all volumes or journal volumes used by remote copy software (TC, TCz, UR, URz) and GAD. For details about the files, see Remote copy operations by TC/TCz and monitoring data by GAD (whole volumes) (on page 157), Remote copy by UR and URz (whole volumes) (on page 161), and Remote copy by UR and URz (at journals) (on page 161). ▪ (VSP G1x00 and VSP F1500) If no CU is specified as a monitoring target, the value (-1) is displayed as the monitoring data. ▪ (VSP G1x00 and VSP F1500) If Disable is selected to stop monitoring in the Monitoring Switch field on the **Monitoring Options** window and longrange is specified as the sampling interval, the monitoring data for the period when Performance Monitor stops monitoring is (-1). ▪ (VSP G1x00 and VSP F1500) If you added the CU during monitoring, specified longrange as the sampling interval, and collected monitoring data, the value (-1) is displayed as the monitoring data before the CU was added. ▪ (VSP G1x00 and VSP F1500) If the CU number is not the monitoring target object, Performance Monitor cannot obtain monitoring data from the CU. However, when the RemoteCopy, Universal Replicator, or URJNL operand is specified for the group subcommand, the value (-1) is not displayed as the monitoring data even if the CU number is not the monitoring target object. In that case, data on the monitored CU is added up and output to the CSV file. ▪ (VSP G1x00 and VSP F1500) If all CU numbers are not the monitoring target, the value (0) is displayed as the monitoring data. ▪ (VSP G1x00 and VSP F1500) If the mainframe host runs a command to clear usage information, the monitoring data counter is cleared. As a result, the monitoring data at that point becomes disabled, and the value (-1) displays as the monitoring data.
The monitoring data in the CSV file includes (-3).	The value (-3) indicates that Performance Monitor failed to obtain monitoring data for the following reason:

Invalid values of monitoring data	Probable causes
	If IOPS is 0 (zero), the Response Time that is included in the monitoring data for LUs, LDEVs, ports, WWNs, or external volumes is (-3). Because IOPS is 0 (zero), the average response time becomes invalid.
The monitoring data in the CSV file includes (-4).	The value (-4) indicates that Performance Monitor failed to obtain monitoring data for the following reason: If the period for the monitoring data that is specified with Export Tool does not match the collecting period for monitoring data, Export Tool cannot collect the monitoring data. If data of SVP is updated while the monitoring data is being collected, the collected monitoring data near the collection start time is (-4).
The monitoring data in the CSV file includes "-5".	When the CU number is not the monitoring target object, Performance Monitor cannot obtain monitoring data from the CU. If the PG, LDEV, LU, RCLU, RCLDEV, URLU, or URLDEV operand is specified, the value of the monitoring data is "-5". To solve this problem, specify the CU as the monitoring target object by using the **Monitoring Options** window of Performance Monitor (not by using Export Tool). If the RemoteCopy, Universal Replicator, or URJNL operand is specified, the value "-5" is not output in the monitoring data though the CU number is not the monitoring target object. In this case, data on monitored CUs are summed up and output into the CSV file.

Chapter 5: Server Priority Manager operations

This chapter describes and provides instructions for managing host I/O activity using Hitachi Server Priority Manager.

Overview of Server Priority Manager

Server Priority Manager allows you to set upper limits of the number of accesses from the server to storage system as well as the amount of data transfer. The upper limits are automatically disabled when the traffic between the server and storage system drops to user-defined levels. Server Priority Manager supports Fibre Channel and iSCSI ports connected to open-systems hosts.

By using Server Priority Manager, you can designate prioritized ports (for example, for production servers) and non-prioritized ports (for example, for development servers) and set upper limits and thresholds for the I/O activity of these ports to prioritize I/O operations to host servers requiring high-throughput I/O operations and prevent low-priority activities from negatively impacting high-priority activities.

You can also control the I/O priority for individual volumes (LDEVs) in a storage system by using CCI. When you use CCI to configure LDEV-level Server Priority Manager operations, you can specify an LDEV and a WWN or iSCSI name of a host adapter. Within a single storage system, you can use only one of the following two methods to set I/O priority level: you can specify ports (GUI or CLI), or you can specify LDEVs (CLI only). For important information about using CCI to perform Server Priority Manager operations, see the Command Control Interface Command Reference.

Note: If you want to control the I/O priority for iSCSI-attached volumes, you must use CCI to set the priority at the LDEV level.

Performance of high-priority hosts

In a SAN environment, the storage system is usually connected with many host servers. Some types of host servers often require higher performance than others. For example, production servers such as database and application servers that are used to perform daily tasks of business organizations usually require high performance. If production servers experience decreased performance, productivity in business activities can be negatively impacted. To prevent this from happening, the system administrator needs to maintain the performance of production servers at a relatively high level.

Computer systems in business organizations often include development servers, which are used for developing, testing, and debugging business applications, as well as production servers. If development servers experience decreased performance, development activities can be negatively impacted, but a drop in development server performance does not have as much negative impact to the entire organization as a drop in production server performance. In this case, you can use Server Priority Manager to give higher priority to I/O activity from production servers than I/O activity from development servers to manage and control the impact of development activities.

Upper-limit control

Using Server Priority Manager you can limit the number of I/O requests from servers to the storage system as well as the amount of data that can be transferred between the servers and the storage system to maintain production server performance at the required levels. This practice of limiting the performance of low-priority host servers is called upper-limit control. The upper-limit control is automatically disabled when traffic between the servers and the storage system drops to user-defined levels called thresholds.

Threshold control

While upper-limit control can help production servers to perform at higher levels during periods of heavy use, it may not be desirable when production servers are not busy. For example, if the I/O activity on production servers is high between 09:00 and 15:00 hours and decreases significantly after 15:00, upper-limit control for development servers may not be required after 15:00.

To address this situation Server Priority Manager provides threshold control in which upper-limit control is automatically disabled when I/O traffic between production servers and the storage system decreases to a user-specified level. This user-specified level at which upper-limit control is disabled is called the threshold. You can specify the threshold as an I/O rate (number of I/Os per second) and a data transfer rate (amount of data transferred per second).

For example, if you set a threshold of 500 I/Os per second to the storage system, the upper-limit controls for development servers are disabled when the I/O rate of the production servers drops below 500 I/Os per second. If the I/O rate of the production servers goes up and exceeds 500 I/Os per second, upper-limit control is restored on the development servers.

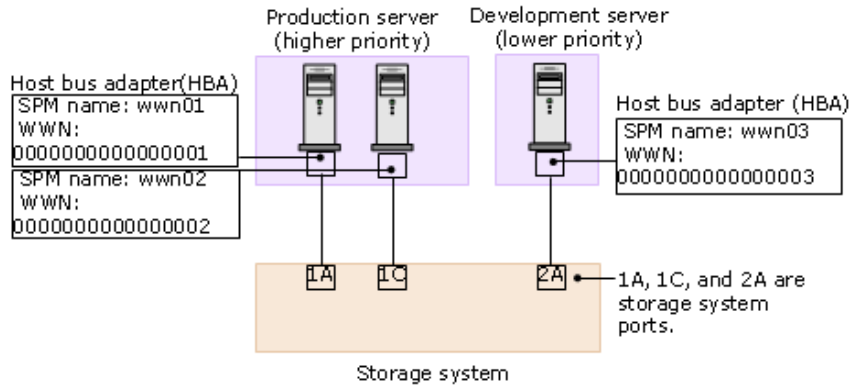
If you also set a threshold of 20 MB per second to the storage system, the upper-limit controls for development servers are disabled when the amount of data transferred between the storage system and the production servers is less than 20 MB per second.

Use cases for Server Priority Manager

This section describes the use cases for implementing Server Priority Manager on your storage system.

Use case for one-to-one connections

The following figure shows an example of a network, called Network A, in which each adapter is connected to only one port on the storage system. The host bus adapters are connected directly to the storage system ports and are not connected via hubs or switches.



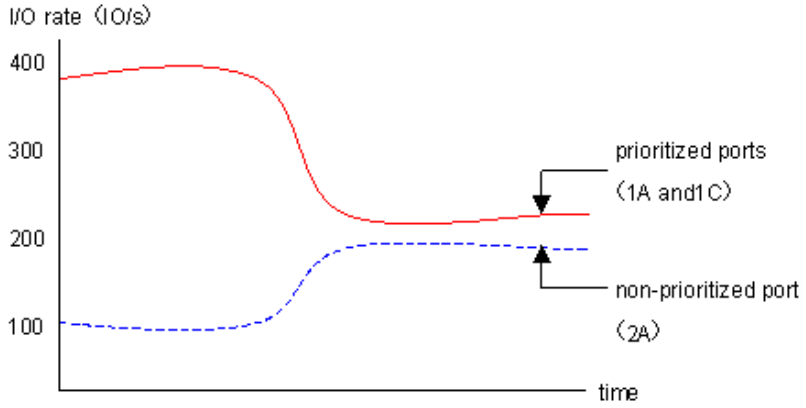
In Network A, ports 1A and 1C are connected to high-priority production servers. Port 2A is connected to a low-priority development server. Therefore, high priority (Prio.) is set to ports 1A and 1C, and low priority (Non-Prio.) is set to port 2A. The following figure shows the priority settings for these ports on the Port tab of the Server Priority Manager main window.

Port	Ave.[IOPS]	Peak[IOPS]	Attribute
CL1-A(EF)	-	-	Prio.
CL3-A(E8)	-	-	Prio.
CL5-A(E4)	-	-	Prio.
CL7-A(E2)	-	-	Prio.
CL1-B(E1)	-	-	Non-Prio.

Prio. : a prioritized port
Non-Prio. : a non-prioritized port

The I/O traffic at the ports is now monitored. When the desired amount of data has been collected, the traffic statistics are reviewed on graphs using the Performance Monitor window. The following figure shows the changes in the I/O rate for the three ports (1A, 1C, and 2A). According to the data, the I/O rate for ports 1A and 1C was approximately 400 IO/s at first, and the I/O rate for port 2A was approximately 100 IO/s at first. However, as the I/O rate for port 2A gradually increased from 100 IO/s to 200 IO/s, the I/O rate for ports 1A and 1C decreased from 400 IO/s to 200 IO/s, which indicates that the performance of the high-priority production servers decreased. If you want to maintain the I/O rate for prioritized ports 1A and 1C at 400 IO/s, you can set an upper limit to the I/O rate for the non-prioritized port 2A.

When an upper limit is set for the first time, it is recommended that the upper limit be approximately 90 percent of the peak traffic. In Network A, the peak I/O rate for the non-prioritized port (2A) is 200 IO/s, so the recommended upper limit for port 2A is 180 IO/s. You can then adjust this value later as needed according to the results of your data analysis.



After upper limit values have been applied, the traffic at the ports is measured to check the result of the upper limits and see whether host performance has improved to a desirable level, in this case 400 IO/s for ports 1A and 1C. If production server performance is not improved to a desirable level, you can adjust the upper limit to a smaller value until the I/O rate for the high priority servers reaches the desirable level.

If you want to allow improved performance for non-prioritized ports when system activity is low, you can apply a threshold. For one-to-one connections threshold values can be set in either of the following two ways:

- Set a threshold to each prioritized port.

  In Network A, if you set a threshold of 200 IO/s to port 1A and a threshold of 100 IO/s to port 1C, the upper limit on the non-prioritized port (2A) is disabled when both of the following conditions occur:

  The I/O rate for port 1A is 200 IO/s or lower.

  The I/O rate for port 1C is 100 IO/s or lower.

- Set one threshold to the entire storage system.

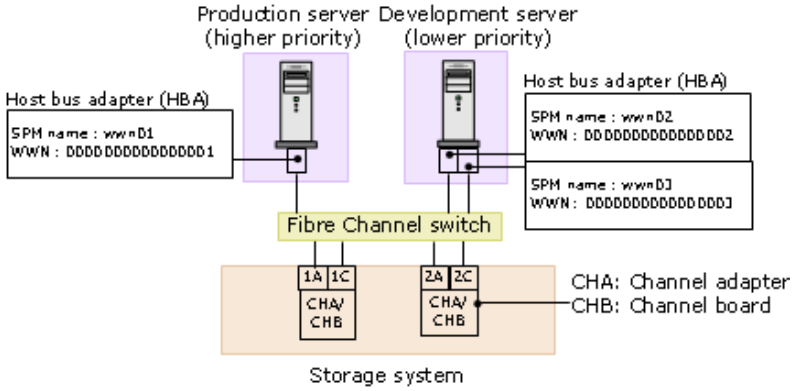
  In Network A, if you set a threshold of 500 IO/s to the storage system, the upper limit on the non-prioritized port (2A) is disabled when the sum of the I/O rates for all prioritized ports (1A and 1C) falls below 500 IO/s.

The following table shows the relationship between the thresholds of prioritized ports and the upper limits of non-prioritized ports.

Threshold settings	Upper limit is set (non-zero) on the non-prioritized port	Upper limit of the non-prioritized port = 0
Threshold is set to the prioritized port	When thresholds are set on multiple prioritized ports, depending on the transfer rate, the following controls are executed: ▪ When the I/O rate or transfer rate goes above the threshold in any prioritized port, the upper limits of all non-prioritized ports are in effect. ▪ When the I/O rate or transfer rate goes below the threshold in all prioritized ports, the upper limits of all non-prioritized ports are not in effect.	The threshold control of the prioritized port is not executed.
Threshold is not set to the prioritized port	The specified upper limit is always in effect.	

Use case for many-to-many connections

The following figure shows an example of a network, called Network B, in which a production server and a development server are connected to the storage system in a many-to-many configuration. HBA wwn01 on the production server is connected to ports 1A, 2A, 1C, and 2C, and HBAs wwn02 and wwn03 on the development server are also connected to the same four ports. CHA is for (VSP G1x00 and VSP F1500), and CHB is for (VSP Gx00, VSP Fx00, and VSP Nx00).

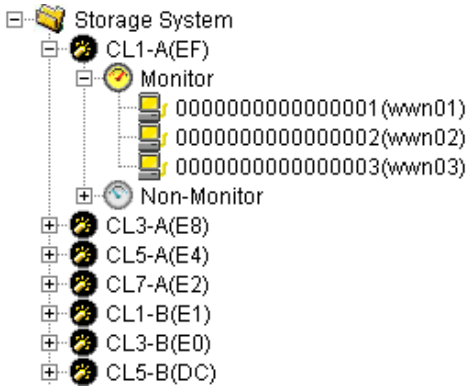


Before using Server Priority Manager, you must find the WWN (Worldwide Name) of each host bus adapter in host servers. WWNs are 16-digit hexadecimal numbers used to identify host bus adapters. For details on how to find WWNs, see the *Provisioning Guide* of your storage system.

When using Server Priority Manager, ensure that all host bus adapters connected to ports in the storage system are monitored. Use the WWN tab of the Server Priority Manager main window to monitor host bus adapters. Place host bus adapters connected to each port below the Monitor icons.

In Network B, each of the four ports in the storage system is connected to three host bus adapters (wwn01, wwn02, and wwn03). Place the host bus adapter icons of wwn01, wwn02, and wwn03 below the Monitor icons for all four port icons.

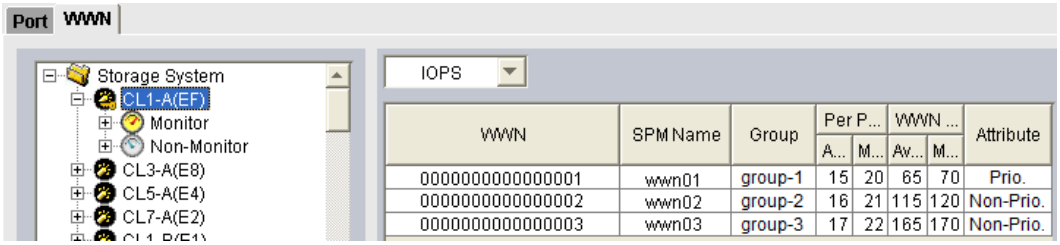
Server Priority Manager is not able to monitor and control the performance of hosts whose host bus adapters are placed below the Non-Monitor icon. Therefore, make sure to place host bus adapters below the Monitor icons.



The priority for the host bus adapters is set using the WWN tab of the Server Priority Manager main window. In Network B, the production server is high priority (Prio.), and the development server is low priority (Non-Prio.). To give priority to the three host bus adapters, take the following steps:

- On the WWN tab of the Server Priority Manager main window, select one of the four ports that the HBAs are connected to (that is, ports 1A, 1C, 2A, and 2C).
- Set Prio. to wwn01. Also, set Non-Prio. to wwn02 and wwn03.

The following figure shows the priority settings for host bus adapters. When you select port 1A and set the priority for host bus adapters, the same settings are automatically applied to the other ports (ports 1C, 2A, and 2C).



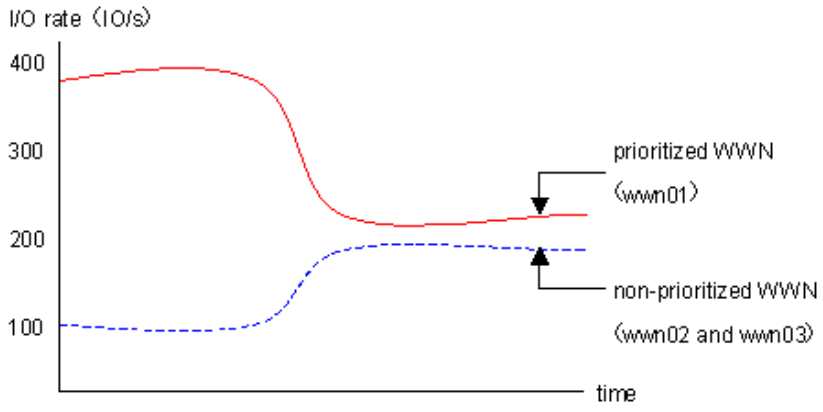
The term prioritized WWN to refers to a high-priority host bus adapter (for example, wwn01). The term non-prioritized port refers to a low-priority host bus adapter (for example, wwn02 and wwn03).

Monitor traffic between host bus adapter and ports. There are two types of traffic statistics: the I/O rate and the transfer rate. The I/O rate is the number of I/Os per second. The transfer rate is the size of data transferred between a host and the storage system per second. When you view traffic statistics in the window, you select either the I/O rate or the transfer rate. For Network B, you must do the following:

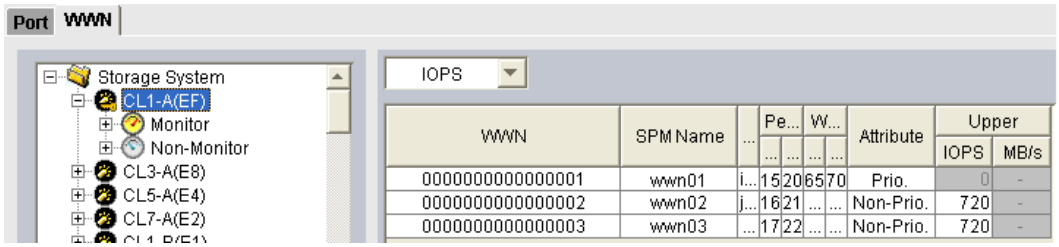
- Measure traffic between port 1A and the three host bus adapters (wwn01, wwn02, wwn03).
- Measure traffic between port 2A and the three host bus adapters (wwn01, wwn02, wwn03).
- Measure traffic between port 1C and the three host bus adapters (wwn01, wwn02, wwn03).
- Measure traffic between port 2C and the three host bus adapters (wwn01, wwn02, wwn03).

The following figure shows these settings on the WWN tab of the Server Priority Manager main window.

The I/O traffic between the ports and host bus adapters is now monitored. When the desired amount of data has been collected, the traffic statistics are reviewed on graphs using the Performance Monitor window. The following graph shows the measured I/O rate for the paths between each port and the host bus adapters. According to the data, the I/O rate for the path between port 1A and the prioritized WWN (wwn01) was approximately 400 IO/s at first, and the I/O rate for the path between port 1A and the non-prioritized WWNs (wwn02 and wwn03) was approximately 100 IO/s at first. However, as the I/O rate for the non-prioritized WWNs gradually increased from 100 IO/s to 200 IO/s, the I/O rate for the prioritized WWN decreased from 400 IO/s to 200 IO/s, which indicates a decrease in the performance of the prioritized WWN.



To maintain a higher I/O rate (400 IO/s) for the prioritized WWN, you can set upper limits on the I/O rate for the non-prioritized WWNs to minimize their effect on the performance of the high-priority production server. When an upper limit is set for the first time, it is recommended that the upper limit value be approximately 90 percent of the peak traffic level. In Network B, the peak I/O rate at the paths between each of the four ports and the non-prioritized WWNs (wwn02 and wwn03) is 200 IO/s, so the recommended upper limit for wwn02 and wwn03 is 720 IO/s (200 × 4 × 0.90). The following figure shows the result of setting the upper limit of 720 IO/s on the paths between port 1A and non-prioritized WWNs wwn02 and wwn03 on the WWN tab of the Server Priority Manager main window.



After upper limits have been applied, the traffic is measured again to check the result of the upper limits and see whether host performance has improved to a desirable level, in this case 400 IO/s for wwn01. If not, you can adjust the upper limit of non-prioritized WWNs to a smaller value until the I/O rate for wwn01 reaches the desirable level.

If you want to allow higher performance for non-prioritized WWNs when system activity is low, you can apply a threshold. For many-to-many connections you can specify one threshold for the entire storage system, regardless of the number of prioritized WWNs. For example, if there are three prioritized WWNs in the network and the threshold is 100 IO/s, the upper limit on the non-prioritized WWNs is disabled when the sum of the I/O rates for all three prioritized WWNs falls below 100 IO/s.

The following table shows the relationship between the thresholds of prioritized WWNs and the upper limits of non-prioritized WWNs.

Threshold settings	Upper limit is set (non-zero) to the non-prioritized WWN	Upper limit of the non-prioritized WWN = 0
Threshold is set to the prioritized WWN	When thresholds are set to prioritized WWNs, depending on the I/O rate or the transfer rate, the following controls are executed. ▪ If the total value of I/O rate or transfer rate exceeds the threshold in all prioritized WWNs, upper limits of all non-prioritized WWNs are in effect. ▪ If the total value of I/O rate or transfer rate goes below the threshold in all prioritized WWNs, upper limits of all non-prioritized WWNs are not in effect.	The threshold control of the prioritized WWN is not executed.
Threshold is not set to the prioritized WWN	The specified upper limit is always in effect.	

Cautions and restrictions for Server Priority Manager

- (VSP Gx00, VSP Fx00, and VSP Nx00) **Using Universal Volume Manager**

  Server Priority Manager monitors the I/O requests between the storage systems for Universal Volume Manager.

  I/O requests issued from a port on the local storage system are not subject to the upper limit control, therefore I/Os are not restricted.

  If you set the priority attribute to an external storage system port, all I/Os received on the port are controlled as the threshold control, and its performance data is added to the total number of I/Os of all prioritized ports. I/Os on the port will not be limited.

  If you set the non-priority attribute to an external storage system port, I/O requests from the local storage system port are controlled as the upper limit value control, and I/Os on the port will be limited. On the other hand, I/O requests from a host are controlled by upper limit control, and I/Os on the port will be limited.

- **Real-time monitoring mode**

  Server Priority Manager cannot be started when Performance Monitor is in real-time mode. Before starting Server Priority Manager, ensure that Time Range in the **Monitor Performance** window is not set to Use Real Time.

- (VSP G1x00 and VSP F1500) **Using Universal Volume Manager**

  When using Universal Volume Manager, Server Priority Manager monitors I/Os between storage systems.

  I/Os issued from Initiator port of your storage systems are not controlled by upper limit control and not limited.

  When using Universal Volume Manager, if you specify the external storage system port as a priority port with Server Priority Manager, all the I/Os received from the port are controlled by threshold control, and its performance data is added. I/Os are not limited in this port.

  When using Universal Volume Manager, if you specify the external storage system port as a non priority port with Server Priority Manager, I/Os received from the Initiator port of the storage system are controlled by upper limit control and limited. I/Os received from the host are also controlled by upper limit control and limited.

- **Remote copy ports**

  When the remote copy functions (TrueCopy, TrueCopy for Mainframe, Universal Replicator, Universal Replicator for Mainframe) or global-active device are used in your environment, Server Priority Manager monitors write I/O requests issued from the initiator ports of your storage system.

  I/O requests issued from a port on the primary storage system is not subject to the upper limit control, therefore I/Os are not restricted.

  (VSP G1x00 and VSP F1500) I/Os issued from Initiator port of your storage system are not controlled by upper limit control and not limited.

  If you set the priority attribute to an RCU target port, all I/Os received on the port are controlled as the threshold control, and its performance data is added to the total number of I/Os (or the transfer rate) of all prioritized ports. I/Os on the port will not be limited.

  If you set the non-priority attribute to an RCU target port, I/O requests from the initiator port are not controlled by threshold control, and I/Os on the port will not be limited. On the other hand, I/O requests from a host are controlled by upper limit control, and I/Os on the port will be limited.

- (VSP Gx00, VSP Fx00, and VSP Nx00) **Statistics for storage system ports at the primary site**

  The I/O requests from the storage system ports at the primary site are not controlled by Server Priority Manager.

- (VSP G1x00 and VSP F1500) **Statistics for initiator/external ports**

  The initiator ports and external ports of your storage system are not controlled by Server Priority Manager. Although you can set Prioritize or Non-Prioritize to initiator ports and external ports by using Server Priority Manager, the initiator ports and the external ports become the prioritized ports that are not under threshold control, regardless of whether the setting of the ports are Prioritize or Non-Prioritize. If the port attributes are changed from Initiator/External into Target/RCU Target, the settings by Server Priority Manager take effect instantly and the ports are subject to threshold or upper limit control.

  The statistics of the **Monitor Performance** window are sum total of statistics on Target/RCU Target ports that are controlled by Server Priority Manager. The statistics does not include the statistics of Initiator/External ports. Because the statistics of Initiator/External ports and Target/RCU Target ports are based on different calculation methods, it is impossible to sum up the statistics of Initiator/External ports and Target/RCU Target ports.

- **Settings on the Server Priority Manager main window**

  The Server Priority Manager main window has two tabs: the Port tab and the WWN tab. The settings on only one tab at a time can be applied to the storage system. If you make settings on both tabs, the settings cannot be applied at the same time. When you select Apply, the settings on the last tab on which you made settings are applied, and the settings on the other tab are discarded.

- **Using Command Control Interface**

  Do not perform Server Priority Manager operations from CCI and the GUI at the same time.

  Note: When you are using Server Priority Manager in Command Control Interface, you cannot perform the setting required for WWN monitoring.

  If you change some settings for Server Priority Manager from CCI, you cannot change Server Priority Manager and the monitoring WWN of Performance Monitor settings from the GUI. If you do, some settings might not appear. Before you change features that use Server Priority Manager, delete all Server Priority Manager settings from the currently used features.

  To delete all settings specified from Device Manager - Storage Navigator, open the Server Priority Manager main window, and click either the Port or WNN tab, and then click the Initialize button to initialize the settings.

- **Connecting one HBA to multiple ports**

  If one host bus adapter is connected to multiple ports and you specify an upper limit of the non-prioritized WWN for one port, the specified upper limit value will be applied to the host bus adapter settings for other connected ports automatically.

- **Setting the connection between host bus adapter and port**

  To make setting for connecting the host bus adapter's WWN and the port, use the WWN tab of the Server Priority Manager main window. Alternatively you can use the Monitored WWNs tab of the Performance Monitor main window. Note that the monitored WWN name displayed in Performance Monitor is displayed as the SPM name in Server Priority Manager.

- **Differences of operations between Device Manager - Storage Navigator and CCI**

  There are differences in operations for Server Priority Manager information between Device Manager - Storage Navigator and CCI. The table below describes the differences. For details, see the *Command Control Interface User and Reference Guide*.

Object	Operation	Device Manager - Storage Navigator	CCI	
		Operable	Operable	Command example*
port (FC only)	Set Server Priority Manager information	Yes	No	-
	Delete Server Priority Manager information	Yes	No	-
	Get Server Priority Manager information	Yes	No	-
wwn (FC only)	Set Server Priority Manager information	Yes	Yes	raidcom modify spm_wwn
	Delete Server Priority Manager information	Yes	Yes	raidcom delete spm_wwn
	Get Server Priority Manager information	Yes	Yes	raidcom get spm_wwn

Object	Operation	Device Manager - Storage Navigator	CCI	
		Operable	Operable	Command example*
LDEV (FC and iSCSI)	Set Server Priority Manager information	No	Yes	raidcom modify spm_ldev
	Delete Server Priority Manager information	No	Yes	raidcom modify spm_ldev
	Get Server Priority Manager information	No	Yes	raidcom modify spm_ldev
* For details, see *Command Control Interface User and Reference Guide*.				

When you perform one or more of the following operations, the upper limit value control might be disabled for about two minutes:

- Adding, replacing, or removing cache memory
- Changing the system configuration
- Updating the microcode/firmware
- Replacing MP blade /controller
- Adding, replacing, or removing the front-end director
- Powering on and off the storage system

Note: The upper limit value control might be disabled when an abnormal condition occurs, such as a network failure or damage to the HBA or Fibre cable, as these conditions can cause the login or logout of the host. Resolve the cause of the unexpected login/logout behavior and then enable the upper limit value control.

- **Differences of registration numbers between Device Manager - Storage Navigator and CCI**

The following table describes differences between Device Manager - Storage Navigator and CCI regarding the number of ports, WWNs, and LDEVs.

Item	Description	Registration number	
		Device Manager - Storage Navigator	CCI
Port	Number of ports that can be registered for a storage system	192[1] (VSP G1x00 and VSP F1500) 80[1] (VSP Gx00, VSP Fx00, and VSP Nx00)	Not supported
WWN	Number of WWNs that can be registered for a storage system	2,048	2,048
	Number of SPM groups that can be registered for a storage system	512[2] (VSP G1x00 and VSP F1500) 255 (VSP Gx00, VSP Fx00, and VSP Nx00)	512[2] (VSP G1x00 and VSP F1500) 255 (VSP Gx00, VSP Fx00, and VSP Nx00)
	Number of WWNs that can be registered for a port	32	32
	Number of WWNs that can be registered for an SPM group	32	2,048
LDEV	Number of LDEVs that can be registered for a storage system	Not supported	16,384[3]
	Number of WWNs that can be registered for a storage system	Not supported	2,048[4]
	Number of iSCSI names that can be registered for a storage system	Not supported	2,048[4]
	Number of WWNs that can be registered for an LDEV	Not supported	32[5]

Item	Description	Registration number	
		Device Manager - Storage Navigator	CCI
	Number of iSCSI names that can be registered for an LDEV	Not supported	32[5]

Notes:

1. If the number of ports installed in a storage system is less than 192 (VSP G1x00 and VSP F1500) or 80 (VSP Gx00, VSP Fx00, and VSP Nx00), the maximum number of ports that can be registered is the number of ports installed in a storage system.
2. (VSP G1x00 and VSP F1500) You can create up to 255 SPM groups if the microcode version is earlier than 80-05-6x, and up to 512 SPM groups if the microcode version is 80-05-6x or later.
3. If the number of LDEVs installed in a storage system is less than 16,384, the maximum number of LDEVs that can be registered is the number of LDEVs installed in a storage system.
4. The maximum number of WWNs and iSCSI names for a storage system is 2,048.
5. The maximum total number of WWNs and iSCSI names for an LDEV is 32.

Implementing Server Priority Manager: one-to-one connections

This section describes and provides instructions for implementing Server Priority Manager for one-to-one connections.

Server Priority Manager workflow: one-to-one connections

The workflow for Server Priority Manager depends on the connection between the host bus adapters and the ports. When one-to-one connections are established between host bus adapters and ports, you can manage the priority of I/O operations on each port. You can specify upper limit values on the non-prioritized ports. You can also specify threshold values on the prioritized ports or apply one threshold value to the entire storage system. When traffic drops below this threshold, the upper limits on non-prioritized ports are disabled to allow higher performance on non-prioritized ports during periods of low system activity.

The Port tab of the Server Priority Manager main window is used to manage Server Priority Manager operations for one-to-one connections.

1. If desired, assign names to the WWNs for ease of identification. For details, see Changing the SPM name of a host bus adapter (on page 196) .

2. Set the priority (Prio or Non-Prio) for the ports of the storage system. For details, see Setting priority for ports: one-to-one connections (on page 183).
3. Monitor the I/O traffic at the prioritized and non-prioritized ports to collect data and statistics for analysis. For details, see Monitoring WWNs (on page 30).
4. Analyze the traffic statistics that you have collected to determine the appropriate upper limits to set for the non-prioritized ports. For details, see Analyzing traffic statistics: one-to-one connections (on page 184).
5. Set upper limits for I/O traffic at the non-prioritized ports to prevent these ports from affecting the prioritized ports. For details, see Setting upper-limit values for non-prioritized ports: one-to-one connections (on page 184).
6. Monitor the I/O traffic at the ports again to check the results of applying the upper limits to the non-prioritized ports, and adjust the upper-limit values as needed.
7. If desired, apply a threshold to the ports or to the entire storage system to allow higher performance at non-prioritized ports when activity on the prioritized ports or storage system is low. For details, see Setting a threshold: one-to-one connections (on page 186).

Setting priority for ports: one-to-one connections

Prioritized ports are ports on which processing has high priority, and non-prioritized ports are ports on which processing has lower priority. Specify a port that connects to a high-priority host bus adapter as a prioritized port. Specify a port that connects to a lower-priority host bus adapter as a non-prioritized port.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Select the **Port** tab.
5. Select **All** from the list at the top right corner of the window.
6. Right-click a high-priority port, and in the pop-up menu select **Non-Prio -** > > **Prio**. The **Attribute** column displays **Prio**. Repeat this action for each high-priority port.
7. Right-click a lower-priority port and in the pop-up menu select **Prio -** > > **Non-Prio**. The **Attribute** column displays **Non-Prio**. Repeat this action for each lower-priority port. You can set upper limit values only on the **Non-prio.** ports.
8. Click **Apply** to apply the settings to the storage system.

   Now that you have set the port priorities, you can start monitoring the traffic (I/O rates and transfer rates) to collect data for analysis.

Analyzing traffic statistics: one-to-one connections

You must analyze the traffic statistics to determine the upper limit values to be applied to I/O rates or transfer rates on non-prioritized ports.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Select the **Port** tab.
5. Select **All** from the list at the top right corner of the window.
6. Display the desired traffic statistics as follows:
   - To view I/O rates, select **IOPS** from the list at the upper left corner of the list.
   - To view transfer rates, select **MB/s** from the list at the upper left corner of the list.

   The list displays the traffic statistics (average and peak I/O rates or transfer rates) of the ports.
7. Analyze the data in the list to determine the upper limit values to be applied to non-prioritized ports and, if desired, the threshold values to be applied to prioritized ports or the storage system.
8. To view the traffic statistics on data graphs, see Displaying the monitor data on graphs (on page 37).

   To export the traffic statistics (as text in CSV format) for analysis in other applications, see Using Export Tool (on page 76).

Setting upper-limit values for non-prioritized ports: one-to-one connections

After you analyze traffic statistics, you can set upper limit values for I/O rates or data transfer rates on non-prioritized ports to provide better performance for high-priority host servers. For details about upper limit values, see Upper-limit control (on page 169).

When you set an upper limit for the first time, it is recommended that the upper limit value be approximately 90 percent of the peak traffic.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Select the **Port** tab.
5. Select whether to limit the I/O rate or the transfer rate for the non-prioritized port:
   - To limit the I/O rate, select **IOPS** from the list at the upper left corner of the list.
   - To limit the transfer rate, select **MB/s** from the list at the upper left corner of the list.
6. Locate the non-prioritized port in the list.

   Note: The **Attribute** column of the list indicates whether ports are prioritized or non prioritized. If you cannot find any non prioritized port in the list, check the list at the top right corner of the window. If the list displays **Prioritize**, select **All** or **Non Prioritize** from the list.
7. Enter the desired upper limit value for the non-prioritized port:
   - To set the upper limit for the I/O rate, double-click the desired cell in the **IOPS** column in **Upper**, and enter the upper limit value in the cell.
   - To set the upper limit for the transfer rate, double-click the desired cell in the **MB/s** column in **Upper**, and enter the upper limit value in the cell.

     In the list, either the **IOPS** or **MB/s** column is activated depending on the selected rate. You can use either of them to specify the upper limit value for one port. You can specify different types of rates (**IOPS** or **MB/s**) for the upper limit values of different non-prioritized ports.

     The upper limit value that you entered is displayed in blue.

     Caution: If an upper limit of the non-prioritized WWN is set to zero or nearly zero, I/O performance might be lowered. If I/O performance is lowered, the host cannot be connected to the storage system in some cases.
8. Click **Apply** to apply the settings to the storage system. The upper limit value that you entered turns black.

Setting a threshold: one-to-one connections

When one-to-one connections are established between HBAs and ports, you can set a threshold value for each prioritized port or one threshold value for the entire storage system. When traffic between high-priority servers and the ports or storage system falls below the specified threshold level, upper limit control is disabled to allow higher performance on non-prioritized ports during periods of low activity on prioritized ports. For details about threshold values, see Threshold control (on page 169) .

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **Port** tab.
5. If you want to set a threshold value for each prioritized port, select the type of rates for the threshold value from the list in the upper left corner of the list.
   - To use the I/O rates for the threshold value, select **IOPS**.
   - To use the transfer rates for the threshold value, select **MB/s**.

   If you want to set one threshold value for the entire storage system, this step is unnecessary.

6. Set the desired threshold value:
   - To set a threshold to each prioritized port, locate the desired prioritized port, which is indicated by **Prio.** in the **Attribute** column. Next, double-click the cell in the **IOPS** or **MB/s** column in **Threshold**, and then enter the threshold value. In the list, either of **IOPS** or **MB/s** column is activated depending on the rate selected at step 5 above. Repeat this operation to set the thresholds for all prioritized ports. You can use different types of rates (**IOPS** or **MB/s**) for thresholds of different prioritized ports.

     Caution: If you enter zero (0) in a cell to disable the upper limit, the cell displays a hyphen (–) and the threshold for the prioritized port becomes ineffective. If the thresholds of all prioritized ports are ineffective, threshold control will not be performed but upper limit control will be performed. If you set thresholds for multiple prioritized ports and the I/O rate or transfer rate goes below the threshold at all prioritized ports, threshold control works in the entire storage system and the upper limits of the non-prioritized ports are disabled.

   - To set one threshold to the entire storage system, select the **All Thresholds** check box. Next, select **IOPS** or **MB/s** from the list of right side in **All Thresholds** and enter the threshold value in the text box. Even if the types of rates for upper limit values and the threshold are different, the threshold control can work for all non-prioritized ports.
7. Click **Apply** to apply the settings to the storage system.

Implementing Server Priority Manager: many-to-many connections

This section describes and provides instructions for implementing Server Priority Manager for many-to-many connections.

Server Priority Manager workflow: many-to-many connections

The workflow for using Server Priority Manager depends on the connection between the host bus adapters and the storage system ports. When many-to-many connections are established between HBAs and storage system ports, the server priority cannot be defined by the port, because one port can be connected to multiple adapters and multiple ports can be connected to one adapter. For many-to-many connections, you can specify the priority of I/O operations and the upper limit value for each host bus adapter, and you can specify one threshold value for the entire storage system.

The WWN tab of the Server Priority Manager main window is used to manage Server Priority Manager operations for many-to-many connections.

1. Find the WWNs of the host bus adapters. For details about finding WWNs, see the *Provisioning Guide* of your storage system.
2. If desired, assign names to the WWNs for ease of identification. For details, see Changing the SPM name of a host bus adapter (on page 196).

3. If you want to manage multiple host bus adapters as a single group, create SPM groups. For details, see Creating an SPM group (on page 199).
4. Set the priority (Prio or Non-Prio) on the host bus adapters (WWNs). For details, see Setting priority for WWNs: many-to-many connections (on page 188).
5. Monitor the I/O traffic for all prioritized and non-prioritized host bus adapters to collect data and statistics for analysis. For details, see Monitoring WWNs (on page 30).
6. Analyze the traffic statistics that you have collected to determine the appropriate upper limits to set for the non-prioritized WWNs. For details, see Analyzing traffic statistics: many-to-many connections (on page 192).
7. Set upper limits for traffic on non-prioritized WWNs to prevent these WWNs from affecting the prioritized WWNs. For details, see Setting upper-limit values for non-prioritized WWNs: many-to-many connections (on page 193).
8. Monitor traffic at the ports again to check the results of applying the upper-limit values to the non-prioritized WWNs, and adjust the upper-limit values as needed.
9. If desired, apply a threshold to the entire storage system to allow higher performance for the non-prioritized WWNs when activity on the storage system is low. For details, see Setting a threshold for the entire storage system: many-to-many connections (on page 195).

Setting priority for WWNs: many-to-many connections

If many-to-many connection is established between HBAs and ports, you need to define the priority of WWNs, measure the traffic between the HBAs and the ports that the HBAs are connected to, and analyze the traffic data.

The HBAs are divided into two types: prioritized WWNs and non-prioritized WWNs. Specify an HBA on which high-priority processing is performed as a prioritized WWN. Specify an HBA on which lower-priority processing is performed as a non-prioritized WWN.

Note: You cannot change the priority of a WWN that is contained in an SPM group. For details on how to change the attribute of a WWN contained in an SPM group, see Changing the priority of an SPM group (on page 201).

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.

4. Select the **WWN** tab.
5. Select **All** from the list at the top right corner of the window.
6. In the upper-left tree, double-click a port.
7. Double-click **Monitor**, which is displayed below the specified port.
8. Check to see if all WWNs of the host bus adapters to be controlled by using Server Priority Manager appear below **Monitor**.

   If some of the WWNs are missing, use the procedure in Monitoring all port-HBA traffic: many-to-many connections (on page 189) to move all WWNs to below **Monitor**.
9. Click **Monitor** to display the information of the host bus adapters that are monitored in the list on the right of the tree.
10. Right-click a host bus adapter (WWN) in the list, and in the pop-up menu select **Non-Prio -** > > **Prio**.

    The **Attribute** column of the selected WWN in the list displays **Prio**. If you want to specify more than one prioritized WWN, repeat this operation.
11. Right-click a host bus adapter (WWN) in the list, and in the pop-up menu select **Prio -** > > **Non-Prio**.

    The **Attribute** column of the selected WWN in the list displays **Non-Prio**. If you want to specify more than one non-prioritized WWN, repeat this operation.

    Note: You cannot change the priority of a WWN which is contained in an SPM group. For details on how to change the attribute of a WWN contained in an SPM group, see Changing the priority of an SPM group (on page 201).

    You must set upper limit values for the **Non-prio.** specified ports. For details, see Setting upper-limit values for non-prioritized WWNs: many-to-many connections (on page 193).
12. Repeat steps 6 to 11 for ports (except for the port selected in step 6).

    If one host bus adapter is connected to multiple ports and you specify the priority of the host bus adapter for one port, the specified priority will be also applied to the host bus adapter settings for other connected ports automatically.
13. In the Server Priority Manager main window click **Apply** to apply the settings to the storage system.

Result

For instructions on measuring traffic (I/O rates and transfer rates), see Starting monitoring (on page 29).

Monitoring all port-HBA traffic: many-to-many connections

When many-to-many connections are established between HBAs and ports, you must make sure that all traffic between HBAs and ports is monitored.

Before you begin

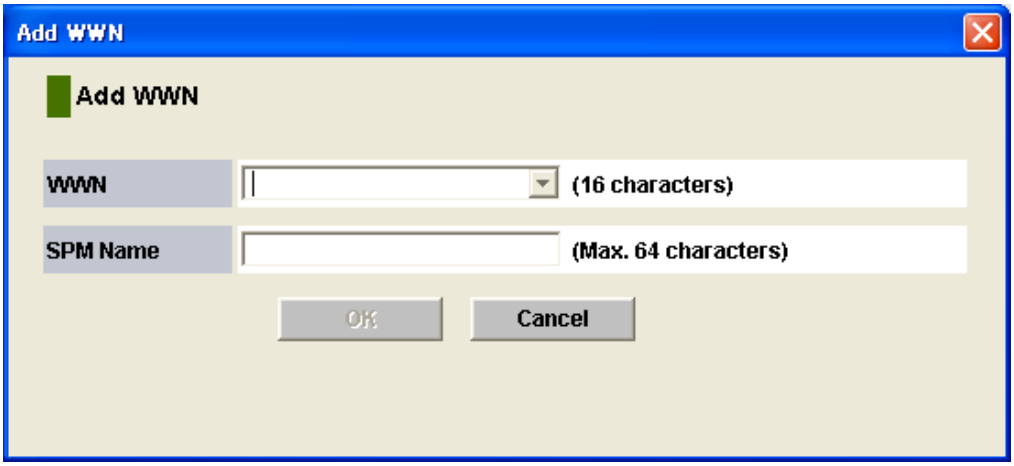
- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Click the **WWN** tab.

   Two trees are displayed on the left side of the **WWN** tab. The upper-left tree lists ports in the storage system.
5. Select **All** from the list at the top right corner of the window.
6. In the upper-left tree, double-click a port.
7. Double-click **Non-Monitor** below the specified port.

   If there are any host bus adapters whose traffic with the specified port are not monitored, those host bus adapters are displayed below **Non-Monitor**.
8. Right-click **Monitor**, and then select **Add WWN** to open the **Add WWN** window.



9. In the **Add WWN** window, specify the WWN and the SPM name.

   Expand the **WWN** list to show the WWNs of the host bus adapters that are connected to the port but are not monitored. These host bus adapters are the same as that displayed in step 7. From that list, select a WWN and specify the SPM name (up to 64 characters).

> **Note:** It is recommended that you specify the same names for the SPM names and the host bus adapter nicknames defined in LUN Manager for convenience of host bus adapter management. In the Performance Monitor window, both the SPM names and the nicknames are displayed as the aliases of host bus adapters (WWNs), so if you use the same names, management of the host bus adapters is easier.

10. Click **OK**. The selected WWN (of the host bus adapter) is moved from **Non-Monitor** to **Monitor**.

    If the specified host bus adapter is connected to other ports, after clicking **OK**, a message appears asking whether to change the settings of that host bus adapter for other ports. Apply the same setting to all of the ports.
11. Repeat steps 8 to 10 to move all host bus adapters from below **Non-Monitor** to below **Monitor**.

    Up to 32 host bus adapters (WWNs) can be monitored for one port. If more than 32 host bus adapters are connected to one port, the traffic statistics for all host bus adapters cannot be monitored. Consider the intended use of each host, and place the host bus adapters that do not need to be monitored below **Non-Monitor**.

    > **Note:** When you disconnect a host that has been connected via a cable to your storage system or change the port to the another port of the host, the WWN for the host will remain in the WWN list on the **WWN** tab. To remove the WWN from the list, you need to delete the WWN using LUN Manager. For details, see the *Provisioning Guide* of your storage system.
12. In the Server Priority Manager main window click **Apply** to apply the settings to the storage system.
13. If you add a port or a host bus adapter to the storage system after the settings above, the traffic for the new port or host bus adapter will not be monitored. In this case, follow this procedure again to make sure all traffic between host bus adapters and ports is being monitored.

Excluding traffic between an HBA and a port from the monitoring target: many-to-many connections

Up to 32 host bus adapters (WWNs) can be monitored for one port. If more than 32 host bus adapters are connected to one port, the traffic statistics for all host bus adapters cannot be monitored. Consider the intended use of each host, and move the host bus adapters that do not need to be monitored to Non-Monitor.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Click the **WWN** tab.
5. Select **All** from the list at the top right corner of the window.
6. In the upper-left tree, double-click a port to which more than 32 host bus adapters are connected.
7. Double-click **Monitor** below the specified port.
8. Right-click the WWN of a host bus adapter you want to exclude from the monitoring target and then select **Delete WWN** from the pop-up menu.

   If the selected host bus adapter is connected to multiple ports, when you select the host bus adapter and select the **Delete WWN** pop-up menu, a message will appear that asks you whether to move the host bus adapter from **Monitor** to **Non-Monitor** below all other ports, too.

   If the selected host bus adapter is contained in an SPM group, a message will appear that tells you to delete the host bus adapter from the SPM group on ahead. You cannot move a host bus adapter that is contained in an SPM group from **Monitor** to **Non-Monitor**. For details on how to delete a host bus adapter from an SPM group, see Deleting an HBA from an SPM group (on page 200) .
9. Click **OK** for the confirmation message that asks you whether to delete the host bus adapter.

   The deleted host bus adapter (WWN) is moved from **Monitor** to **Non-Monitor**.
10. In the **Server Priority Manager** main window click **Apply** to apply the settings to the storage system.

Analyzing traffic statistics: many-to-many connections

The traffic statistics indicate the number of I/Os via ports from HBAs and the amount of data that has been transferred between ports and HBAs. You must analyze the traffic statistics to determine the upper limit values to be applied to I/O rates or transfer rates for low-priority HBAs.

The following procedure uses the Server Priority Manager main window to analyze traffic statistics. You can also use the Performance Monitor window to analyze traffic statistics and display a line graph that shows the changes in traffic.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Select the **WWN** tab.
5. Select **All** from the list at the top right corner of the window.
6. Select whether to analyze I/O rate or transfer rates:
   - To analyze I/O rates, select **IOPS** from the list at the upper left corner.
   - To analyze transfer rates, select **MB/s** from the list at the upper left corner of the list.
7. Below the **Storage System** folder in the upper-left tree, click the icon of the port whose traffic statistics you want to collect.

   The list displays traffic statistics (I/O rates or transfer rates) about the host bus adapters that connect to the selected port.

   The following two types of traffic are shown. The traffic has attributes including the average and maximum values.
   - Traffic between the host bus adapter and the selected port (shown in **Per Port**)
   - Sum of the traffic between the host bus adapter and all ports connected to the host bus adapter (shown in **WWN Total**)

   The traffic statistics only about the host bus adapters below **Monitor** appear in the list.

   The **WWN Total** traffic statistics will also be displayed in the list when you click an icon in the lower left tree. If you click the **Storage System** folder in the lower left tree, the sum of the traffic of the host bus adapters registered on each SPM group is displayed. For details on SPM groups, see Working with SPM groups (on page 199).
8. Analyze the information in the list and then determine upper limit values that should be applied to non-prioritized WWNs. If necessary, determine threshold values that should be applied to prioritized WWNs. For details, see Server Priority Manager workflow: many-to-many connections (on page 187).

Setting upper-limit values for non-prioritized WWNs: many-to-many connections

After you analyze traffic statistics about prioritized WWNs and non-prioritized WWNs, you must set upper limit values to I/O rates or transfer rates for non-prioritized WWNs. Upper limit values for I/O rates are used to suppress the number of I/Os from the low priority host servers and thus provide better performance for high-priority host servers. Upper limit values for transfer rates are used to suppress the amount of data that is transferred between the storage system and the low priority ports, thus providing better performance for high-priority host servers.

When you set an upper limit for the first time, it is recommended that the upper limit be approximately 90 percent of the peak traffic.

Tip: To set the same upper limit value to more than one non-prioritized WWN, use an SPM group. For details on SPM groups, see Working with SPM groups (on page 199).

Note: You cannot set the upper-limit value of a host bus adapter that is contained in an SPM group. The upper limit value of a host bus adapter in an SPM group is defined by the SPM group settings. For details, see Setting an upper-limit value to HBAs in an SPM group (on page 202).

Caution: If an upper limit of the non-prioritized WWN is set to zero or nearly zero, I/O performance might be lowered. If I/O performance is lowered, the host cannot be connected to the storage system in some cases.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the **Server Priority Manager** window, click **Server Priority Manager**. The **Server Priority Manager** main window appears.
4. Click the **WWN** tab.
5. Select whether to limit the I/O rate or the transfer rate of the non-prioritized WWN:
   - To limit the I/O rate, select **IOPS** from the list at the upper left corner.
   - To limit the transfer rate, select **MB/s** from the list at the upper left corner.
6. In the upper-left tree, click the icon of the port whose traffic you want to limit below the **Storage System** folder.

   The information about the host bus adapters which connect to the selected port is displayed in the list.
7. Locate the non-prioritized WWN in the list.

Note:

- The **Attribute** column of the list indicates whether WWNs are prioritized or non-prioritized. The **Attribute** column of a non-prioritized WWN displays **Non-Prio**.
- If you cannot find any non-prioritized WWN in the list, check the list at the top right corner of the window. If the list displays **Prioritize**, select **All** or **Non-Prioritize**.

8. Enter the desired upper limit value for the non-prioritized WWN:
   - To enter the upper limit value for the I/O rate, double-click the desired cell in the **IOPS** column in **Upper**, and then enter the upper limit value in the cell.
   - To upper limit value for the transfer rate, double-click the desired cell in the **MB/s** column in **Upper**, and then enter the upper limit value in the cell.

     In the list, either the **IOPS** cells or **MB/s** cells are activated depending on the selected rate. You can specify the limit value by using either the I/O rate or transfer rate for each host bus adapter. The upper limit value that you entered is displayed in blue. You can specify upper limit values by using the I/O rate for some host bus adapters and by using the transfer rate for other host bus adapters.

     Note: If one host bus adapter is connected to multiple ports and you specify an upper limit value of the host bus adapter for one port, the specified upper limit value is applied to the host bus adapter settings for other connected ports automatically.
9. Click **Apply** to apply the settings to the storage system.

   The upper limit value that you entered turns black.

Setting a threshold for the entire storage system: many-to-many connections

If threshold control is used, upper limit control is automatically disabled when traffic between production servers and the storage system is reduced to a specified level. For details, see Upper-limit control (on page 169) and Server Priority Manager workflow: many-to-many connections (on page 187).

If many-to-many connections are established between host bus adapters and storage system ports, you can set one threshold value for the entire storage system. In this environment, you cannot set individual threshold values for each prioritized WWN.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. Select the **All Thresholds** check box.
6. Select **IOPS** or **MB/s** from the **All Thresholds** list, and do one of the following:
   - To specify the threshold value by using the I/O rate, select **IOPS** from the list below the check box.
   - To specify the threshold value by using the transfer rate, select **MB/s** from the list below the check box.

     Even if the types of rates differ between the upper limit values and the threshold value, the threshold control is effective for all non-prioritized WWNs.
7. Enter the threshold in the text box of **All Thresholds**.

   Caution: If you enter zero (0) in a cell to disable the upper limit, the cell displays a hyphen (–) and the threshold for the prioritized port becomes ineffective. If the thresholds of all prioritized ports are ineffective, threshold control will not be performed but upper limit control will be performed.
8. Click **Apply** to apply the settings to the storage system.

Managing host bus adapters

You can use Server Priority Manager to change the name assigned to a host bus adapter and replace an existing host bus adapter.

Changing the SPM name of a host bus adapter

Use Server Priority Manager to assign an SPM name to a host bus adapter. Although you can identify host bus adapters by WWNs, you might be able to identify host bus adapters more easily if you assign SPM names. WWNs are 16-digit hexadecimal numbers that cannot be changed, whereas SPM names need not be 16-digit hexadecimal numbers and can be changed as needed.

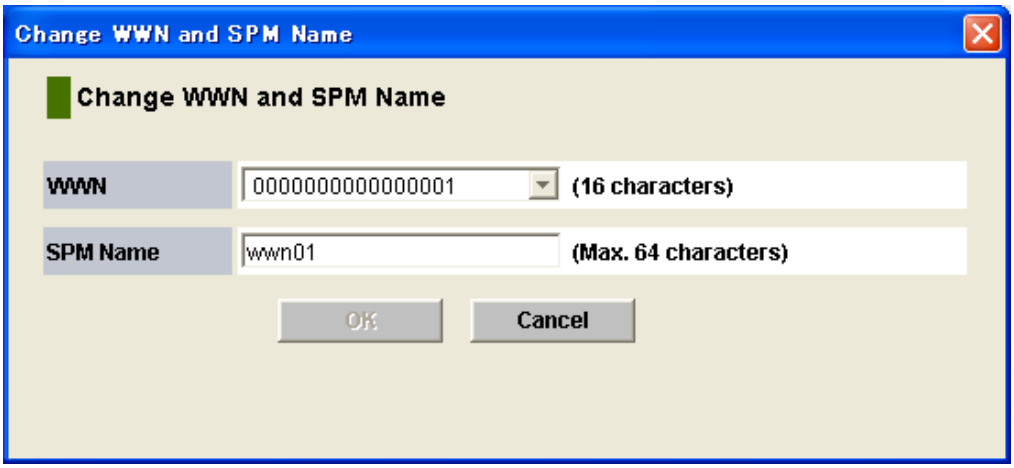
For details about assigning SPM names, see Monitoring all port-HBA traffic: many-to-many connections (on page 189) .

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Open the **Server Priority Manager** window.
   Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Ensure that the **WWN** tab is displayed.
5. In the upper-left tree, select a host bus adapter ( ) from below **Monitor** and then right-click the selection.
6. From the pop-up menu, select **Change WWN and SPM Name**. The **Change WWN and SPM Name** window opens.



7. Enter the WWN of the new host bus adapter in the **WWN** combo box. For details on how to get the HBA WWN, see the *Provisioning Guide* of your storage system. You can select the WWN of the newly connected host bus adapter in the **WWN** combo box.
8. Enter a new SPM name in the **SPM Name** box and then select **OK**. You can use up to 64 characters for an SPM name.
9. In the Server Priority Manager main window, click **Apply** to apply the settings to the storage system.

Replacing a host bus adapter

If you replace an existing host bus adapter, you need to use Server Priority Manager to delete the host bus adapter being removed and then add the host bus adapter being installed.

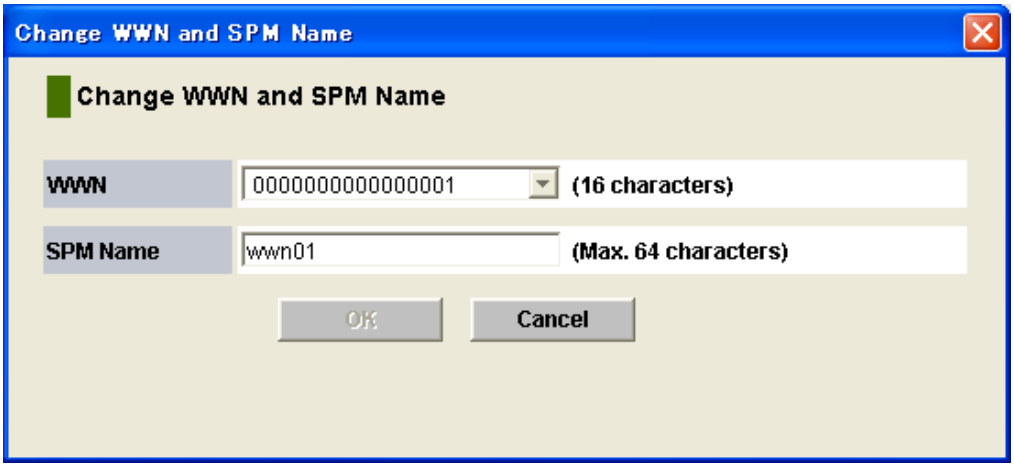
When you add a new host bus adapter rather than replacing one, the WWN of the new host bus adapter is automatically displayed below Non-Monitor for the connected port in the list.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the upper-left tree, select the old host bus adapter ( ) from below **Monitor** and then right-click the selection.
6. From the pop-up menu, select **Change WWN and SPM Name**. The **Change WWN and SPM Name** window opens.



7. Enter the WWN of the new host bus adapter in the **WWN** combo box. For details on how to get the HBA WWN, see the *Provisioning Guide* of your storage system.

   You can select the WWN of the newly connected host bus adapter in the **WWN** combo box.
8. If necessary, enter a new SPM name in the **SPM Name** box. You can use up to 64 characters for an SPM name.
9. Select **OK** to close the **Change WWN and SPM Name** window.
10. In the Server Priority Manager main window, click **Apply** to apply the settings to the storage system.

Working with SPM groups

You can use Server Priority Manager to create SPM groups to manage multiple host bus adapters as a single group. All HBAs in an SPM group have the same priority. Prioritized WWNs and non-prioritized WWNs cannot be mixed in the same group. For the maximum number of WWNs you can register, see Cautions and restrictions for Server Priority Manager (on page 176).

You can use an SPM group to switch priority of multiple HBAs from prioritized to non-prioritized, or vice versa. You can also use an SPM group to set the same upper limit value to all HBAs in the group. You can perform the upper-limit value control for the SPM group by setting the upper-limit value on the SPM group.

Note:

The upper-limit value of each HBA which belongs to the SPM group is the upper-limit value set for the SPM group divided by the number of HBAs which belong to the SPM group and have I/O. The I/O existence in HBA is distinguished with one minute interval monitoring. The upper-limit value of HBAs which belong to the SPM group is updated in one minute intervals. Therefore, when the existence of I/O is alternated, the upper-limit value of the SPM group might be over or under the setting value.

For example, in the condition that the upper-limit value is set to 200 IOPS for an SPM group to which 2 HBAs belong and only 1 HBA has I/O, the upper-limit value allocated to each HBA is 200 (200÷1) IOPS. After that, if the number of HBAs that have I/O turns from 1 to 2, until the next detection (updating the HBA upper-limit value which belongs to the SPM group is in one minute interval), the upper-limit value might become 400 (200+200) IOPS because the upper-limit value is allocated to 200 IOPS to each HBA, which is over the setting value for the SPM group.

In the condition that the upper-limit value is set to 200 IOPS for an SPM group to which 2 HBAs belong and 2 HBAs have I/O, the upper-limit value allocated to each HBA is 100 (200÷2) IOPS. After that, if the number of HBAs which have I/O turns from 2 to 1, until the next detection (updating HBA upper-limit value which belongs to the SPM group is in one minute interval), the upper-limit value might become 100 IOPS because the upper-limit value is allocated 100 IOPS to each HBA, which is under the setting value for the SPM group.

Creating an SPM group

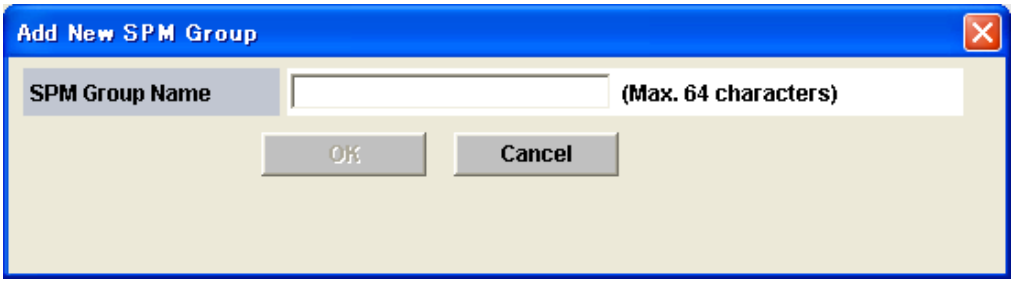
Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

A host bus adapter can belong to only one SPM group. To create an SPM group and add host bus adapters to the group:

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, select and right-click the **Storage System** folder.
6. From the pop-up menu, select **Add New SPM Group**.
7. In the **Add New SPM Group** window, enter the name of the SPM group and then select **OK**. An SPM group is created and an SPM group icon ( ) is added to the lower-left tree.



8. Select an HBA from the upper-left tree and select an SPM group from the lower-left tree. Next, click **Add WWN**.
   Repeat this operation until all desired HBAs are added to the SPM group.

   Note:
   - Select a host bus adapter under Monitor. You cannot add HBAs under Non-Monitor to SPM groups.
   - When selecting a host bus adapter that is already contained in some SPM group from the upper-left tree, the **Add WWN** button is not activated. Select a host bus adapter that is not contained in any SPM groups.
9. Click **Apply** to apply the settings to the storage system.

Deleting an HBA from an SPM group

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, double-click the SPM group ( ) that contains the host bus adapter to be deleted.
6. Below the SPM icon, right-click the icon of the host bus adapter ( ) you want to delete.
7. Select **Delete WWN** from the pop-up menu.

   The selected host bus adapter icon is deleted from the tree.
8. Click **Apply** to apply the settings to the storage system.

Changing the priority of an SPM group

All host bus adapters in one SPM group must have the same priority. Prioritized WWNs and non-prioritized WWNs cannot be mixed in one SPM group.

You can use an SPM group to change the priority of multiple HBAs between prioritized and non-prioritized.

You can perform the upper-limit value control for an SPM group by setting the upper-limit value on the SPM group. For more information, see Working with SPM groups (on page 199).

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, select and right-click the desired SPM group ( ).

6. Change the priority:
   - To change priority from prioritized to non-prioritized, select **Prio -** > > **Non-Prio** from the pop-up menu.
   - To change priority from non-prioritized to prioritized, select **Non-Prio -** > > **Prio** from the pop-up menu.
7. Click **Apply** to apply the settings to the storage system.

Setting an upper-limit value to HBAs in an SPM group

If all host bus adapters in an SPM group are non-prioritized WWNs, you can set an upper limit value to HBA performance (such as I/O rate or transfer rate). You can assign one upper limit value for one SPM group.

For example, suppose that the upper limit value 100 IOPS is assigned to an SPM group consisting of four host bus adapters. If the sum of the I/O rate of the four host bus adapters reaches 100 IOPS, Server Priority Manager controls the system so that the sum of the I/O rates will not exceed 100 IOPS.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

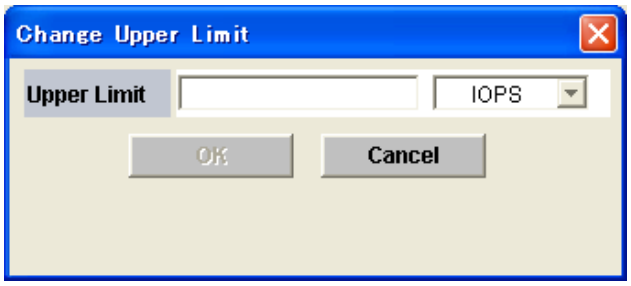
Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, select and right-click the **Storage System** folder or an SPM group ( ).
6. If you selected the **Storage System** folder, take the following steps:
   - Select **IOPS** or **MB/s** from the list at the upper-left corner of the list. Select **IOPS** if you want to assign an upper limit to the I/O rate. Select **MB/s** if you want to assign an upper limit to the transfer rate.
   - To assign an upper limit to the I/O rate, enter the upper limit value in the **IOPS** column of the list. To assign an upper limit to the transfer rate, enter the upper limit value in the **MB/s** column of the list.

     Tip: If you cannot see the IOPS or MB/s column, scroll the list to the left. The column is located at the right side of the list.

If you selected an SPM group ( ), take the following steps:

- Right-click the selected SPM group and then select **Change Upper Limit** from the pop-up menu. The **Change Upper Limit** dialog box opens.



- To assign an upper limit to the I/O rate, enter the upper limit value and then select **IOPS** from the list. Next, select **OK**. To assign an upper limit to the transfer rate, enter the upper limit value and then select **MB/s** from the list. Next, select **OK**.

7. In the Server Priority Manager main window, click **Apply** to apply the settings to the storage system.

   To confirm an upper limit value specified for each SPM group, select the **Storage System** folder in the lower-left tree on the **WWN** tab. The SPM groups are displayed in the list and you can confirm each upper limit value.

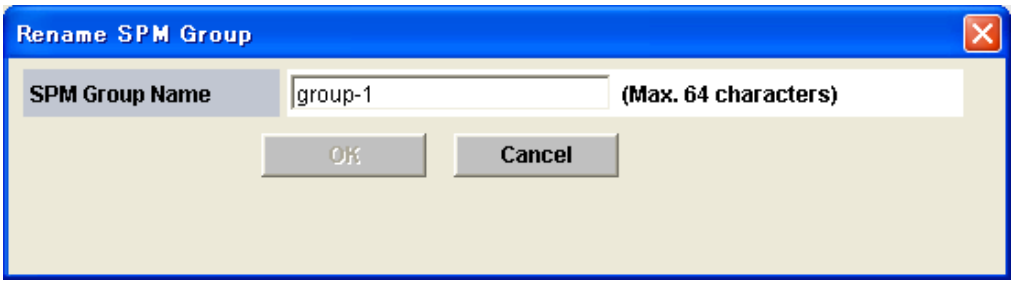
Renaming an SPM group

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, select and right-click an SPM group ( ).
6. Select **Rename SPM Group** from the pop-up menu. The **Rename SPM Group** dialog box opens.



7. Enter the new name and select **OK**.
8. In the Server Priority Manager main window, click **Apply** to apply the settings to the storage system.

Deleting an SPM group

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide* of your storage system.

Procedure

1. Click **Reports** > **Performance Monitor** > **Server Priority Manager** to open the **Server Priority Manager** window.
2. Click to change to Modify mode.
3. In the Server Priority Manager window, click **Server Priority Manager**. The Server Priority Manager main window appears.
4. Select the **WWN** tab.
5. In the lower-left tree, select and right-click an SPM group ( ).
6. Select **Delete SPM Group** from the pop-up menu.
7. In the Server Priority Manager main window, click **Apply** to apply the settings to the storage system.

Chapter 6: Hitachi Virtual Partition Manager operations

This chapter describes and provides instructions for performing cache partitioning operations using Hitachi Virtual Partition Manager.

Overview of Virtual Partition Manager

Your storage system can connect to multiple hosts and can be shared by multiple users, which can result in conflicts among users. For example, if a host issues many I/O requests or reads or writes a large amount of data, the I/O performance of other hosts may be affected. Virtual Partition Manager allows you to create multiple virtual cache memories called cache logical partitions (CLPRs), each allocated to different hosts, to prevent contention for cache memory and improve I/O performance.

A cache logical partition is a pool of the cache and parity groups in the storage system. Partitioning cache into one or more CLPRs allows storage administrators to dedicate individual CLPRs to a different host, preventing I/O contention for cache memory. Partitioning cache dedicates cache resources for exclusive use by specific applications to maintain priority and quality of service for business-critical applications. Storage administrators can secure or restrict access to storage resources to ensure confidentiality for specific applications. By dedicating resources to each partition as needed, a high quality of service can be maintained for all users.

You can allocate one of the following for a CLPR:

- A parity group
- An external volume
- A virtual volume of Dynamic Provisioning or Thin Image

Hitachi Virtual Storage Platform F400, F600, F800 do not support Virtual Partition Manager.

CLPR names

CLPR0 is the default CLPR in the storage system. If you have not yet created any cache logical partitions, all cache belongs to CLPR0.

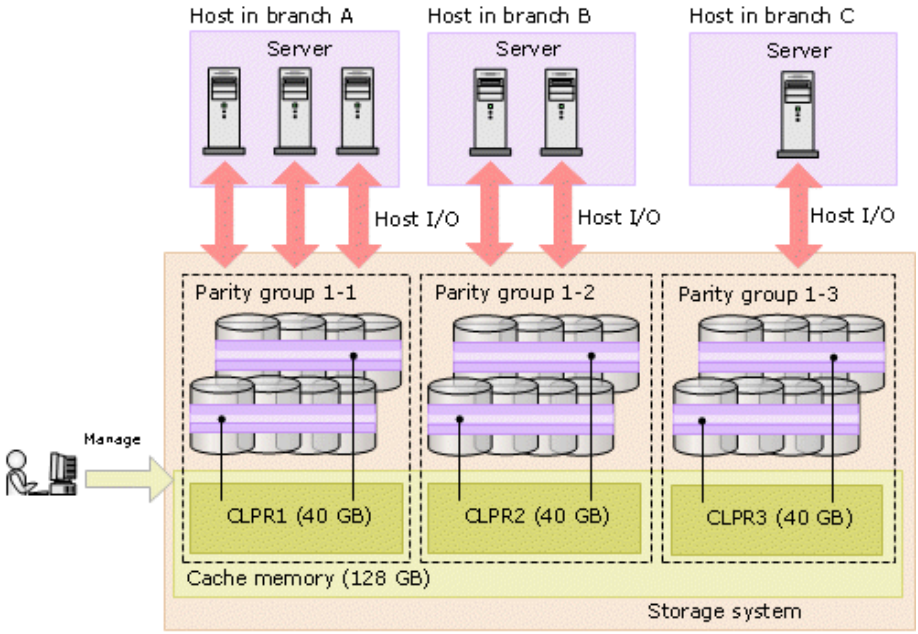
The following table lists the reserved CLPR names and corresponding CLPR IDs. These CLPR names are reserved with each CLPR ID. You cannot use another CLPR ID. For example, if the CLPR ID is 1, you cannot change the CLPR name to CLPR2.

Note: You can create a maximum of 32 CLPRs including CLPR0, which is created by default.

CLPR ID	CLPR name	CLPR ID	CLPR name
0	CLPR0	16	CLPR16
1	CLPR1	17	CLPR17
2	CLPR2	18	CLPR18
3	CLPR3	19	CLPR19
4	CLPR4	20	CLPR20
5	CLPR5	21	CLPR21
6	CLPR6	22	CLPR22
7	CLPR7	23	CLPR23
8	CLPR8	24	CLPR24
9	CLPR9	25	CLPR25
10	CLPR10	26	CLPR26
11	CLPR11	27	CLPR27
12	CLPR12	28	CLPR28
13	CLPR13	29	CLPR29
14	CLPR14	30	CLPR30
15	CLPR15	31	CLPR31

Use case for cache logical partitioning

The following figure shows three branch offices and 128 GB of cache memory partitioned into one 40-GB segment for each office. The host for branch A has a heavy I/O load. Because the cache memory is partitioned, that heavy I/O load cannot affect the cache memory for branch B or branch C.



Cache partitioning workflow

1. Calculate the cache capacity required for your needs, taking into account other features and functions that also have cache capacity requirements. For details, see Calculating cache capacity (on page 209).
2. If needed, install additional cache memory in your storage system.
3. Determine an appropriate time to create CLPRs and migrate resources to the new CLPRs. Creating CLPRs and migrating resources can significantly degrade host performance and should be performed during the initial installation and setup of the storage system or during maintenance.
4. Create the CLPRs and migrate resources to the new CLPRs. For details, see Creating a CLPR (on page 222) and Migrating resources to and from a CLPR (on page 223).
5. Manage the CLPRs as needed.
   - After a CLPR has been created, you can change the CLPR name, CLPR cache capacity, resident cache size, and number of resident cache extents. For details, see Editing an existing CLPR (on page 224).
   - (VSP G1x00 and VSP F1500) If Cache Residency Manager operations decrease the cache capacity of a CLPR, you might need to adjust the cache capacity of the CLPR.

Cautions and restrictions for Virtual Partition Manager

- **Increased cache memory requirements**

  Install additional cache memory before partitioning cache. Adding cache memory after CLPRs have been created is difficult and can be problematic. For details, see Calculating cache capacity (on page 209) .

- **Impact on host performance**

  Creating and changing cache logical partitions can significantly degrade host performance and should only be performed during the initial installation and setup of the storage system or during maintenance. If you must perform these changes on a production machine, use Hitachi Performance Monitor to verify that the write pending rate and sidefile occupancy rate of the CLPR and CLPR0 satisfy the following formulas on all MP blade or unit:

  - For CLPR with decreased cache capacity

    ```
    Write pending rate x cache capacity before operation /
    cache capacity after operation < 30%
    ```

    ```
    Sidefile occupancy rate x cache capacity before operation /
    cache capacity after operation < sleep wait threshold x 50%
    ```

  - For CLPR with increased cache capacity

    ```
    Sidefile occupancy rate < sleep wait threshold x 50%
    ```

- When you move resources in CLPRs, make sure that the writing pending rates of the MP blade or unit for each CLPR are less than 50 percent at both the source and the destination. The process for changing the CLPR settings will be suspended until the write pending rates of each MP blade or unit become less than 50 percent.

- **Duration of cache partition operations**

  Adding or changing CLPR definitions or configurations can take hours to complete. After a CLPR operation has been started, you cannot cancel or modify the process until the operation is complete.

- **Interoperability restrictions for cache partitioning**

Application	Behaviors
ShadowImage/ ShadowImage for Mainframe	You cannot use ShadowImage or ShadowImage for Mainframe Quick Restore functions that affect multiple CLPRs.
Volume Migration	You cannot use Volume Migration when it affects multiple CLPRs.
Cache Residency Manager (VSP G1x00 and VSP F1500)	▪ A parity group containing LDEVs assigned to Cache Residency Manager cache areas cannot be migrated to another CLPR. ▪ When you decrease the cache capacity of the CLPR to which the cache area of Cache Residency Manager is allocated, or in a configuration that contains CLPR for which the cache area of Cache Residency Manager is defined, if you want to increase the cache size by adding CPEX, perform the following steps: **1.** Cancel the Cache Residency Manager bind mode or priority mode setting. **2.** Change or increase the cache capacity of the CLPR. **3.** Set the Cache Residency Manager bind mode or priority mode again.
Universal Replicator	Universal Replicator data volumes and journal volumes can belong to different CLPRs. All journal volumes in the same journal must belong to the same CLPR. If not, an error occurs.

Calculating cache capacity

Before you partition cache memory into one or more CLPRs, calculate the cache capacity that you need for the storage system. If necessary, install additional cache memory.

The recommended cache capacity varies depending on the system configuration. System differences include:

- Number of mounted MP blade or unit
- RAID level

- Number of installed drives
- Use of the following specialized applications:
  - Dynamic Provisioning
  - Dynamic Tiering
  - active flash
  - Universal Volume Manager
  - (VSP G1x00 and VSP F1500) Cache Residency Manager
  - (VSP G1x00 and VSP F1500) Dynamic Provisioning for Mainframe
  - (VSP G1x00 and VSP F1500) Dynamic Tiering for Mainframe
  - (VSP G1x00 and VSP F1500) active flash for mainframe
  - (VSP G1x00 and VSP F1500) Compatible XRC

Use this formula to calculate the recommended cache capacity for a CLPR:

```
Recommended cache capacity (GB) for a CLPR =
CLPR cap. (GB) − ceil(Cache Residency extents (MB) / 2,048) × 2 GB
```

Cache capacity without Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, active flash for mainframe, Cache Residency Manager, and Compatible XRC

The following products require more cache capacity to run:

- Dynamic Provisioning
- Dynamic Tiering
- active flash
- Universal Volume Manager
- (VSP G1x00 and VSP F1500) Cache Residency Manager
- (VSP G1x00 and VSP F1500) Dynamic Provisioning for Mainframe
- (VSP G1x00 and VSP F1500) Dynamic Tiering for Mainframe
- (VSP G1x00 and VSP F1500) active flash for mainframe
- (VSP G1x00 and VSP F1500) Compatible XRC

The recommended cache capacity for storage systems that do not use these products is lower.

The following table lists the recommended cache capacity for storage systems that do not use the products listed above.

(VSP G1x00 and VSP F1500)

Internal/external VOL for a CLPR (total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
Less than 4 TB	2	8 GB
	4	12 GB
	6	20 GB
	8	28 GB
	10	36 GB
	12	44 GB
	14	52 GB
	16	60 GB
4 TB or more	2	16 GB
	4	16 GB
	6	20 GB
	8	28 GB
	10	36 GB
	12	44 GB
	14	52 GB
	16	60 GB
16 TB or more	2	24 GB
	4	24 GB
	6	24 GB
	8	28 GB
	10	36 GB
	12	44 GB
	14	52 GB
	16	60 GB
48 TB or more	2	32 GB
	4	32 GB
	6	32 GB

Internal/external VOL for a CLPR (total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
	8	32 GB
	10	36 GB
	12	44 GB
	14	52 GB
	16	60 GB
96 TB or more	2	40 GB
	4	40 GB
	6	40 GB
	8	40 GB
	10	40 GB
	12	44 GB
	14	52 GB
	16	60 GB
160 TB or more	2	48 GB
	4	48 GB
	6	48 GB
	8	48 GB
	10	48 GB
	12	48 GB
	14	52 GB
	16	60 GB
240 TB or more	2	56 GB
	4	56 GB
	6	56 GB
	8	56 GB
	10	56 GB
	12	56 GB

Internal/external VOL for a CLPR (total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
	14	56 GB
	16	60 GB
360 TB or more	2	64 GB
	4	64 GB
	6	64 GB
	8	64 GB
	10	64 GB
	12	64 GB
	14	64 GB
	16	64 GB
600 TB or more	2	72 GB
	4	72 GB
	6	72 GB
	8	72 GB
	10	72 GB
	12	72 GB
	14	72 GB
	16	72 GB

(VSP Gx00, VSP Fx00, and VSP Nx00)

Internal/external VOL for a CLPR (total capacity) [1]	Recommended cache capacity for a CLPR
Less than 4 TB	12 GB
4 TB or more	16 GB
16 TB or more	24 GB
48 TB or more	32 GB
96 TB or more	40 GB

Internal/external VOL for a CLPR (total capacity) [1]	Recommended cache capacity for a CLPR
160 TB or more	48 GB[2]
240 TB or more	56 GB[2]
360 TB or more	64 GB[2]
600 TB or more	72 GB[2]

Notes:

1. If you are calculating the total capacity of internal/external volumes, note the following for each volume capacity:
   - Internal volume: For RAID 1, add the half of total parity group capacity. For RAID 5/6, subtract the parity disk capacity from the total parity group capacity and add the resulting amount.
   - External volume: Add the total capacity of the parity group.
2. 40 GB for VSP G200.

Formula to size VOL capacity of internal storage (VSP G1x00 and VSP F1500)

Use this formula to calculate the internal volume capacity for a CLPR:

```
Internal volume capacity for a CLPR =
[(number of (3D+1P) parity groups) × (capacity of one drive) × 3] +
[(number of (6D+2P) parity groups) × (capacity of one drive) × 6] +
[(number of (7D+1P) parity groups) × (capacity of one drive) × 7] +
[(number of (14D+2P) parity groups) × (capacity of one drive) × 14] +
[(number of (2D+2D) parity groups) × (capacity of one drive) × 2]
```

Do not use this formula for an external volume or virtual volume.

Formula to size VOL capacity of external storage (VSP G1x00 and VSP F1500)

If you use an external volume, calculate the total capacity of parity groups of external volumes that are associated with the CLPR.

Formula to size VOL capacity of Dynamic Provisioning or Dynamic Tiering (VSP G1x00 and VSP F1500)

If you use a virtual volume, calculate the total LDEV capacity of the virtual volume that is associated with the CLPR.

To check the LDEV capacity of the virtual volume, see the LDEVs tab in the **Logical Devices** window of Device Manager - Storage Navigator.

Cache capacity with Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, or active flash for mainframe

You must allocate more cache capacity for each CLPR when any of the following is in use:

- Dynamic Provisioning
- Dynamic Tiering
- active flash
- (VSP G1x00 and VSP F1500) Dynamic Provisioning for Mainframe
- (VSP G1x00 and VSP F1500) Dynamic Tiering for Mainframe
- (VSP G1x00 and VSP F1500) active flash for mainframe

The following table lists the recommended cache capacity for storage systems that use any of the above listed products. For the formula to calculate the internal volume capacity for a CLPR, see Formula to size VOL capacity of internal storage (VSP G1x00 and VSP F1500) (on page 214) .

(VSP G1x00 and VSP F1500)

Internal/external VOL for a CLPR (Total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
Less than 4 TB	2	12 GB
	4	20 GB
	6	28 GB
	8	36 GB
	10	44 GB
	12	52 GB
	14	60 GB
	16	68 GB
4 TB or more	2	16 GB
	4	20 GB
	6	28 GB
	8	36 GB
	10	44 GB
	12	52 GB
	14	60 GB

Internal/external VOL for a CLPR (Total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
	16	68 GB
16 TB or more	2	24 GB
	4	24 GB
	6	28 GB
	8	36 GB
	10	44 GB
	12	52 GB
	14	60 GB
	16	68 GB
48 TB or more	2	32 GB
	4	32 GB
	6	32 GB
	8	36 GB
	10	44 GB
	12	52 GB
	14	60 GB
	16	68 GB
96 TB or more	2	40 GB
	4	40 GB
	6	40 GB
	8	40 GB
	10	44 GB
	12	52 GB
	14	60 GB
	16	68 GB
160 TB or more	2	48 GB
	4	48 GB

Internal/external VOL for a CLPR (Total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
	6	48 GB
	8	48 GB
	10	48 GB
	12	52 GB
	14	60 GB
	16	68 GB
240 TB or more	2	56 GB
	4	56 GB
	6	56 GB
	8	56 GB
	10	56 GB
	12	56 GB
	14	60 GB
	16	68 GB
360 TB or more	2	64 GB
	4	64 GB
	6	64 GB
	8	64 GB
	10	64 GB
	12	64 GB
	14	64 GB
	16	68 GB
600 TB or more	2	72 GB
	4	72 GB
	6	72 GB
	8	72 GB
	10	72 GB

Internal/external VOL for a CLPR (Total capacity)	Number of MP blades	Recommended cache capacity for a CLPR
	12	72 GB
	14	72 GB
	16	72 GB

(VSP Gx00, VSP Fx00, and VSP Nx00)

Internal/external VOL for a CLPR (Total capacity) [1]	Recommended cache capacity for a CLPR
Less than 4 TB	20 GB
4 TB or more	20 GB
16 TB or more	24 GB
48 TB or more	32 GB
96 TB or more	40 GB
160 TB or more	48 GB[2]
240 TB or more	56 GB[2]
360 TB or more	64 GB[2]
600 TB or more	72 GB[2]

Notes:

1. If you are calculating the total capacity of internal/external/virtual volumes, note the following for each volume capacity:
   - Internal volume: For RAID 1, add the half of total parity group capacity. For RAID 5/6, subtract the parity disk capacity from the total parity group capacity and add that amount.
   - External volume: Add the total capacity of the parity group.
   - Virtual volume: Add the total capacity of LDEV. Check virtual volume LDEV capacity in Logical Device window. For details on Logical Device window, see *Provisioning Guide* of your storage system.
2. 40 GB for VSP G200.

Cache capacity with capacity saving-enabled V-VOLs

I/O operations for capacity saving requires access to cached metadata. Metadata cache uses the same CLPR as the cache of user data.

The following table lists recommended cache capacity when all volumes in a storage system are capacity saving-enabled V-VOLs.

Table 1 For VSP G1x00 and VSP F1500

Total capacity of DRD-VOLs* (Effective Capacity)	Recommended cache capacity (each CLPR)							
	2MPB	4MPB	6MPB	8MPB	10MPB	12MPB	14MPB	16MPB
Less than 4Tib	20GiB	28GiB	36GiB	44GiB	52GiB	60GiB	68GiB	76GiB
4TiB or more	16GiB +X	20GiB +X	28GiB +X	36GiB +X	44GiB +X	52GiB +X	60GiB +X	68GiB +X
16TiB or more	24GiB +X	24GiB +X	28GiB +X	36GiB +X	44GiB +X	52GiB +X	60GiB +X	68GiB +X
48TiB or more	32GiB +X	32GiB +X	32GiB +X	36GiB +X	44GiB +X	52GiB +X	60GiB +X	68GiB +X
96TiB or more	40GiB +X	40GiB +X	40GiB +X	40GiB +X	44GiB +X	52GiB +X	60GiB +X	68GiB +X
160TiB or more	48GiB +X	48GiB +X	48GiB +X	48GiB +X	48GiB +X	52GiB +X	60GiB +X	68GiB +X
240TiB or more	56GiB +X	56GiB +X	56GiB +X	56GiB +X	56GiB +X	56GiB +X	60GiB +X	68GiB +X
360TiB or more	64GiB +X	64GiB +X	64GiB +X	64GiB +X	64GiB +X	64GiB +X	64GiB +X	68GiB +X
600TiB or more	72GiB +X	72GiB +X	72GiB +X	72GiB +X	72GiB +X	72GiB +X	72GiB +X	72GiB +X
982TiB or more	2036GiB	2036GiB	2036GiB	2036GiB	2036GiB	2036GiB	2036GiB	2036GiB

X is the total capacity of DRD-VOLs x 0.2%

* DRD-VOL: data reduction volume, which is a DP-VOL with capacity saving enabled.

Table 2 For VSP Gx00, VSP Fx00, and VSP Nx00

Total capacity of DRD-VOLs* (Effective Capacity)	Recommended cache capacity (each CLPR)			
	VSP G200	VSP G/N400	VSP G/N600	VSP G/N800
Less than 4TiB	28GiB	28GiB	28GiB	28GiB

Total capacity of DRD-VOLs* (Effective Capacity)	Recommended cache capacity (each CLPR)			
	VSP G200	VSP G/N400	VSP G/N600	VSP G/N800
4TiB or more	20GiB+X	20GiB+X	20GiB+X	20GiB+X
7.5TiB or more	35GiB	20GiB+X	20GiB+X	20GiB+X
16TiB or more		24GiB+X	24GiB+X	24GiB+X
31TiB or more		86GiB	24GiB+X	24GiB+X
48TiB or more			32GiB+X	32GiB+X
90.5TiB or more			213GiB	32GiB+X
96TiB or more				40GiB+X
160TiB or more				48GiB+X
201.5TiB or more				451GiB
X is the total capacity of DRD-VOLs x 0.2% * DRD-VOL: data reduction volume, which is a DP-VOL with capacity saving enabled.				

Cache capacity with Cache Residency Manager (VSP G1x00 and VSP F1500)

When you use the Cache Residency Manager Priority mode for a CLPR, you should consider adding cache capacity depending on the number of areas in which the Priority mode is set in addition to the cache used for Cache Residency Manager. For more information, see Priority mode (read data in cache) (on page 227) .

Cache capacity with Compatible XRC (VSP G1x00 and VSP F1500)

Compatible XRC uses a sidefile that contains administrative information. To allow for the sidefile, you must allocate more cache capacity than the value listed in the reference tables. You must know the sleep wait threshold to calculate the minimum required cache capacity value.

Use this formula to calculate the recommended CLPR capacity:

```
Recommended cache capacity =
Recommended cache capacity from reference tables) × 100 / (100 –
(Sleep wait threshold)
```

Cache capacity with Universal Volume Manager only

If you are using only Universal Volume Manager, sometimes you can allocate less cache capacity to a CLPR. To use less cache capacity, the CLPR that you want to create must meet the following conditions:

- The CLPR uses only external open-systems volumes.
- Transfer speed is not important.
- The cache mode of the mapped volume is Disable.

The following table lists the recommended cache capacity for storage systems that use Universal Volume Manager.

(VSP G1x00 and VSP F1500)

Total capacity of external volume of CLPR with UVM	Number of MP blades	Recommended cache capacity for a CLPR
Less than 128 TB	2, 4, 6, or 8	8 GB
	10 or 12	12 GB
	14 or 16	16 GB
128 TB or more	2 or 4	8 GB
	6	12 GB
	8	16 GB
	10	20 GB
	12	24 GB
	14	28 GB
	16	32 GB

(VSP Gx00, VSP Fx00, and VSP Nx00)

Total capacity of external volume of CLPR with UVM	Number of MP units	Recommended cache capacity for a CLPR
Less than 128 TB	4	4 GB
128 TB or more	4	8 GB

When adding cache memory, use either the Standard Cache Access Model mode or the High Performance Cache Access Model mode. If the storage system has any additional printed circuit boards (PCBs), you must use the High Performance Cache Access Model mode. For more information about adding cache memory, contact customer support.

Managing CLPRs

Creating a CLPR

> **Caution:**
>
> Creating CLPRs can significantly degrade host performance and should be performed during the initial installation and setup of the storage system or during maintenance.
>
> Before creating a CLPR, read Cautions and restrictions for Virtual Partition Manager (on page 208).

If no CLPRs have been created, the entire cache is displayed as CLPR0. When you create the first CLPR, CLPR1 is added. The maximum number of CLPRs that you can create are listed below:

- (VSP G1x00 and VSP F1500) Maximum of 31 CLPRs (CLPR1 to CLPR31).
- (VSP Gx00, VSP Fx00, and VSP Nx00) Maximum of 9 CLPRs (CLPR1 to CLPR9) for VSP G200, 22 CLPRs (CLPR1 to CLPR22) for VSP G/N400, and 31 CLPRs (CLPR1 to CLPR31) for VSP G/N600 and VSP G/N800.

When you create a CLPR, you assign the necessary capacity from CLPR0 to the new CLPR. The default cache capacity is listed below

- (VSP G1x00 and VSP F1500) 8 GB
- (VSP Gx00, VSP Fx00, and VSP Nx00) 4 GB

(VSP G1x00 and VSP F1500) If you use Cache Residency Manager, the remaining cache capacity after subtracting the Cache Residency Manager capacity from the cache capacity of CLPR0 must be at least 8 GB.

Before you begin

- Required role: Storage Administrator (System Resource Management)

Procedure

1. Open the **Cache Partitions** window.
   a. On the **Administration** tree, click **Cache Partitions**.
   b. Click the **Cache Partitions** tab.
2. Click **Create CLPRs** to open the **Create CLPRs** window. **CLPR ID** displays the first available CLPR ID or a blank if no CLPR ID is available.
3. In **CLPR Name**, enter the CLPR name (maximum 16 alphanumeric characters). Each CLPR name must be unique. You cannot use a CLPR name that is already reserved. If no CLPR ID is available, a blank is displayed.
4. (VSP G1x00 and VSP F1500) In **Total Cache Size**, select the cache capacity. If no CLPR ID is available, a blank is displayed.

   The default size is 8 GB, and you can select 8 GB or higher value in increments of 4 GB. The maximum value is 2,022 GB (subtract 8 GB from the cache capacity of the

storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.

The remaining cache capacity (subtract the resident cache size from the total cache size) must be 8 GB or more. Ensure that the remaining capacity in CLPR0 is at least 8 GB when selecting the total cache size or the resident cache size.

5. (VSP Gx00, VSP Fx00, and VSP Nx00) In **Cache Size** , select the cache capacity. If no CLPR ID is available, a blank is displayed.

   The default size is 4 GB, and you can select 4 GB or higher value in increments of 2 GB. The maximum available capacity (subtracted the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.

6. (VSP G1x00 and VSP F1500) In **Resident Cache Size**, select the resident cache capacity. If no CLPR ID is available, a blank is displayed.

   The default is 0 GB, and you can select 0 GB or higher value in increments of 0.5 GB. The maximum value is 2,014 GB (cache residency capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.

7. (VSP G1x00 and VSP F1500) In **Number of Resident Extents**, enter the number of resident cache. If no CLPR ID is available, a blank is displayed.

   The default is 0, and you can specify 0 to 16384. The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.

8. Click **Add**. The created CLPR is added to the **Selected CLPRs** table.

   To delete a CLPR from the **Selected CLPRs** table, select the CLPR and click **Remove**. To change the settings of an existing CLPR, select the CLPR and **Change Settings** to open the **Change Settings** window.

9. Click **Finish**.

10. Check the settings in the **Confirm** window, enter the task name in **Task Name**, and click **Apply**.

    The **Tasks** window opens if **Go to tasks window for status** is checked.

Next steps

After creation, a CLPR has no resources (parity groups). To migrate resources to the new CLPR, see Migrating resources to and from a CLPR (on page 223) .

Migrating resources to and from a CLPR

Caution: Migrating resources to and from a CLPR can significantly degrade host performance and should be performed during the initial installation and setup of the storage system or during maintenance.

After creating a CLPR, you can migrate resources (parity groups) from existing CLPRs to the new CLPR.

When migrating resources to and from a CLPR:

- Multiple parity groups that configure interleaved parity groups must be in the same CLPR.
- (VSP G1x00 and VSP F1500) If a parity group contains one or more LDEVs that have defined Cache Residency Manager cache areas, you cannot migrate that parity group to another CLPR.

Before you begin

- Required role: Storage Administrator (System Resource Management)

Procedure

1. Open the **Cache Partitions** window.
   a. On the **Administration** tree, click **Cache Partitions**.
   b. Click the **Cache Partitions** tab.
2. On the **Cache Partitions** tab, click **Migrate CLPR Resources** to open the **Migrate CLPR Resources** window.
3. In the **Available Parity Groups** table or **Available Virtual Volumes** table, select the resource that you want to migrate.
4. Select the migration destination CLPR in the **CLPRs** table.
5. Click **Set**.

   The resource selected in the **Available Parity Groups** table or the **Available Virtual Volumes** table is migrated to the CLPR selected in the **CLPRs** table. To check the information of the CLPR, select the CLPR and click **Detail** to open the **CLPR Properties** window.
6. When you are done adding resources to migrate, click **Finish**.
7. On the **Confirm** window, check the settings carefully.
8. When you are ready to start the resource migration, enter the task name in the **Confirm** window, and then click **Apply**.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Editing an existing CLPR

You can change the following settings after creating a CLPR:

- CLPR name
- CLPR cache capacity
- (VSP G1x00 and VSP F1500) Resident cache size
- (VSP G1x00 and VSP F1500) Number of resident cache extents

When you select "CLPR0" to edit, you can edit only the CLPR name.

Before you begin

- Required role: Storage Administrator (System Resource Management)

Procedure

1. Open the **Cache Partitions** window.
   a. On the **Administration** tree, click **Cache Partitions**.
   b. Click the **Cache Partitions** tab.
2. Select the CLPR to be edited, and then click **Edit CLPR** to open the **Edit CLPR** window on the **Cache Partitions** tab.

   In **CLPR ID**, an automatically assigned CLPR ID is displayed.
3. Edit the CLPR settings as follows.
   a. In **CLPR Name**, edit the CLPR name as needed. You can use up to 16 alphanumeric characters but cannot specify CLPR names that are already reserved. The default is the name set at the time of the CLPR creation.
   b. (VSP G1x00 and VSP F1500) In **Total Cache Size**, edit the CLPR cache capacity as needed. The minimum cache size is 8 GB, and the size can be changed in increments of 4 GB. The default is the value set at the time of the CLPR creation.

      The maximum value is 2,022 GB (subtract 8 GB from the cache capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. The remaining cache capacity (subtract the resident cache size from the total cache size) must be 8 GB or more. Ensure that the remaining capacity in CLPR0 is at least 8 GB when selecting the total cache size or resident cache size.

      When you reduce the value of **Total Cache Size**, the resident cache size before change may not be applied in some cases. If so, ensure the value of the resident cache size and check the **Resident Cache Size** check box.

   c. (VSP Gx00, VSP Fx00, and VSP Nx00) In **Cache Size**, edit the CLPR cache capacity as needed. You can select 4 GB or a higher value for the cache capacity of the CLPR and the size can be changed in increments of 2 GB. The default is the value set at the time of the CLPR creation.

      The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.
   d. (VSP G1x00 and VSP F1500) In **Resident Cache Size**, edit the resident cache capacity as needed. The minimum size is 0 GB, and the size can be changed in increments of 0.5 GB. The default is the value set at the time of the CLPR creation.

      The maximum value is 2,014 GB (cache residency capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. If resident cache exists in the selected CLPR and you select a resident cache size that is smaller than the existing resident cache, an error will occur. Before decreasing the size, check the resident cache capacity set in the selected CLPR.

e. (VSP G1x00 and VSP F1500) In **Number of Resident Extents**, edit the number of resident cache extents as needed. You can specify from 0 to 16384. The default is the value set at the time of the CLPR creation.

   The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the maximum value. If resident cache exists in the selected CLPR and you select fewer resident cache extents than the existing number of extents, an error will occur. Before decreasing the number, check the number of resident extents set in the selected CLPR.

4. When you are done editing the CLPR settings, click **Finish**.
5. On the **Confirm** window, check the settings carefully.
6. When you are ready to change the settings, enter the task name in the **Confirm** window, and then click **Apply**.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Deleting a CLPR

You can only delete CLPRs that you created. CLPR0 cannot be deleted. CLPRs to which parity groups or virtual volumes are allocated cannot be deleted.

Before you begin

- Required role: Storage Administrator (System Resource Management)

Procedure

1. Open the **Cache Partitions** window.
   a. On the **Administration** tree, click **Cache Partitions**.
   b. Click the **Cache Partitions** tab.
2. Select the CLPR that you want to delete, and then click **Delete CLPRs** in the **More Actions** on the **Cache Partitions** tab to open the **Delete CLPRs** window.
3. In the **Selected CLPRs** table, check the CLPR that you want to delete, and then enter the task name in the **Task Name** field. To cancel the deletion, click **Cancel** to go back to the **Cache Partitions** tab.
4. Click **Apply**.

   The **Tasks** window opens if **Go to tasks window for status** is checked.

Chapter 7: Cache Residency Manager operations

This section provides instructions for managing data in cache using Hitachi Cache Residency Manager.

Overview of Cache Residency Manager

Cache Residency Manager enables you to retain frequently accessed data in the storage system's cache memory so that it is immediately available to hosts.

Using Cache Residency Manager, you can increase the data access speed for specific data by enabling read and write I/Os to be performed at the higher front-end access speeds. You can use Cache Residency Manager for both open-systems and mainframe data.

When Cache Residency Manager is used, total storage system cache capacity must be increased to avoid data access performance degradation for non-cache-resident data. The maximum allowable Cache Residency Manager cache area is configured when the cache is installed, so you must plan carefully for Cache Residency Manager operations and work with your Hitachi Vantara representative to calculate the required amount of cache memory for your configuration and requirements.

All write I/Os to Cache Residency Manager data are duplex writes, guaranteeing full data integrity. The Cache Residency Manager data remains fixed in cache until you manually delete it. Deletion of Cache Residency Manager cache areas destages any write data to the affected volumes.

Cache Residency Manager provides the following functions:

- Priority cache mode
- Bind cache mode
- Prestaging data in cache

Priority mode (read data in cache)

In priority mode the Cache Residency Manager extents are used to hold read data for specific extents on volumes. Write data is write duplexed in cache other than Cache Residency Manager cache, and the data is destaged to the drives when drive utilization is low.

The required total cache capacity for priority mode (normal mode) is:

standard cache + Cache Residency Manager cache + additional cache

The next table specifies the standard cache capacity requirements for priority mode operations. Meeting these requirements is important for preventing performance degradation. For more information about calculating cache size for priority mode, see Estimating cache size for Cache Residency Manager (on page 231).

Settings of priority mode	Standard cache capacity
Specified number of cache areas is 8,192 or less and the specified capacity is 128 GB or less	16 GB
Specified number of cache areas exceeds 8,192 or the specified capacity exceeds 128 GB	32 GB
1 GB = 1,073,741,824 bytes	

Bind mode (read and write data in cache)

In bind mode the Cache Residency Manager extents are used to hold read and write data for specific extents on volumes, so both read and write speeds are improved. Data written to the Cache Residency Manager bind area is not destaged to the drives. To ensure data integrity, write data is duplexed in the Cache Residency Manager cache area, which consumes a significant amount of the Cache Residency Manager cache.

Bind mode provides the following advantages over priority mode:

- The accessibility of read data is the same as Cache Residency Manager priority mode.
- Write operations do not have to wait for available cache segments.
- There is no back-end contention caused by destaging data.

The required total cache capacity for bind mode is:

standard cache + Cache Residency Manager cache

Cache Residency Manager bind data that has write attributes is normally not destaged. However, the data is destaged to disk in the following cases:

- When the cache residency area is released.
- During cache blockage that is caused by certain maintenance operations (for example, cache upgrades) or by cache failure.
- When the storage system is powered off.
- When the volume is deleted from Cache Residency Manager bind mode.

The next table specifies the cache requirements for bind mode operations. Meeting these requirements is important for preventing performance degradation. For more information about calculating cache size for bind mode, see Estimating cache size for Cache Residency Manager (on page 231).

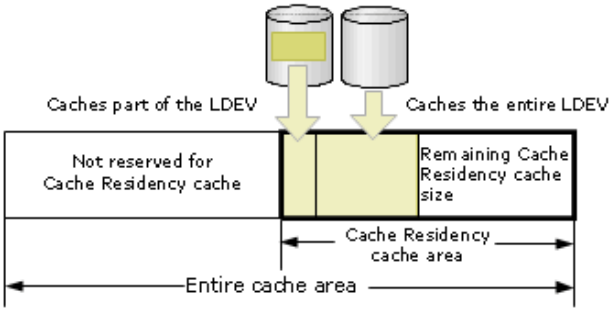
System Type	RAID Level or Volume Type	Capacity Specifications	Cache Residency Cache Requirement
Open systems	RAID 5 (3390) or RAID 6	Slot capacity: 256 KB Cache segment capacity: 16.5 KB Cache segments needed per slot: 48 (slot capacity / cache segment capacity)	3 times the space required for user data: 1 slot = 3 × 256 KB = 768 KB = 48 cache segments
	RAID 1, or external volumes	Slot capacity: 256 KB Cache segment capacity: 16.5 KB Cache segments needed per slot: 32 (slot capacity / cache segment capacity)	2 times the space required for user data: 1 slot = 2 × 256 KB = 512 KB = 32 cache segments
Mainframe (for example, 3390-3, 3390-9)	RAID 5 mainframe or RAID 6	Slot capacity: 66 KB Cache segment capacity: 16.5 KB Cache segments needed per slot: 12 (slot capacity / cache segment capacity) Note: Even though a mainframe track is 56 KB, because cache is divided into 16.5 KB segments, it requires 4 segments.	3 times the space required for user data: 1 slot = 3 × 66 KB = 198 KB = 12 cache segments
	RAID 1 mainframe, or external volumes	Slot capacity: 66 KB Cache segment capacity: 16.5 KB Cache segments needed per slot: 8 (slot capacity / cache segment capacity)	2 times the space required for user data: 1 slot = 2 × 66 KB = 132 KB = 8 cache segments

Prestaging data in cache

Normally, the Cache Residency Manager data is staged into the Cache Residency cache at the first access from the host. From the second access, cache hit can be done. By using the Cache Residency Manager prestage function, the cache hit is available from the first host access, further improving data access performance. Prestaging can be used for both priority mode and bind mode operations.

Prestaging occurs under any of the following circumstances:

- When prestaging is performed using Cache Residency Manager.
- When the storage system is powered on.
- When cache maintenance is performed.



Cache Residency Manager system specifications

Item	Specification	
	Open system	Mainframe system
Supported device emulation types	OPEN-V OPEN-3, 8, 9, E, K, L	3390-1, 2, 3, 9, A, L, M 3390-3A, 3B, 3C 3390-9A, 9B, 9C 3390-LA, LB, LC 3390-MA, MB, MC
Supported volume types	Virtual LUN	Virtual LVI
Unit of cache area allocation	For OPEN-V, at least 512 LBAs: Equivalent to 256 KB For other than OPEN-V, at least 96 LBAs: Equivalent to 48 KB	At least one cache slot (or track): Equivalent to 66 KB. Up to 1 LDEV.
Number of cache areas	Per storage system: 16,384 Per LDEV: 4,096	

Allocate the cache residency cache to an LDEV for each logical cylinder or head. Cache Residency Manager recognizes the logical block address (LBA) in the unit of 512 blocks for OPEN-V, or in the unit of 96 blocks for other emulation types.

When you configure cache residency, specify whether to enable the Cache Residency mode (priority mode or bind mode), and the prestage function.

Note: Settings specified when you configure cache residency cannot be changed. If you want to change settings, cancel them first, and then specify new settings when you configure cache residency again.

Estimating cache size for Cache Residency Manager

Calculating the cache size required for Cache Residency Manager depends on the cache residency mode (bind or priority) and use of external storage.

Cache Residency Manager cache areas

The resident cache areas are defined in logical blocks using logical block addresses (LBAs), with a minimum size of 512 LBAs (equivalent to 256 KB) for OPEN-V volumes, and a minimum size of 96 LBAs (equivalent to 48 KB) for volumes other than OPEN-V volumes. In most cases you will assign an entire open-systems volume for cache residency.

For mainframe volumes, the resident cache areas are defined on contiguous tracks with a minimum size of one cache slot (or track) (equivalent to 66 KB) and a maximum size of one LVI.

If desired, you can prestage the data to the resident cache area. If prestaging is not used, the data is loaded into the resident cache area when the first “miss” occurs. If prestaging is used, performance may be affected while the data is read into resident cache.

Caution: Prestaging of data into resident cache may impact host I/O performance and should not be performed during peak activity.

The Cache Residency Manager cache areas are dynamic and can be added and deleted when adding or removing cache memories. If you need to expand the amount of Cache Residency Manager cache without canceling the existing settings, contact customer support.

Cache size requirements

The required cache size for using Cache Residency Manager depends on the cache residency mode (bind or priority) and use of external storage. If bind mode is used, storage systems require three times the cache size for the Cache Residency Manager data.

If priority mode or bind mode is used, the cache size is calculated assuming that one slot has the following values.

- For open-systems volumes:
  - For OPEN-V, one slot is 256 KB (512 LBAs).
  - For other than OPEN-V, one slot is 48 KB (96 LBAs).
- For mainframe (3390) volumes:
  - One slot is 66 KB (128 LBAs).

Calculating cache size for open systems

You can calculate cache size for open systems.

Caution:

- If the area is changed from priority mode to bind mode and no cache is added, then only 33% of the user data will fit in the area previously assigned for priority mode, and the remaining 67% is used to save read/write data.
- If the area is changed and no cache is added, set the Cache Residency Manager again.

Procedure

1. Calculate the converted values of the starting address and the ending address.
   For all specified LDEVs:
   a. For OPEN-V:
      `Number of LBAs = LDEV size (KB) × 2`
      Convert the LDEV size to the number of LBAs.
      `Number of slots = ceil(Number of LBAs / 512)`
      ceil(): Round up the value that is calculated from the formula.
      `Converted value of starting address = 0`
      `Converted value of ending address = (Number of slots × 512) - 1`
   b. For emulation types other than OPEN-V:
      `Number of LBAs = LDEV size (KB) × 2`
      Convert the LDEV size to the number of LBAs
      `Number of slots = ceil(Number of LBAs / 96)`
      Round up the value that is calculated from the formula enclosed by ceil().
      `Converted value of starting address = 0`
      `Converted value of ending address = (Number of slots × 96) - 1`
   If the volumes are specified:

a. For OPEN-V:

```
Starting value = floor(Setting value of starting address
(LBA) / 512)
```

Round down the value that is calculated from the formula enclosed by floor(). "Setting value of starting address (LBA)" is the value which is input on the Cache Residency window.

```
Ending value = floor(Setting value of ending address (LBA) /
512)
```

Round down the value that is calculated from the formula enclosed by floor(). "Setting value of ending address (LBA)" is the value which is input on the Cache Residency window.

```
Converted value of starting address = Starting value × 512
```

```
Converted value of ending address = ((Ending value + 1) ×
512) - 1
```

b. For emulation types other than OPEN-V:

```
Starting value = floor(Setting value of starting address
(LBA) / 96)
```

Round down the value that is calculated from the formula enclosed by floor(). "Setting value of starting address (LBA)" is the value which is input on the Cache Residency window.

```
Ending value = floor(Setting value of ending address (LBA) /
96)
```

Round down the value that is calculated from the formula enclosed by floor(). "Setting value of ending address (LBA)" is the value which is input on the Cache Residency window.

```
Converted value of starting address = Starting value × 96
```

```
Converted value of ending address = ((Ending value + 1) × 96)
- 1
```

2. Calculate the number of addresses between the starting address and the ending address calculated in step 1.

```
Number of addresses = Converted value of ending address -
Converted value of starting address + 1
```

3. Calculate the required cache size according to the operation mode to use Cache Residency Manager.

a. When bind mode is set:

```
Required cache = No. of addresses × (512 + 16) × 3 / 1,024
```

The unit is KB.

b. When priority mode is set:

```
Required cache = Number of addresses × (512 + 16) / 1,024
```

The unit is KB.

Calculating cache size for mainframe systems

You can calculate cache size for mainframe systems.

Caution:

- If the area is changed from priority mode to bind mode and no cache is added, then only 33% of the user data will fit in the area previously assigned for priority mode, and the remaining 67% is used to save read/write data.
- If the area is changed and no cache is added, set the Cache Residency Manager again.

Procedure

1. Calculate the converted number of slots. To calculate the number of slots as converted from the specified starting address and ending address, use the following formulas:

   ```
   Converted value of starting address = Setting value of starting
   address (CC) × 15 + Setting value of starting address (HH)
   ```

   where Setting value of starting address (CC) and Setting value of starting address (HH) are the values entered in the Operations box of the Cache Residency window.

   ```
   Converted value of ending address = Setting value of ending address
   (CC) × 15 + Setting value of ending address (HH)
   ```

   where Setting value of ending address (CC) and Setting value of ending address (HH) are the values entered in the Operations box of the Cache Residency window.

   ```
   Number of slots = Converted value of ending address - Converted value
   of starting address + 1
   ```

2. Calculate the required cache size according to the Cache Residency operation mode:
   a. Bind mode:

      ```
      Required cache size (in KB) = (Number of slots × ((128 × (512
      + 16)) × 3) / 1,024
      ```

   b. Priority mode:

      ```
      Required cache size (in KB) = (Number of slots × (128 × (512
      + 16))) / 1,024
      ```

Cautions and restrictions for Cache Residency Manager

Cautions and restrictions for cache residency

- Allocating cache
  - Do not attempt to allocate Cache Residency Manager cache beyond the allocated capacity.
  - Do not attempt to allocate Cache Residency Manager cache redundantly over a cache area that is already allocated to an LDEV.
- Maximum capacity limits
  - Specify 128 GB or less as the capacity of the BIND-mode cache residency extent per parity group. If the capacity is too large, destaging will require too much time, thus resulting in possible failure in planned outage or cache maintenance.
  - Do not specify too large a capacity for the cache residency extent allocated per processor blade. Specify a value as follows:

    [(capacity for BIND) x 3] + (capacity for PRIO) ≤ 192 GB

    Specifying too large a capacity will result in too much overhead in cache management, and thus cache residency performance may not improve as expected.
- Unsupported volumes
  - Pool-VOLs and V-VOLs. You cannot allocate pool-VOLs and V-VOLs for Cache Residency Manager. For more information about pool-VOLs and V-VOLs, see the *Hitachi Thin Image User Guide*, the *Provisioning Guide for Open Systems*, or the *Provisioning Guide for Mainframe Systems*.
  - Journal volumes. You cannot allocate the journal volumes for Cache Residency Manager. For additional information about the journal volumes, see the *Hitachi Universal Replicator User Guide* or the *Hitachi Universal Replicator for Mainframe User Guide*.
  - Remote command device. You cannot allocate the remote command device for Cache Residency Manager. For more information about the remote command device, see the *Hitachi Universal Volume Manager User Guide*.
  - FlashCopy® SE TSE-VOLs. Cache Residency cannot be assigned to a TSE-VOL of Hitachi Compatible Software for IBM® FlashCopy® SE.

- Host I/O response time

  Performing Cache Residency Manager operations on many LDEVs during host I/O may slow the host I/O response time. To avoid degradation of response time, set only one LDEV at a time.

  Deleting data from cache during host I/O may cause the response time of host I/O to become slow. To avoid degradation of host response time, limit the amount of data you delete in one operation as follows:

  If the host timeout period is set to 10 seconds or shorter, limit the total amount of data to:

  - 1 GB or less for open systems
  - 1,000 cylinders or less for mainframe systems

  If the host timeout period is set to 11 seconds or longer, limit the total amount of data to:

  - 3 GB or less for open systems
  - 3,000 cylinders or less for mainframe systems

- Minimum cache requirements

  If the remaining cache memory after the cache residency operation will be less than 512 MB, Cache Residency Manager is not available.

Interoperability restrictions for cache residency

Application	Behaviors
ShadowImage/ ShadowImage for Mainframe	Do not perform the ShadowImage or ShadowImage for Mainframe Quick Restore operation on a Cache Residency Manager volume. Also, do not specify the Cache Residency Manager setting on the volume on which the ShadowImage or ShadowImage for Mainframe Quick Restore operation is performed. This operation swaps the internal locations of the source and target volumes, which causes a loss of data integrity. For additional information, see the *Hitachi ShadowImage® User Guide* or *Hitachi ShadowImage® for Mainframe User Guide*.
Universal Volume Manager	The Cache Residency Manager bind mode is not available to external volumes whose Cache mode is set to Disable (which is the mode that disables the use of the cache when there is an I/O request from the host).
Cache Manager	Do not perform Cache Residency Manager operations using Cache Manager and the GUI at the same time.

Cautions and restrictions for prestaging

- Unsupported volumes

  The prestaging function cannot be used for the following volumes:

  - Dynamic Provisioning volume
  - Dynamic Provisioning for Mainframe volume
  - Dynamic Tiering volume
  - Dynamic Tiering for Mainframe volume

- External volumes and storage system power off

  When external volumes are configured in the storage system, you need to disconnect the external storage system before powering off the storage system. If you power off the storage system without performing the disconnect external storage system operation and then turn on the power supply again, the prestaging process is aborted. If the prestaging process is aborted, you need to perform the prestaging operation again.

- Access before completion of the prestaging operation

  If the Cache Residency Manager cache area is accessed for I/O before the prestaging operation is complete, the data may not be available in cache at the first I/O access.

- Prestaging during high cache load

  To prevent slow response times for host I/Os, the storage system may interrupt the prestaging operation when the cache load is heavy.

- Quick formatting

  Do not use the prestaging function if you specify the Cache Residency Manager setting on a volume during the quick formatting operation. To use the prestaging function after the quick formatting operation completes, first release the Cache Residency Manager setting and then specify the setting again with the prestaging setting enabled. For information about quick formatting, see the *Provisioning Guide for Open Systems* or *Provisioning Guide for Mainframe Systems*.

- Creating, restoring, and deleting a volume

  The prestaging process is aborted if a volume is created, deleted, or restored during the prestaging operation. If the prestaging process is aborted, you need to perform the prestaging operation again after the create, delete, or restore volume operation is complete.

Managing cache-resident data

Placing specific data into cache

This procedure writes specific data from one or more LDEVs into Cache Residency Manager cache.

Caution: If you configure Cache Residency for many LDEVs while I/Os from the host are in progress, host I/O responses might be slowed down. To avoid this, configure Cache Residency for one LDEV at a time.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide*.

Procedure

1. Click **Actions** > **Other Function** > **Cache Residency** to open the **Cache Residency** window.
2. Click to change to Modify mode.
3. In the **Cache Residency** window, select the desired CLPR from the **CLPR**: list.
4. In the CU:LDEV tree, select the LDKC and the CU containing the desired LDEV, and then select the desired LDEV.

   The LDEV information table shows the information for the selected LDEV. A dash (-) in the **Mode** column indicates an area not already allocated to Cache Residency Manager cache.
5. Select an unallocated area in the LDEV information table as the area to place specific data from one or more LDEVs into Cache Residency Manager cache. The starting and ending addresses of the selected area appear in the **Start** and **End** fields.

   Note: For OPEN-V LUs, Cache Residency Manager identifies a logical area in units of 512 blocks. If you enter 0 or 1 as the starting LBA and a value less than 511 as the ending LBA, Cache Residency Manager automatically changes the ending block address to 511.
6. In the **Cache Residency** window, select options to apply to all selected LDEVs:
   a. In the **Cache Residency Mode** box, select the desired mode (**Bind** or **Priority**).
   b. Select the desired Prestaging Mode setting (**Yes** or **No**). To set the prestaging function, the **Prestaging** check box must already be selected.
   c. Verify the starting and ending addresses of the area to be placed in Cache Residency Manager cache in the **Start** and **End** fields. Edit as needed. Make sure that the **Select All Area** box is NOT checked.

   Caution: Make sure to select the correct options, because the options cannot be changed after data is added to cache. To change between bind and priority modes, or to enable and disable the prestaging function, release the cache area that you want to change, and then place the data back into Cache Residency Manager cache with the desired settings.
7. Specify the starting and ending addresses for the area where you place specific data into cache.

a. For open system volumes:

   In the **Start** field, enter the starting address of the logical block address (LBA). In the **End** field, enter the ending address.

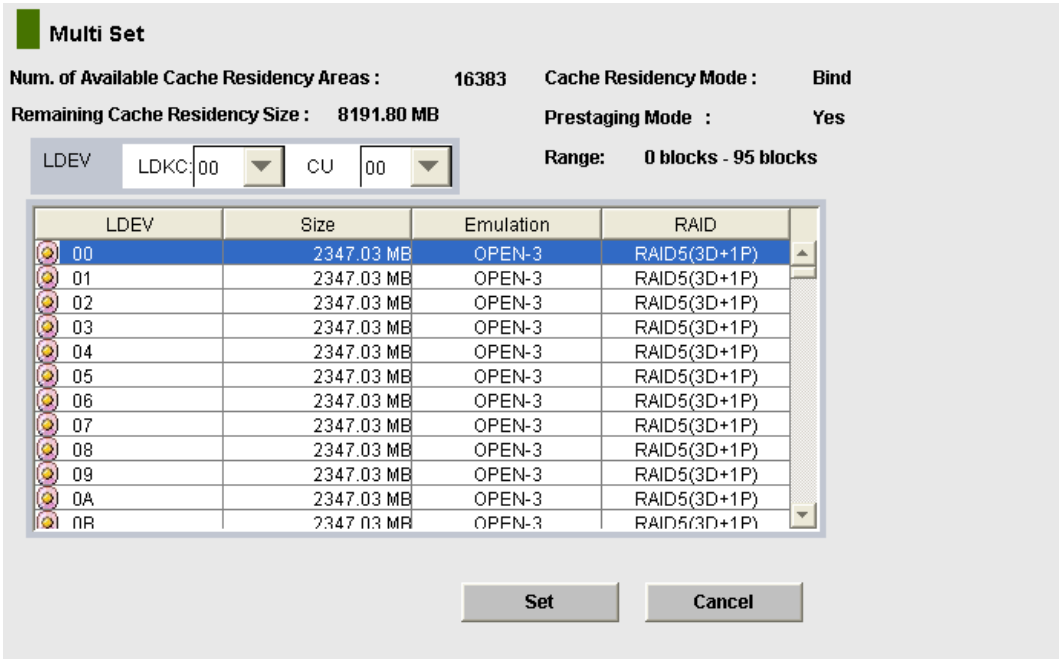
b. For mainframe volumes:

   In CC and HH of the **Start** field, enter the starting cylinder and head numbers. In CC and HH of the **End** field, enter the ending cylinder and head numbers.

8. If you do not want to apply the same options to any other LDEV, make sure that the **Multi Set / Release** box is not checked, click **Set**, and then click **OK** on the confirmation dialog box. The requested Cache Residency Manager operation appears in blue in the LDEV information table.

To apply the same options and data range to additional LDEVs:

a. On the Cache Residency window, select the **Multi Set / Release** box, click **Set**, and then click **OK**. The **Multi Set** dialog box opens showing the data range and options selected on the Cache Residency window.



b. In the **Multi Set** dialog box, select the desired LDKC and CU image, and select the desired LDEVs. The data range and options displayed in the dialog box will be applied to all selected LDEVs.

c. Click **Set** to return to the **Cache Residency** window. The requested Cache Residency Manager operations appear in blue in the LDEV information table.

> **Caution:** Prestaging cannot be set to the following volumes. As a result, even if **Yes** is set for **Prestaging Mode** and the **Multi Set/Release** box is checked, these volumes are not displayed in the **Multi Set** window.
>
> - Dynamic Provisioning volume
> - Dynamic Tiering volume
> - Dynamic Provisioning for Mainframe volume
> - Dynamic Tiering for Mainframe volume

9. Repeat steps 2-5 until all desired operations are listed. The **Release** is unavailable until you apply (or cancel) your requested operations.
10. Verify the Prestaging setting:
    - To enable prestaging, select **Prestaging**.
    - To disable prestaging, clear **Prestaging**.
11. To start the operations, click **Apply**. If Prestaging was selected, respond to the Yes/No confirmation. To continue with prestaging, click **Yes**. To continue without it, click **No**.
12. Monitor the **Cache Residency** window to make sure that the operations complete successfully. The cache information area shows the progress of the requested operations.

Placing LDEVs into cache

This procedure places all data on one or more LDEVs into Cache Residency Manager cache.

> **Caution:** If you configure Cache Residency for many LDEVs while I/Os from the host are in progress, host I/O responses might be slowed down. To avoid this, configure Cache Residency for one LDEV at a time.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide.*

Procedure

1. Click **Actions** > **Other Function** > **Cache Residency** to open the **Cache Residency** window.
2. Click to change to Modify mode.
3. In the Cache Residency window, select the desired **CLPR** from the CLPR list.
4. In the CU:LDEV tree, select the LDKC and the CU containing the desired LDEV, and then select the desired LDEV.

The LDEV information table shows the information for the selected LDEV. A dash (-) in the **Mode** column indicates an area not already allocated to Cache Residency Manager cache.

5. In the **Cache Residency** window, select desired options:
   a. In the **Cache Residency Mode** box, select the desired mode (**Bind** or **Priority**).
   b. Select the desired Prestaging Mode setting (**Yes** or **No**). To set the prestaging function, the **Prestaging** check box must already be selected.
   c. Check the **Select All Area** box. Leave the **Start** and **End** fields blank.

   > **Caution:** Make sure to select the correct options, because the options cannot be changed after a cache area is added. To change between bind and priority modes, or to enable and disable the prestaging function, you must release the cache area that you want to change and then place the data back into cache with the desired settings.

6. If you do not want to apply the same options to any other LDEVs, make sure that the **Multi Set / Release** box is not checked, click **Set**, and then click **OK** on the confirmation dialog box. The requested operation appears in blue in the LDEV information table.

   To apply the same options to additional LDEVs:
   a. In the **Cache Residency** window, select the **Multi Set / Release** box, click **Set**, and then click **OK**. The **Multi Set** dialog box opens showing the data range and options selected on the Cache Residency window.
   b. In the **Multi Set** dialog box, select the desired CU image, and select the desired LDEVs. The options displayed on the dialog box will be applied to all selected LDEVs.
   c. Click **Set** to return to the **Cache Residency** window. The requested Cache Residency Manager operations appears in blue in the LDEV information table.

7. Repeat steps (2)-(4) until all desired operations are listed. The **Release** is unavailable until you apply (or cancel) your requested operations.
8. Verify the Prestaging setting:
   - To enable prestaging, select **Prestaging**.
   - To disable prestaging, clear **Prestaging**.
9. To start the operations, click **Apply**:
   - If Prestaging was selected, respond to the Yes/No confirmation. To continue with prestaging, select **Yes**. To continue without it, select **No**.
   - To cancel the operation, click **Cancel** and click **OK** on the confirmation.
10. Monitor the **Cache Residency** window to make sure that the operations complete successfully. The cache information area shows the progress of the requested operations.

Releasing specific data from cache

You can release specific data areas on one or more LDEVs from Cache Residency Manager cache.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide.*

Procedure

1. Click **Actions** > **Other Function** > **Cache Residency** to open the **Cache Residency** window.
2. Click to change to Modify mode.
3. In the **Cache Residency** window, select the desired CLPR from the CLPR list.
4. In the CU:LDEV tree, select the LDKC and the CU containing the desired LDEV, and then select the desired LDEV.

   The LDEV information table shows the information for the selected LDEV. The **Mode** column indicates **PRIO** or **BIND** for each data area that is allocated to Cache Residency Manager cache.
5. Select the data areas that you want to release from Cache Residency Manager cache. This enables the **Release**.
6. Click **Release**, and click **OK** on the confirmation message.

   The requested operation is displayed in blue in the LDEV information table.
7. Repeat steps (2)-(4) for each LDEV for which you want to release specific data from Cache Residency Manager cache. The **Set** is unavailable until you apply (or cancel) your requested operations.
8. Verify the Prestaging setting:
   - To enable prestaging, select **Prestaging**.
   - To disable prestaging, clear **Prestaging**.
9. To start the operations, click **Apply**:
   - If Prestaging was selected, respond to the Yes/No confirmation. To continue with prestaging, select **Yes**. To continue without it, select **No**.
   - To cancel the operation, click **Cancel** and click **OK** on the confirmation.
10. When the delete confirmation message appears, click **OK** to begin the deletion, or click **Cancel** to cancel your request to delete data.
11. Monitor the **Cache Residency** window to make sure that the operations complete successfully. The cache information area shows the progress of the requested operations.

    When the data has been released, the verification window will appear.

Releasing LDEVs from cache

This procedure releases all data on one or more LDEVs from Cache Residency Manager cache.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide.*

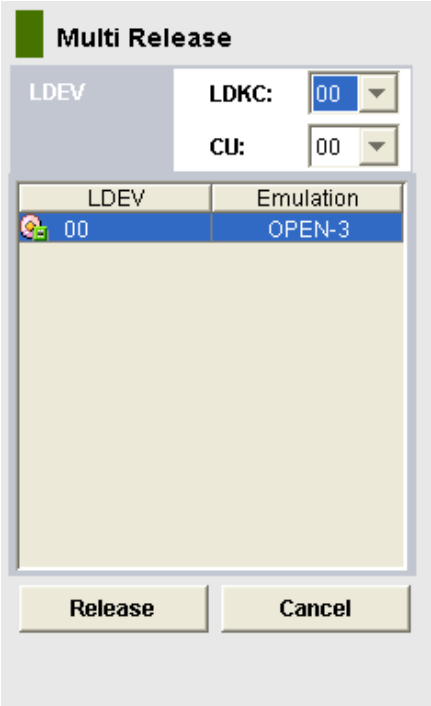
Procedure

1. Click **Actions** > **Other Function** > **Cache Residency** to open the **Cache Residency** window.
2. Click to change to Modify mode.
3. In the **Cache Residency** window, select the desired **CLPR** from the CLPR list.
4. In the CU:LDEV tree, select the LDKC and the CU containing the desired LDEV, and then select the desired LDEV.

   The LDEV information table shows the information for the selected LDEV. The **Release** is available if the selected LDEV has data that is stored in Cache Residency Manager cache (indicated by **PRIO** or **BIND** in the **Mode** column).
5. If you do not want to release any other LDEVs from Cache Residency Manager cache, make sure that the **Multi Set / Release** box is not checked, click **Release**, and then click **OK** on the confirmation dialog box. The requested operation appears in blue in the LDEV information table.

   To release additional LDEVs from Cache Residency Manager cache:

   a. Check the **Multi Set / Release** box, click **Release**, and then click **OK** on the confirmation message.



b. In the **Multi Release** dialog box, select the desired LDKC and CU image, and select the desired LDEVs to release from Cache Residency Manager cache.

c. Click **Release** to return to the **Cache Residency** window. The requested Cache Residency Manager operations appear in blue in the LDEV information table.

6. Repeat steps (2) and (3) until all desired operations are listed.

   Note: The **Set** is unavailable until you apply (or cancel) your requested operations.

7. Verify the Prestaging setting:
   - To enable prestaging, select **Prestaging**.
   - To disable prestaging, clear **Prestaging**.
8. To start the operations, click **Apply**:
   - If Prestaging was selected, respond to the Yes/No confirmation. To continue with prestaging, click **Yes**. To continue without it, click **No**.
   - To cancel the operation, click **Cancel** and click **OK** on the confirmation.
9. Monitor the **Cache Residency** window to make sure that the operations complete successfully. The cache information area shows the progress of the requested operations.

Changing modes for data already in cache

After data has been placed in cache, the cache residency mode (bind or priority) and prestaging mode (yes, no) cannot be changed. If you need to change the cache residency mode or prestaging mode, you must first release the data from cache and then place the data back into cache with the new settings.

For instructions on releasing data from cache, see Releasing specific data from cache (on page 242) and Releasing LDEVs from cache (on page 243). For instructions on placing data into cache, see Placing specific data into cache (on page 237) and Placing LDEVs into cache (on page 240).

Viewing Cache Residency information

The Cache Residency window displays the cache residency information for the storage system.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide.*

Procedure

1. Click **Actions** > **Other Function** > **Cache Residency** to open the **Cache Residency** window.
2. The cache residency information is displayed in the following fields in the **Cache Residency** window.
   - CU:LDEV tree
   - LDEV information table
   - Cache information area

Chapter 8: Troubleshooting

This chapter provides troubleshooting and contact information for customer support.

General troubleshooting resources

For troubleshooting information on your storage system, see the *Hardware Guide* of your storage system model.

For troubleshooting information on Device Manager - Storage Navigator, see the *System Administrator Guide* of your storage system.

For information about Device Manager - Storage Navigator error codes, see the *Hitachi Device Manager - Storage Navigator Messages*.

Troubleshooting Performance Monitor

Error	Recommended action
Part of monitoring data is missing.	While displaying Performance Monitor in short range, if I/O workloads between hosts and the storage system become heavy, the storage system gives higher priority to I/O processing than monitoring processing. If you notice that monitoring data is frequently missing, change to a longer collection interval. If part of the monitoring data is missing for reasons other than this explanation, see the table in Causes of invalid monitoring data (on page 165)
The monitoring data is not updated, even though Monitoring Switch is set to Enable.	If the time setting of the SVP is changed, the monitoring data might not be updated. Set Monitoring Switch to Disable, and set Monitoring Switch to Enable again.
The WWN of a host bus adapter is displayed in red on the WWN tab.	The HBA for the WWN that is displayed in red is connected to two or more ports, but the traffic between the HBA and some of the ports is not monitored by Performance Monitor. When many-to-many connections are established between HBAs and ports, make sure that all traffic between HBAs and ports is monitored. For details, see Monitoring all port-HBA traffic: many-to-many connections (on page 189) .

Troubleshooting Export Tool for Performance Monitor

The following table explains possible problems with Export Tool and probable solutions to the problems.

Possible problems	Probable causes and recommended action
You cannot run the batch file.	The path to the Java Virtual Machine (Java.exe) might not be defined in the PATH environment variable. If this is true, you must add that path to the PATH environment variable. For information about how to add a path to the environment variable, see the documentation for your operating system. An incorrect version of Java Runtime Environment (JRE) might be installed on your computer. To check the JRE version, enter the following command at the Windows command prompt or the UNIX console window: `Java -version` If the version is incorrect, install the correct version of JRE.
Export Tool stops and the processing does not continue.	▪ The command prompt window might be in pause mode. The command prompt window will be in pause mode if you click the command prompt window when Export Tool is running. To cancel pause mode, activate the command prompt window and then press the <ESC> key. If a timeout of RMI occurs during pause mode, the login will be canceled and an error will occur when you cancel pause mode after the timeout. The error message ID will be (0001 4011). ▪ If a memory size is not specified in a batch file, the Out Of Memory Error occurs in JRE, Export Tool might stop and the processing might not continue. Confirm whether the specified memory size is correct or not.
The command prompt window was displaying progress of the export processing, but the window stopped displaying progress before the processing stopped. The progress information does not seem to be updated anymore.	

Possible problems	Probable causes and recommended action
An error occurs and the processing stops.	If the error message ID is (0001 4011), the user is forcibly logged off and the processing stops because Export Tool did not issue any request to SVP within the timeout period specified by the -Dmd.rmitimeout parameter of the Java command (default: 20 minutes). The computer running Export Tool could be slow. Confirm whether you are using a computer that is not supported, or whether the computer is slow. To continue running Export Tool, first increase the value of the -Dmd.rmitimeout parameter (maximum: 1,440 minutes (24 hours), and then run Export Tool. For details about -Dmd.rmitimeout, see the Operands table for the Java command in Operands (on page 138) . If the error persists, contact the customer support. If the error message ID is (0002 5510), probable error causes and solutions are: ▪ An internal processing is being performed in the storage system. Alternatively, another user is changing configurations. Wait for a while and then run Export Tool again. ▪ Maintenance operations are being performed on the storage system. Wait until the maintenance operations finish and then run Export Tool again. If the error message ID is none of the above, see Messages issued by Export Tool (on page 250) .
The monitoring data in the CSV file includes (-1).	For details on invalid monitoring data, see Causes of invalid monitoring data (on page 165) .

Possible problems	Probable causes and recommended action
▪ When Export Tool terminated abnormally due to error, the row of Check License is shown as Unmarshal Exception in the log file. ▪ Export Tool terminated abnormally because the processing did not continue. version unmatched is shown in the log file.	(VSP G1x00 and VSP F1500) It might be an unsuitable combination of the DKCMAIN/SVP program version and the Export Tool version. Confirm whether versions of these programs are correct. (VSP Gx00, VSP Fx00, and VSP Nx00) It might be an unsuitable combination of the DKCMAIN irmware version, the Device Manager - Storage Navigator software version, and the Export Tool version. Con irm whether versions of these programs are correct.
Export Tool terminated abnormally. NoSuchObjectExceptio n is shown in the log file.	The computer workload might be high. Perform potential fixes to lower the workload as shown below. Then execute Export Tool again. ▪ Reduce the number of Export Tool applications running concurrently. ▪ Execute Export Tool while virus scan is not being performed by anti-virus software.
When a CSV file is opened, the parity group ID and volume ID appear as follows: ▪ The parity group IDs appear as dates. ▪ The volume IDs appear with a decimal point.	To display a CSV file correctly, you need to perform the following operations: 1. Start Microsoft Excel. 2. On the menu bar, select Data, Import External Data, and Import Text File, and specify a CSV file to import. The Text Import.zip - Step 1 of 3 dialog box is displayed. 3. In the Text Import.zip - Step 1 of 3 dialog box, click Next. Text Import.zip - Step 2 of 3 dialog box is displayed. 4. In the Text Import.zip - Step 2 of 3 dialog box, check only Comma in the Delimiter area, and click Next. The Text Import.zip - Step 3 of 3 dialog box is displayed. 5. In the Text Import.zip - Step 3 of 3 dialog box, select all columns of Date preview, and check Text in the Column data format area on the upper right of this dialog box. 6. Click Finish. The imported CSV file is displayed.

Possible problems	Probable causes and recommended action
When you run Export Tool with many volumes specified, Export Tool terminated abnormally while collecting monitoring data.	Because too many volumes are specified, a timeout error might have occurred due to a heavy workload imposed on the computer where Export Tool was running. The error message ID is (0001 4011). Specify fewer volumes. It is recommended that the number of volumes to be specified is 16,384 or less.
When you switch the master and the standby SVP for the SVP in which SVP High Availability Feature is installed, short-range monitoring data disappears. (VSP G1x00 and VSP F1500)	When you switch the master and the standby SVP for the SVP in which SVP High Availability Feature is installed, only the long-range monitoring data is kept. When you switch the SVP, run Export Tool beforehand as necessary, and acquire the short-range monitoring data.
"404 Not found." or other errors appear when you run Export Tool.	This error occurred because the Export Tool execution has failed. Possible causes are as follows: ▪ The **`svpip`** value is wrong. ▪ The SVP version you are using is old.
"Specified "ip" is wrong." appears when you run Export Tool. (VSP Gx00, VSP Fx00, and VSP Nx00)	This error occurred because the network connection with the SVP could not established. Possible causes are as follows: ▪ The IP address or host name specified by the **`ip`** subcommand is incorrect. ▪ The connection port number (default is 1099) specified by the **`ip`** subcommand is incorrect.* ▪ The connection port number (default is 1099) for RMI connection used by the SVP is changed or used by other applications.* ▪ The SVP is not working correctly or does not have a network connection.
* For the connection port number, see the hardware reference guide for your model.	

Messages issued by Export Tool

If an error occurs when running Export Tool, error messages are issued to the standard output (for example, the command prompt) and the log file. The following table lists Export Tool messages, descriptions and recommended actions against errors.

Export Tool messages	Description	Recommended action
Connection to the server has not been established.	Connection to the server has not been established.	Use the **`login`** subcommand.
Execution stops.	Processing was stopped.	Remove errors.
Illegal character: *character*	An illegal character is used.	Use legal characters.
Invalid length: *token*	The length is invalid.	Specify a value that has a correct length.
Invalid Mode: *startup-mode*	Operation has failed due to invalid mode.	Specify a correct mode.
Invalid range: *range*	The specified range is invalid.	Specify the correct range.
Invalid URL: *URL*	The specified URL is invalid.	Check the URL.
Invalid value: *value*	The specified value is invalid.	Specify a correct value.
Login failed	An attempt to log on to the storage system or SVP failed. Probable causes are: 1. An incorrect operand is used for the following subcommands: ▪ (VSP G1x00 and VSP F1500) **`svpip`** ▪ (VSP Gx00, Nx00, and VSP Fx00 models) **`ip`** ▪ (VSP Gx00,Nx00, and VSP Fx00 models) **`dkcsn`** 2. An incorrect operand is used for the **`login`** subcommand. 3. The specified user ID is used by another user, and the user is logging in to the storage system or SVP. 4. Another user is using the Server Priority Manager window.	For 1 and 2, specify the correct operand. For 3, determine the user logging in with same user ID and ask the user to log off. For 4 and 5, take one of the following actions: ▪ Ask the other user to close the Server Priority Manager window. ▪ Ask the other user to log off. ▪ Wait for the other user to quit Export Tool. (VSP G1x00 and VSP F1500) For 6, use the correct combination of versions for DKCMAIN/SVP and Export Tool. (VSP Gx00, VSP Fx00, and VSP Nx00) For 7, match the versions of Device Manager -Storage Navigator and Export Tool.

Export Tool messages	Description	Recommended action
	5. Another user is running Export Tool. 6. (VSP G1x00 and VSP F1500) The combination of DKCMAIN/SVP and Export Tool is invalid. 7. (VSP Gx00, Nx00, and VSP Fx00 models) Versions of Device Manager - Storage Navigator and Export Tool do not match. If the error is not caused by the conditions listed above, see Troubleshooting Export Tool for Performance Monitor (on page 247).	
Missing command file	The command file is not specified.	Specify the name of the command file correctly.
Missing group name	No operand is specified in the **group** subcommand.	Specify operands for the subcommand.
Missing host name	No host name is specified.	Specify a host name.
Missing output directory	No directory is specified for saving files.	Specify the directory for saving files.
Missing password	Export Tool cannot find the user password, which is used to log on to the storage system.	Specify the password.
Missing **svpip** (VSP G1x00 and VSP F1500)	The **svpip** subcommand is not used.	Use the **svpip** command.
Missing **ip** (VSP Gx00, VSP Fx00, and VSP Nx00)	The **ip** subcommand is not specified.	Specify the **ip** subcommand first.
Missing **dkcsn** (VSP Gx00, Nx00, and VSP Fx00 models)	The **dkcsn** subcommand is not specified.	Specify the **dkcsn** subcommand first.
Missing time range	The time range is not specified.	Specify the time range.

Export Tool messages	Description	Recommended action
Missing user ID	Export Tool cannot find the user ID, which is used to log on to the storage system.	Specify the user ID.
Out of range: *range*	The value is outside the range.	If the **`shortrange`** subcommand or the **`longrange`** subcommand is used, specify a value within the range from the monitoring start time to the monitoring end time. For specification required when you narrow down the file save period with a **`longrange`** subcommand, see longrange (VSP G1x00 and VSP F1500) (on page 127). If the **`set`** subcommand is used with the switch operand, specify a value within the range of 1 to 15.
Permission Denied	The user ID does not have the required permission.	Assign the applicable storage administrator's role (performance management) to the user ID.
RMI server error (*part-code*, *error-number*)	An error occurs at the RMI server.	See the *Hitachi Device Manager - Storage Navigator Messages*.
Serial-No not found (VSP Gx00, Nx00, and VSP Fx00 models)	The serial number of the system in which to obtain monitoring data cannot be found.	Specify the serial number of the system connected to the SVP.
Same log path: *path*	Same path is specified for el.logpath and el.logfile parameters, or md.logpath and md.logfile parameters.	Check the path you have specified.
Unable to display help message	Export Tool cannot display the online help due to a system error.	Run Export Tool again. If the problem occurs again, contact customer support. For details, see Calling customer support (on page 257).

Export Tool messages	Description	Recommended action
Unable to execute ExportTool.	Failed to run Export Tool. The downloaded file is damaged or an error might have occured while running Export Tool.	Run Export Tool again. If the problem occurs again, contact customer support. For details, see Calling customer support (on page 257) .
Unable to get ExportTool from the server : URL=*URL* [,code=*error-code*]	Failed to obtain Export Tool from the server. HTTP might have failed to obtain the file.	Check the URL and the HTTP error codes. No error code is displayed for errors that occur while data is being obtained.
Unable to get serial number	Export Tool cannot obtain the serial number due to a system error.	Check the following: - SVP is operating correctly. - SVP is connected to the network.
Unable to get time range for monitoring	SVP does not contain monitoring data.	Accumulate monitoring data before using Export Tool.
Unable to read command file: *file*	Export Tool cannot read the command file.	Specify the name of the command file correctly.
Unknown host: *host-name*	Export Tool cannot resolve the host name.	Specify the correct host name.
Unsupported command: *command*	Export Tool does not support the specified command.	Specify a correct command.
Unsupported operand: *operand*	The specified operand is not supported.	Correct the specified operand.
Unsupported option: *option*	The specified option is not supported.	Correct the specified option.
Some file exists in path. What do you do? clear(c)/ update(u)/stop(p) You selected "action". Is it OK? (y/n)	Files exist in path.	If you want to clear the files, press the <c> key. If you want to overwrite the files, press the <u> key. If you want to stop the operation, press the <p> key.

Export Tool messages	Description	Recommended action
		When you press a key, a message appears and asks whether to perform the specified action. To perform the specified action, press the <y> key. To cancel the specified action, press the <n> key.
Speci ied "ip" is wrong. (VSP Gx00, VSP Fx00, and VSP Nx00)	The IP address, the host name, or the connection port number is not correct.	Check the IP address, host name, or connection port number of the SVP. If you do not specify the connection port number, 1099 (default) is used. If the probable cause is not applicable, see Troubleshooting Export Tool for Performance Monitor (on page 247)
Specify the following subcommand before **`login`** subcommand: **`retry`**	The **`retry`** subcommand is written in an incorrect position in the command file.	Write the **`retry`** subcommand before the **`login`** subcommand.
Syntax error: *line*	A syntax error is detected in a command line in your command file.	Check the command line for the syntax error and then correct the script. Some operands must be enclosed by double quotation marks ("). Check the command line to find whether double quotation marks are missing.
Unable to connect to the server : *host*:*port*	Failed to access the server.	Check the hostname and port number.
Unable to create temporary directory: *tmp*	Failed to create a temporary directory.	Check the access permission to the directory, and make sure if there are any files.

Export Tool messages	Description	Recommended action
[login]version unmatched (VSP Gx00, VSP Fx00, and VSP Nx00)	The Export Tool version does not correspond to the Device Manager - Storage Navigator software version.	Upgrade Export Tool to match the Export Tool and Device Manager - Storage Navigator. software versions.

Troubleshooting Server Priority Manager

Error	Recommended action
The WWN of a host bus adapter is displayed in red on the WWN tab.	The HBA for the WWN that is displayed in red is connected to two or more ports, but the traffic between the HBA and some of the ports is not monitored by Performance Monitor. When many-to-many connections are established between HBAs and ports, make sure that all traffic between HBAs and ports is monitored. For details, see Monitoring all port-HBA traffic: many-to-many connections (on page 189).

Troubleshooting Cache Residency Manager (VSP G1x00 and VSP F1500)

Error	Recommended action
The host I/O response time has become degraded.	To avoid degradation of host response time, add and delete only one LDEV at a time. If the host timeout period is set to 10 seconds or shorter, limit the total amount of data in one operation to: ▪ 1 GB or less for open systems ▪ 1,000 cylinders or less for mainframe systems If the host timeout period is set to 11 seconds or longer, limit the total amount of data in one operation to: ▪ 3 GB or less for open systems ▪ 3,000 cylinders or less for mainframe systems
Cache Residency Manager is not available.	The remaining cache memory after the cache residency operation will be less than 512 MB. Select less data to place in cache, or install additional cache memory.

Troubleshooting Virtual Partition Manager

Error	Recommended Action
The CLPR name cannot be changed.	You cannot assign the same name to more than one CLPR. The name you entered is already in use or is a reserved name. Enter another name.
The parity group in a CLPR cannot be migrated to another CLPR.	If you cannot migrate a parity group in the CLPR to another CLPR, perform the following: ▪ (VSP G1x00 and VSP F1500) If Cache Residency settings are defined for an LDEV in a parity group, the parity group cannot be migrated. Release the defined Cache Residency, and then migrate the parity group. ▪ Make sure to click Apply when creating a new CLPR.

Calling customer support

If you need to call the Hitachi Vantara Support Center, make sure to provide as much information about the error as possible, including:

- 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 Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by Device Manager - Storage Navigator.

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

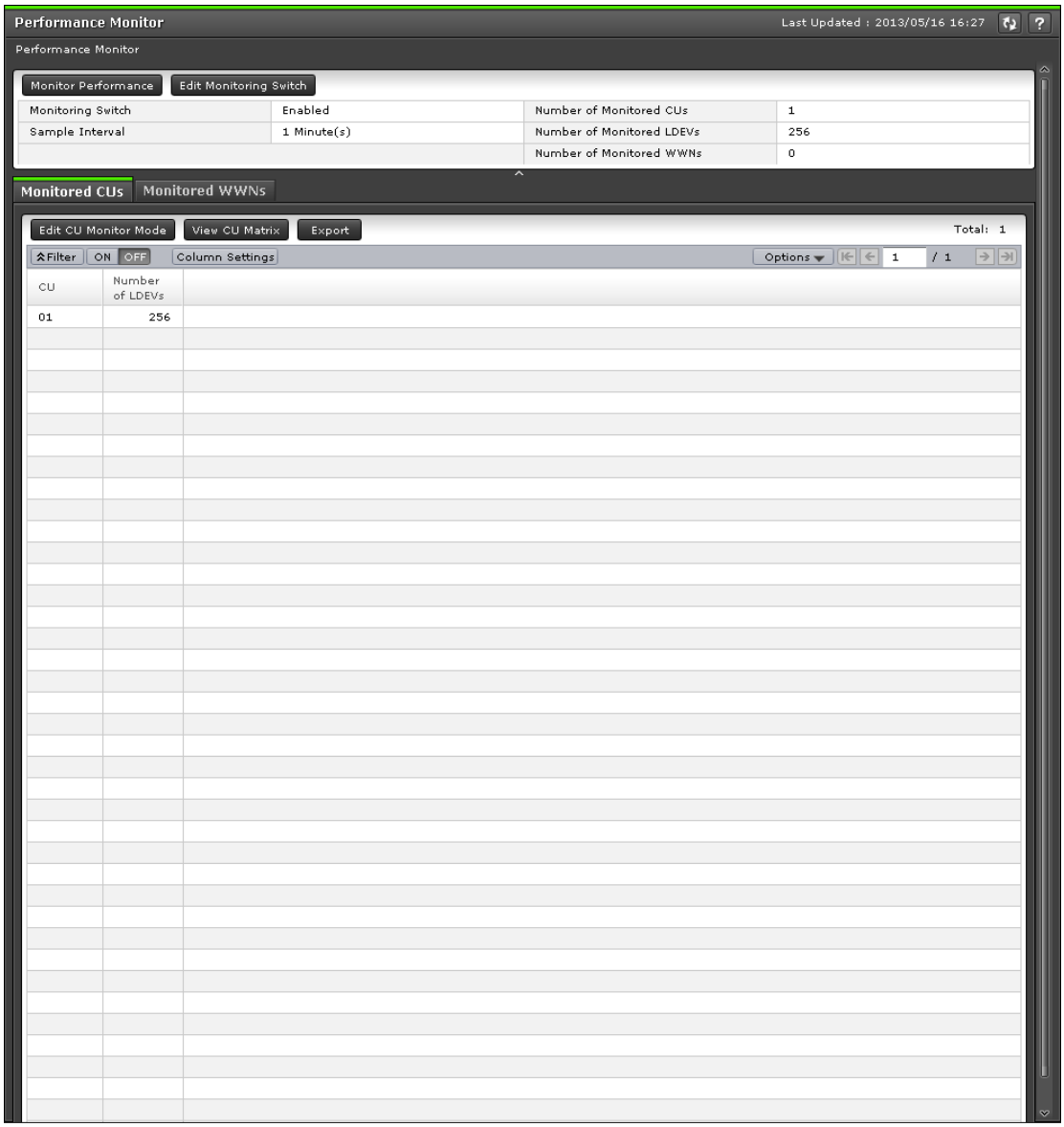
Appendix A: Performance Monitor GUI reference

This chapter provides detailed information about the Performance Monitor GUI.

Performance Monitor main window

This is the main window for monitoring performance on your storage system. From this window you can set up monitoring parameters, start and stop monitoring, and view performance graphs. To open this window, select Performance Monitor in the Device Manager - Storage Navigator main window.

- Summary Information
- Monitored CUs tab
- Monitored WWNs tab



Buttons

Item	Description
Server Priority Manager*	Click to open the Server Priority Manager window, which allows you to prioritize/non-prioritize ports and WWNs and to create WWN monitor groups.
Monitor Performance	Click to open the **Monitor Performance** window where you can specify the monitoring objects and monitoring period. Up to 8 objects can be specified in one graph panel. Up to 16 objects can be specified in 4 graph panels.

Item	Description
Edit Monitoring Switch	Click to open the **Edit Monitoring Switch** window, which allows you to start and stop performance monitoring and specify how often to monitor statistics.
* Appears when the secondary windows are enabled in the **Edit Information Display Settings** window.	

Summary information

Item	Description
Monitoring Switch	Current monitoring status: Enabled: Performance Monitor is monitoring the storage system. Disabled: The storage system is not being monitored.
Sample Interval	Current sampling interval, from 1 to 15 minutes, for which statistics are collected during short-range monitoring. This value is available when Enabled is selected in the Monitoring Switch field. If Disabled is selected, a hyphen appears.
Number of Monitored CUs	▪ (VSP G1x00 and VSP F1500) Number, from 0 to 255, of CUs currently being monitored. ▪ (VSP Gx00, VSP Fx00, and VSP Nx00) Number, from 0 to 64, of CUs currently being monitored. Appears only for VSP G800 and VSP F800.
Number of Monitored LDEVs	Numbers of LDEV currently being monitored: ▪ (VSP G1x00 and VSP F1500) From 0 to 65280 ▪ (VSP Gx00, VSP Fx00, and VSP Nx00) • VSP G200: 0 to 2,048 • VSP G/N400, VSP G/N600, VSP F400, F600: 0 to 4,096 • VSP G/N800, VSP F800: 0 to 16,384
Number of Monitored WWNs	Number, from 0 to 2048, of WWNs currently being monitored.

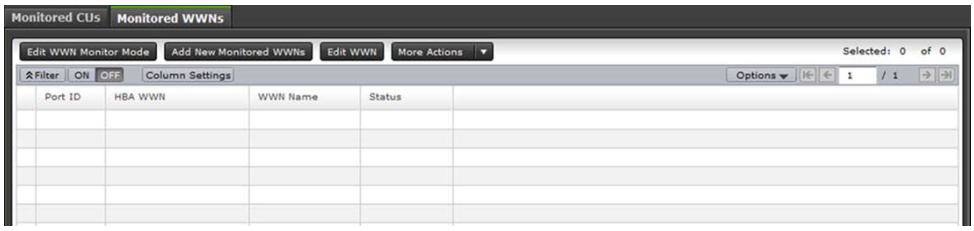
Monitored CUs tab

Use this tab to view information about the CUs that are currently being monitored.

Appears only for VSP G800, VSP Nx00, VSP F800, VSP G1x00 and VSP F1500.

Item	Description
CU	CU number.
Number of LDEVs	Number of LDEVs included in the monitored CUs.
Edit CU Monitor Mode	Click to open the **Edit CU Monitor Mode** window, where you can change the monitoring status.
View CU Matrix	Click to open the **View CU Matrix** window, where you can view following monitoring statuses of CUs. ▪ CU which is being monitored ▪ CU which is scheduled to be monitored ▪ CU which is scheduled to be released from monitoring
Export	Displays the window for outputting table information.

Monitored WWNs tab



Use this tab to view information about the WWNs that are currently being monitored.

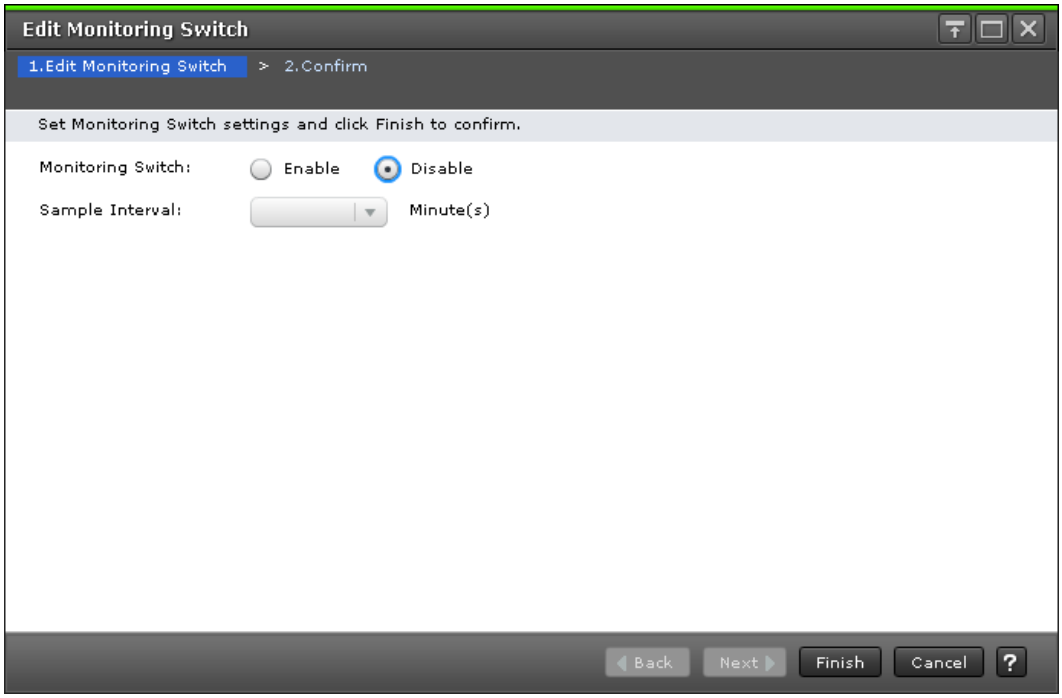
Item	Description
Port ID	Name of the port of the monitored WWN.
HBA WWN	Host bus adapter ID of the monitored WWN.
WWN Name	A WWN name is up to 64 alphanumeric characters and some signs.
Status	Following statuses of the port connected with WWN. Normal: All WWNs connected with the port are monitoring target objects. Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.
Edit WWN Monitor Mode	Click to open the **Edit WWN Monitor Mode** window.

Item	Description
Add New Monitored WWNs	Click to open the **Add New Monitored WWNs** window.
Edit WWN	Click to open the **Edit WWN** window.
Delete Unused WWNs*	Click to open the **Delete Unused WWNs** window.
Add to Ports*	Click to open the **Add to Ports** window.
Export*	Displays the window for outputting table information.
* Appears when you click More Actions.	

Edit Monitoring Switch wizard

Edit Monitoring Switch window

Use this window to start and stop performance monitoring and to specify the sampling interval for how often to monitor statistics.

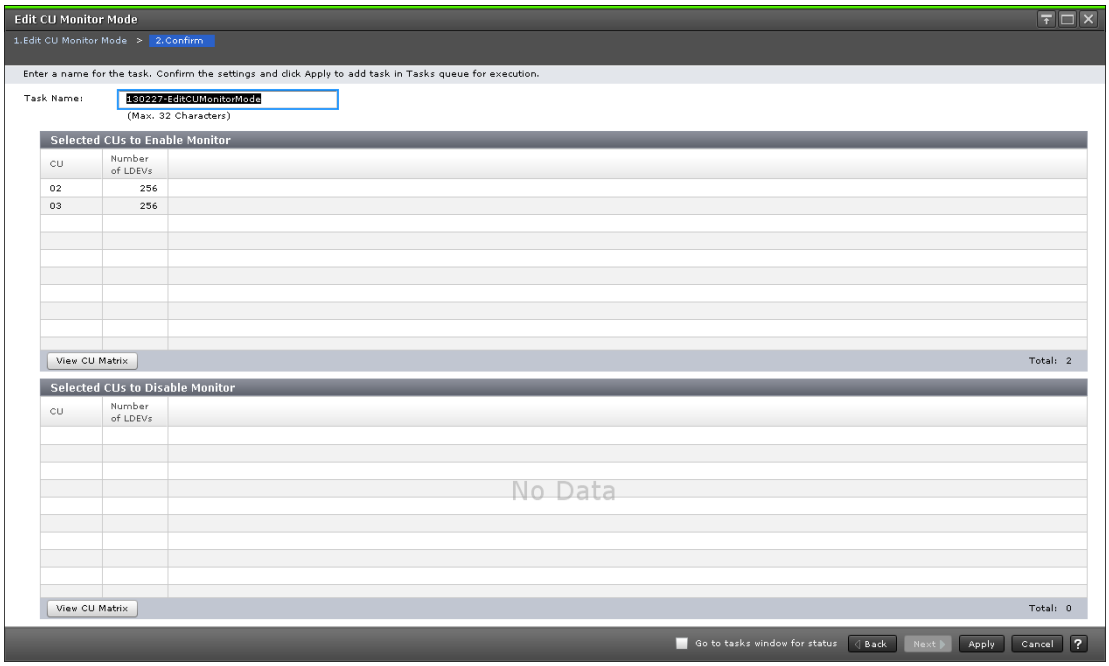


Setting fields

Item	Description
Monitoring Switch	Specify the monitoring status. Enable: Performance Monitor is monitoring the storage system. Disable: Performance Monitor is not monitoring the storage system.
Sample Interval	Specify the time interval of collecting statistics. Default is blank. ▪ (VSP G1x00 and VSP F1500) If the number of CUs to be monitored is 64 or less and short range is selected, you can specify from 1 to 15 minutes at intervals of 1 minute. ▪ (VSP G1x00 and VSP F1500) If 65 or more CUs are monitored and short range is selected, you can specify 5, 10, or 15 minutes. You cannot select long range. ▪ (VSP Gx00, VSP Fx00, and VSP Nx00) If the number of CUs to be monitored is 32 or less, you can specify from 1 to 15 minutes at intervals of 1 minute. ▪ (VSP Gx00, VSP Fx00, and VSP Nx00) If 33 or more CUs are monitored, you can specify 5, 10, or 15 minutes.

Edit Monitoring Switch confirmation window

Use this window to confirm the specified monitoring information and to assign a task name to the editing task.



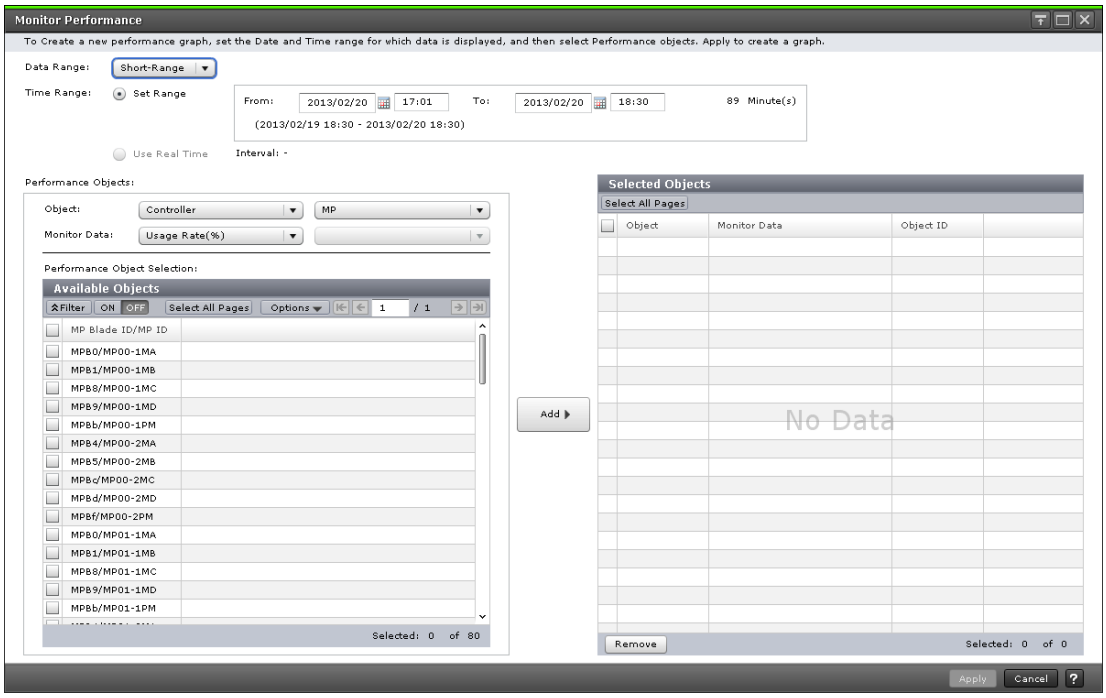
Monitoring Switch Setting table

Confirm the monitoring switch information to be changed.

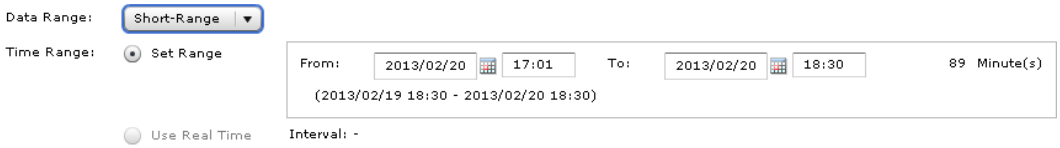
Item	Description
Monitoring Switch	Following monitoring statuses of the storage system are given below. Enabled: Performance Monitor is monitoring the storage system. Disabled: Performance Monitor is not monitoring the storage system.
Sample Interval	Time interval of collecting statistics.

Monitor Performance window

Use this window to specify the monitoring period and monitoring objects that will be displayed in graphs. You can set a maximum of eight monitoring objects per graph panel. You can set a maximum of four graph panels with up to 16 monitoring objects.



Data Range



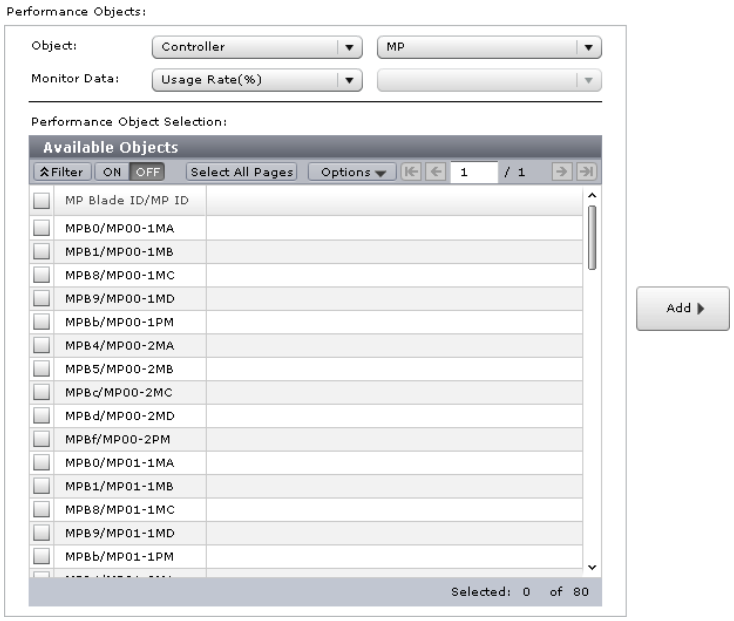
Specify a range of statistics. Short-Range is default when there is monitor data collected with short range. However, Long-Range is default when there is no monitor data collected with short range.

Time Range

Specify the storing period of statistics

- Set Range: Select this option to specify start and ending times to set a time range for which monitoring statistics will be collected.
- Use Real Time: Select this option to view statistics in real time mode, where statistics are updated at the value of the Sample Interval you specify on the Edit Monitoring Switch window. This option is available when the Short-Range mode is selected. When this option is selected, you cannot change the date field in the Set Range option.

Performance Objects

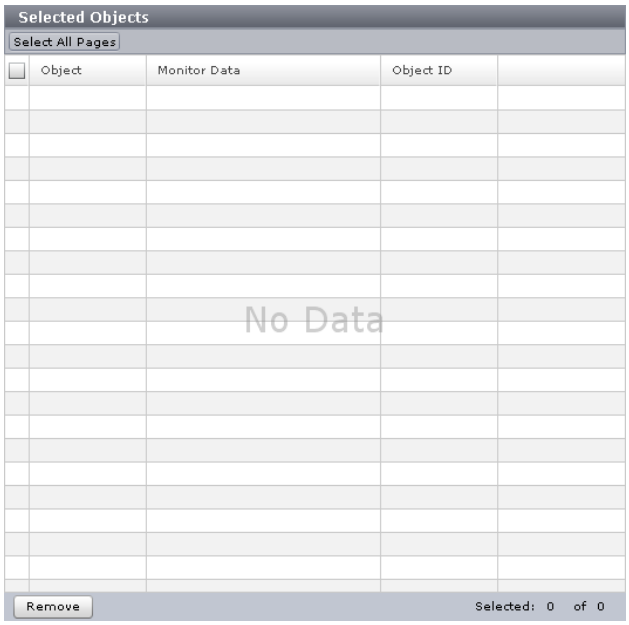


Item	Description
Object	Types of objects to display on graphs. The list on the left specifies a large classification of monitoring objects. The list on the right specifies a small classification of monitoring objects.
Monitor Data	Performance data specified in the field. The list on the left specifies a large classification of performance data. The list on the right specifies a small classification of performance data. For details, see Object and Monitor Data combinations (on page 268) .
Performance Object Selection	Objects that can be displayed in graphs. For details, see Available Objects table (on page 280) .

Add

Adds objects to display the graph.

Selected Objects table



Item	Description
Object	Object types selected in the Performance Objects area.
Monitor Data	Monitor data types selected in the Performance Objects area.
Object ID	IDs of the selected objects.
Remove	Selected rows can be deleted from the table.

Object and Monitor Data combinations

The following table shows the possible Object and Monitor Data combinations that can be selected in the Performance Objects area of the **Monitor Performance** window.

- If Controller is selected on the left side of the Object field, the item on the right side of Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
MP	Usage Rate	%
DRR (VSP G1x00 and VSP F1500)	Usage Rate	%

- If Cache is selected on the left side of the Object field, items on the right side of the Object and Monitor Data is blank field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Usage Rate	%
None	Write Pending Rate	%

- (VSP G1x00 and VSP F1500) If Access Path is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
CHA-Cache	Usage Rate	%
DKA-Cache	Usage Rate	%
MP Blade-Cache	Usage Rate	%
Cache	Usage Rate	%

- (VSP G1x00 and VSP F1500) If Fibre Port is selected on the left side of the Object field, the item on the right side of the Object and Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
None	Data Trans.	MB/s
None	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If Fibre Port is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP G1x00 and VSP F1500) If Mainframe Fibre Port is selected on the left side of the Object field, the item on the right side of the Object field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Throughput	None	IOPS
Data Trans.	Total	MB/s
	Read	MB/s
	Write	MB/s
Response Time	None	ms
CMR delay Time	None	ms
Disconnected Time	None	ms
Connected Time	None	ms
HTP Port open exchanges	None	count/sec

- (VSP G1x00 and VSP F1500) If iSCSI Port is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If iSCSI Port is selected on the left side of the Object ield, the item on right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If NAS Platform (User LU) or NAS Platform (System LU) is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- If WWN is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
WWN	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Port	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- If Logical Device is selected on the left side of the Object field and if Base is selected on the right of the Object field, the following items can be selected.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate[1]	None	%
Drive Access Rate[1]	Read (Sequential)	%
	Read (Random)	
	Write (Sequential)	
	Write (Random)	
ShadowImage[1,2]	None	%

Notes:

1. Only information about internal volumes is displayed. Information about external volumes and FICON DM volumes is not displayed.
2. (VSP G1x00 and VSP F1500) Information for ShadowImage and ShadowImage for Mainframe is displayed.

- If Logical Device is selected on the left side of the Object field and if TC/TCMF/GAD is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If Logical Device is selected on the left side of the Object field and if UR/URMF is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Parity Group is selected on the left side of the Object field, the item on the right side of the Object field is blank. A parity group is displayed only when the CU number of each LDEV within the parity group is to be monitored.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500)Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate*	None	%
* Only information about internal volumes is displayed. Information about the following is not displayed: ▪ external volumes ▪ (VSP G1x00 and VSP F1500) FICON DM volumes		

- If LUN is selected on the left side of the Object field and if Base is selected on the right of the Object field, the following items can be selected.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	

- If LUN is selected on the left side of the Object field and if TC/GAD is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If LUN is selected on the left side of the Object field and if UR is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Journal is selected on the left side of the Object field, UR/URMF is selected on the right side of the Object field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%
	Meta Data Usage Rate	%
Restore Journal	Throughput	IOPS

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%
	Meta Data Usage Rate	%

- If Entire Storage System is selected on the left side of the Object field and if TC/TCz/GAD is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If Entire Storage System is selected on the left side of the Object field and if UR/URz is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms

- If External Storage is selected on the left side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Logical Device	Data Trans.	Total	MB/s
		Read	
		Write	
	Response Time	Total	ms
		Read	
		Write	
Parity Group*	Data Trans.	Total	MB/s
		Read	
		Write	
	Response Time	Total	ms
		Read	

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
		Write	
(VSP G1x00 and VSP F1500) * Only parity groups in which all CUs for all LDEVs are being monitored are displayed. Parity groups in which all CUs are not subject to monitoring are not displayed.			

Available Objects table

The items appearing in the Available Objects table depend on the objects selected in the Performance Objects fields.

Monitoring object	Item	Description
Fibre Port (VSP G1x00 and VSP F1500) Fibre Port/Target and Fibre Port/Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
Mainframe Fibre Port (VSP G1x00 and VSP F1500)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
iSCSI Port (VSP G1x00 and VSP F1500) iSCSI Port/Target and iSCSI Port/Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
NAS Platform (User LU) / Target (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
NAS Platform (System LU) / Target (VSP Gx00, VSP Fx00, and VSP Nx00)		

Monitoring object	Item	Description
WWN/WWN	HBA WWN	Worldwide name of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter. Only the WWNs that correspond to the ports assigned to the user are displayed.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
WWN/Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
	HBA WWN	WWN of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
Logical Device/Base	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Logical Device/TC/ TCMF/GAD	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.

Monitoring object	Item	Description
Logical Device/UR/URMF	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Parity Group	Parity Group ID	ID of the parity group. Only the parity groups assigned to the user are displayed.
LUN/Base	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/TC/GAD	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.

Monitoring object	Item	Description
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/UR	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
External Storage/Logical Device	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
External Storage/Parity Group	Parity Group ID	Parity group ID of the external volume. Only the parity groups assigned to the user are displayed.
Controller/MP	MP blade or unit ID/MP ID	ID of an MP blade or unit and processor.
Controller/DRR (VSP G1x00 and VSP F1500)	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP blade or unit ID	ID of an MP blade or unit.
	Cache	Name of the cache.

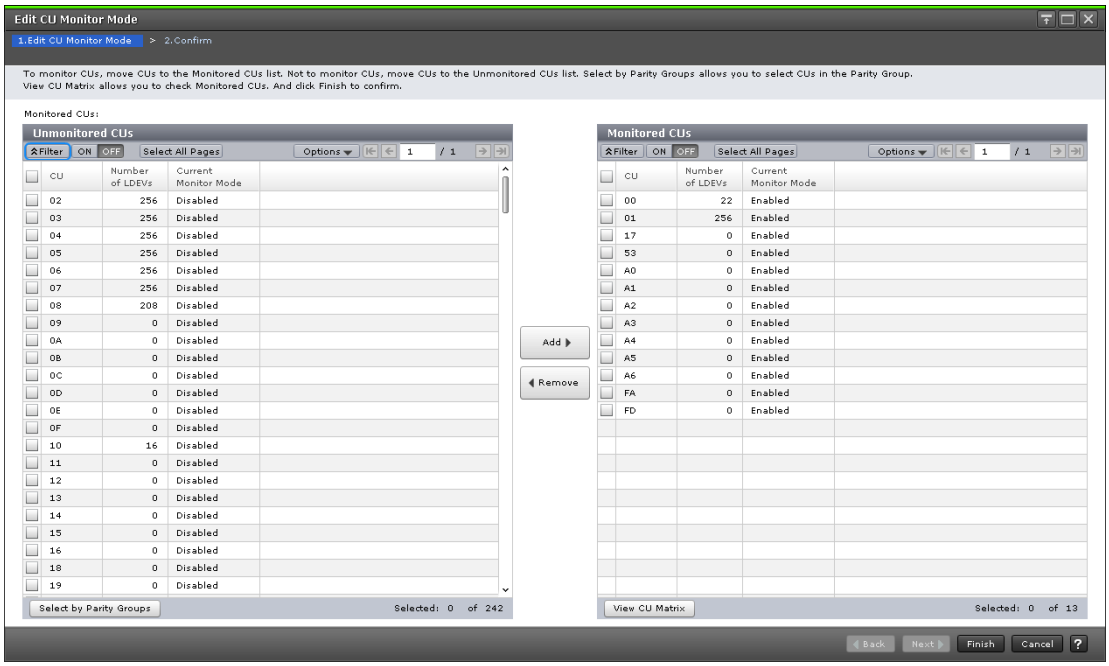
Monitoring object	Item	Description
Access Path/CHA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/DKA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/MP Blade-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Entire Storage System/TC/TCz/GAD	Object	Item for entire storage system.
Entire Storage System/UR/URz	Object	Item for entire storage system.
Journal/UR/URMF	Journal ID	ID of the journal.

Edit CU Monitor Mode wizard

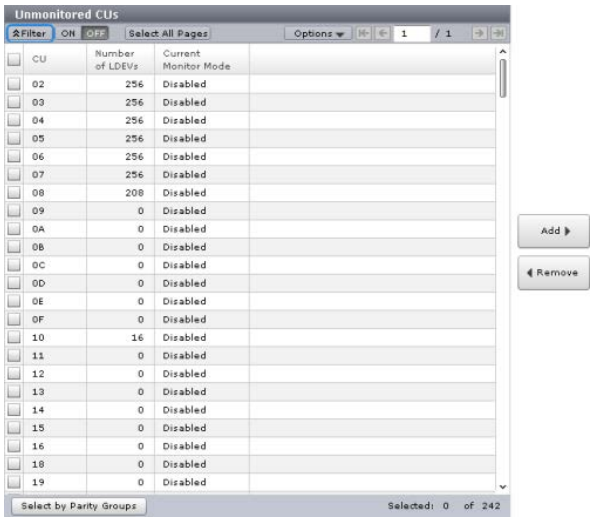
Edit CU Monitor Mode window

This window contains information about all CUs in the storage system, in table format, indicating which are monitored and which are unmonitored. Use this window to add and remove CUs as monitoring target objects.

This window only displays for the VSP G800 and VSP F800, VSP G1x00, and VSP F1500 storage systems.



Unmonitored CUs table



A table of the CUs that are going to be unmonitored.

Item	Description
CU	Unmonitored CU number.
Number of LDEVs	Number of LDEVs included in the unmonitored CUs.
Current Monitor Mode	Enabled: The CU is a monitoring target object. Disabled: The CU is not a monitoring target object.

Item	Description
Select by Parity Groups	Click to open the **Select by Parity Group** window, where you can select CUs from parity groups.

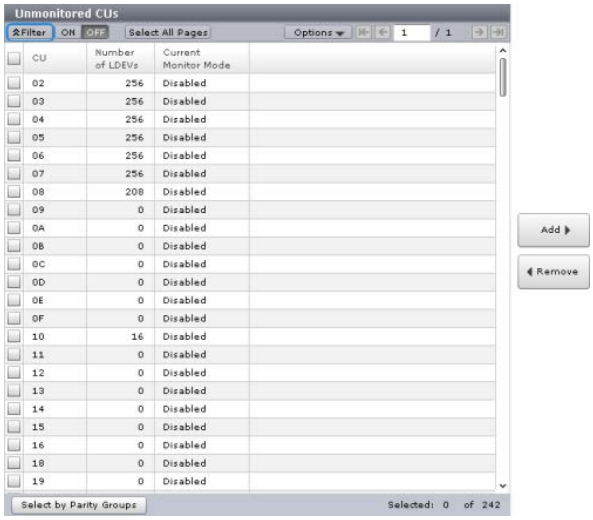
Add

Click to add CUs to Monitored CUs table.

Remove

Click to remove CUs from Monitored CUs table.

Monitored CUs table



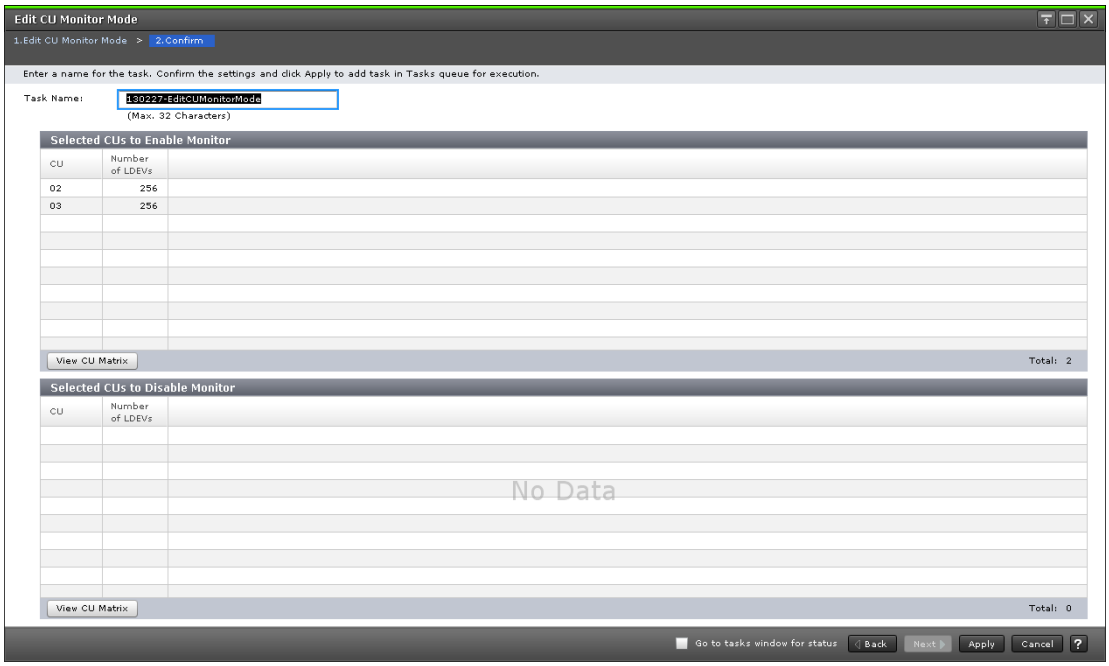
A table of the CUs that are going to be monitored.

Item	Description
CU	Number of a CU which is going to be monitored.
Number of LDEVs	Number of LDEVs included in the monitored CUs.
Current Monitor Mode	Enabled: The CU is a monitoring target object. Disabled: The CU is not a monitoring target object.
View CU Matrix	Click to open the **View CU Matrix** window, where you can view following monitoring statuses of CUs. ▪ CU which is being monitored ▪ CU which is scheduled to be monitored ▪ CU which is scheduled to be released from monitoring.

Edit CU Monitor Mode confirmation window

Use this window to confirm the edited CU monitoring mode information and to assign a task name to the editing task.

This window only displays for the VSP G800 and VSP F800, VSP G1x00, and VSP F1500 storage systems.



Selected CUs to Enable Monitor table

Confirm the information about the CUs to be monitored.

Item	Description
CU	CUs to be monitored.
Number of LDEVs	Number of LDEVs in the CU to be monitored.
View CU Matrix	Click to open the **View CU Matrix** window, where you can view following monitoring statuses of CUs. ▪ CU which is being monitored ▪ CU which is scheduled to be monitored ▪ CU which is scheduled to be released from monitoring.

Selected CUs to Disable Monitor table

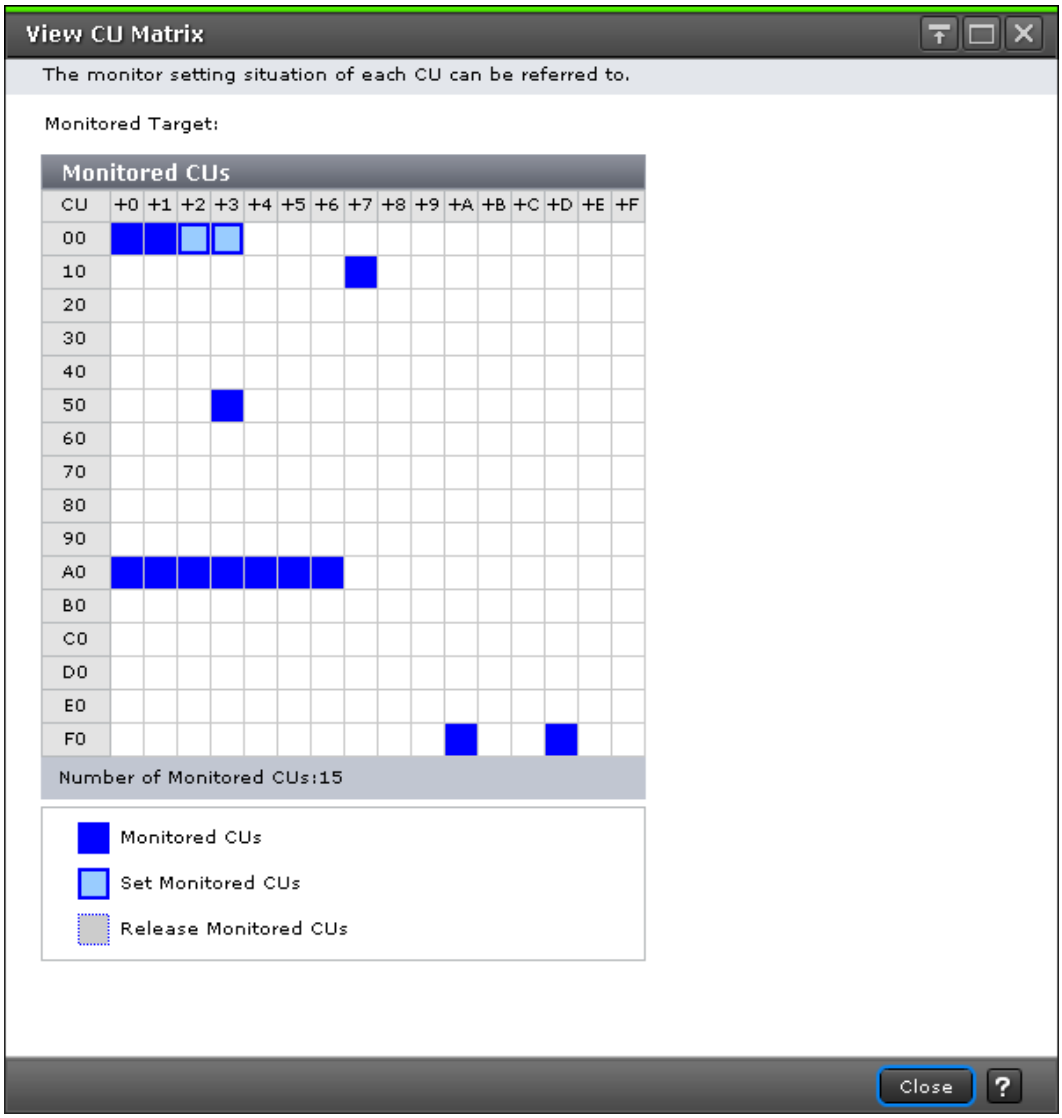
Information about the CUs not to be monitored.

Item	Description
CU	CUs not to be monitored.
Number of LDEVs	Number of LDEVs in the CU not to be monitored.
View CU Matrix	Click to open the **View CU Matrix** window, where you can view following monitoring statuses of CUs. ▪ CU which is being monitored ▪ CU which is scheduled to be monitored ▪ CU which is scheduled to be released from monitoring.

View CU Matrix window

Use this window to view a matrix of the monitoring status of all CUs in one LDKC. The cell markers indicate the monitoring status of the individual CUs.

This window only displays for the VSP G800 and VSP F800, VSP G1x00, and VSP F1500 storage systems.



Monitored CUs table

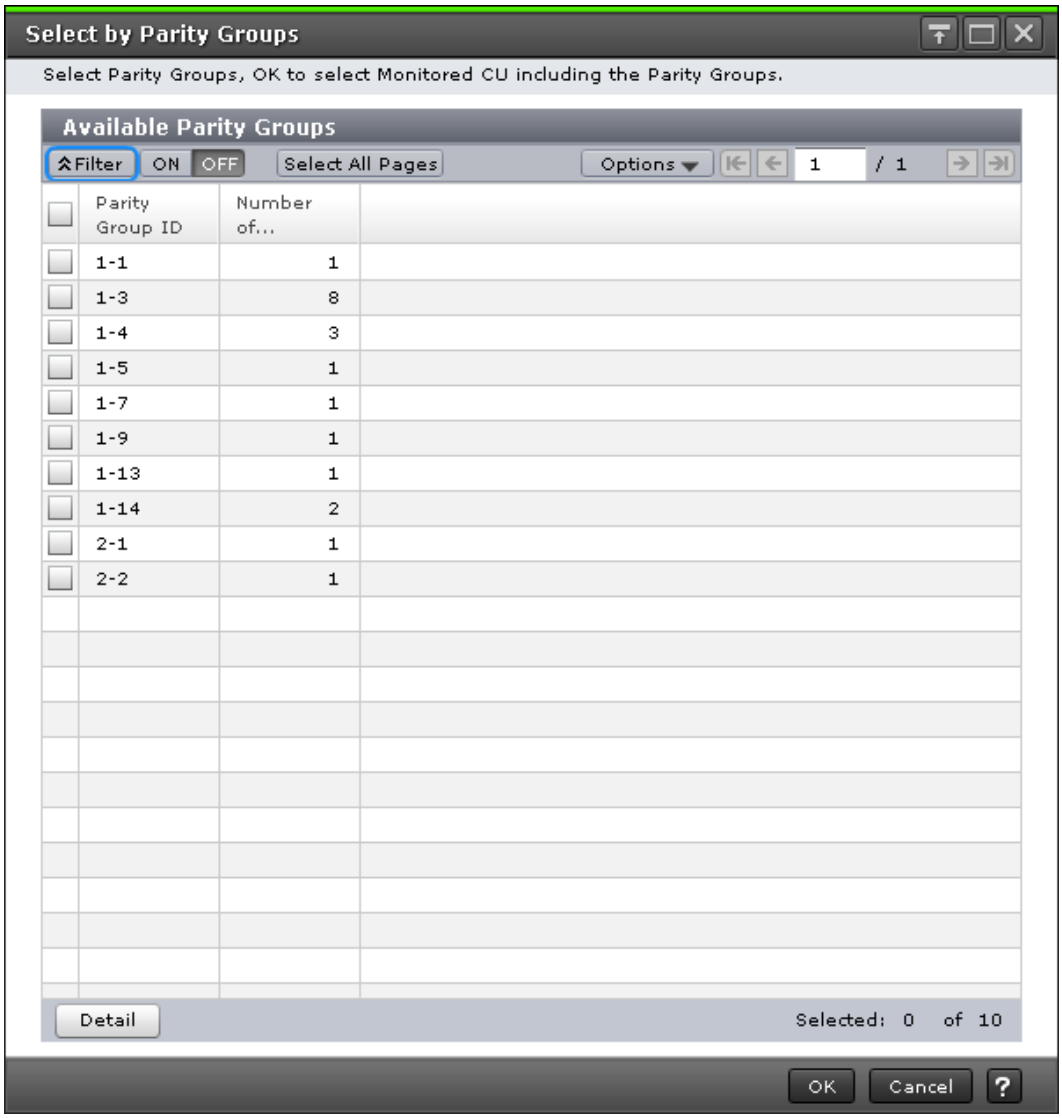
Item	Description
Monitored CUs	The table consists of cells representing CUs. One cell corresponds to one CU. Each row consists of 16 cells (CUs). A set of 16 rows represents CUs for one LDKC. The table header row shows the last digit of each CU number in the form of +*n* (where *n* is an integer from 0 to 9, or a letter from A to F).
Number of Monitored CUs:	Total count of monitored CUs.
Monitored CUs	Cell marker indicating that a CU is being monitored.

Item	Description
Set Monitored CUs	Cell marker indicating that the CU is scheduled to be monitored.
Release Monitored CUs	Cell marker indicating that the CU is scheduled to be released from monitoring.

Select by Parity Groups window

Use this window to monitor CUs in the parity group. When you select a parity group and click Detail in this window, you can view the CUs in the parity group. When you select the parity group and click OK, the CUs are selected in the Unmonitored CUs table.

This window only displays for the VSP G800 and VSP F800, VSP G1x00, and VSP F1500 storage systems.



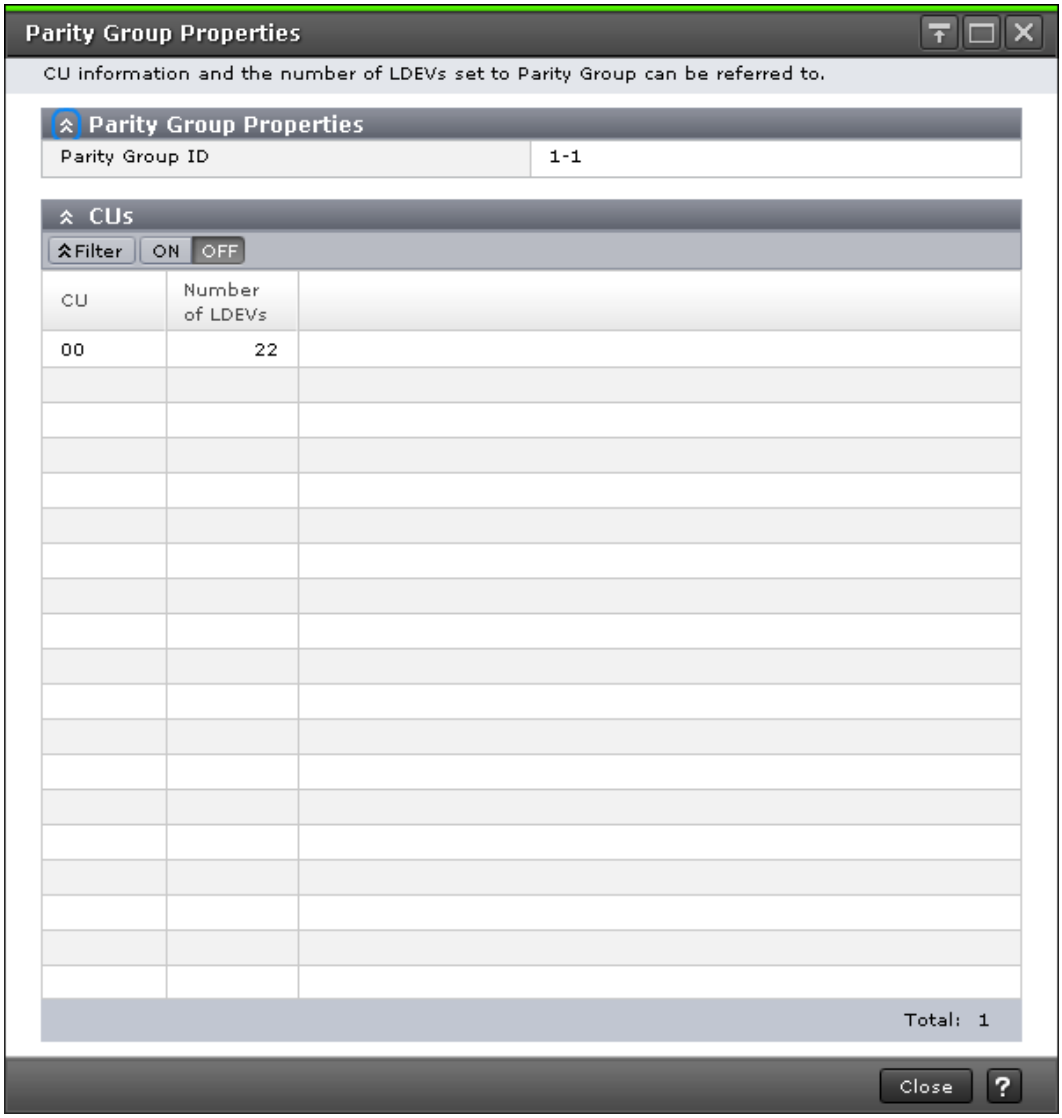
Available Parity Groups table

Item	Description
Parity Group ID	ID of the parity group.
Number of CUs	Number of CUs included in the parity group.
Detail	Click to display the **Parity Group Properties** window to view information about the CUs in the selected parity group.

Parity Group Properties window

Use this window to view information about the CUs in the parity group selected in the previous window.

This window only displays for the VSP G800 and VSP F800, VSP G1x00, and VSP F1500 storage systems.



Parity Group Properties table

Item	Description
Parity Group ID	Identification number of the parity group.

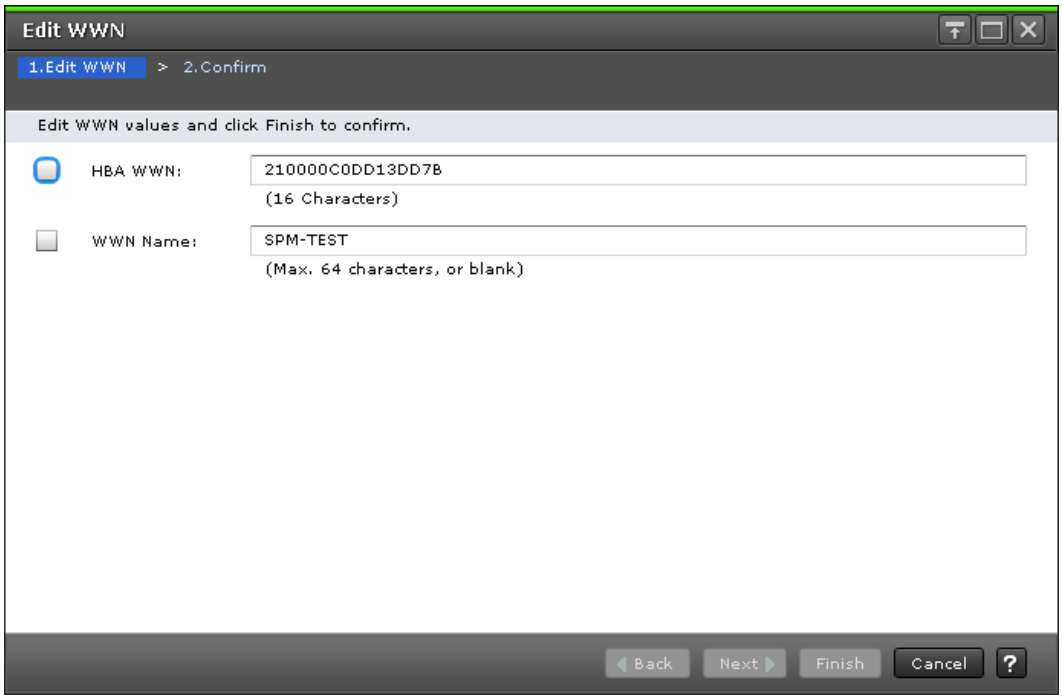
CUs table

Item	Description
CU	Identification number of the CU in this parity group.
Number of LDEVs	Number of LDEVs included in the individual CUs.

Edit WWN wizard

Edit WWN window

Use this window to edit the HBA WWN and WWN name of the WWN to be monitored.

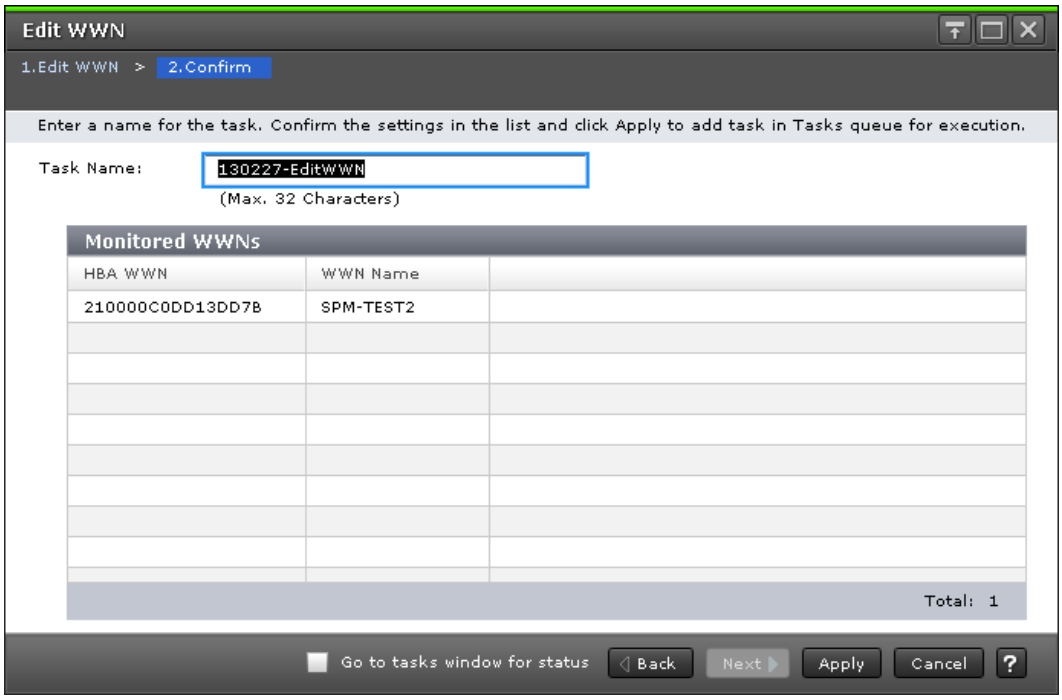


Setting fields

Item	Description
HBA WWN	Edit the worldwide name of the host bus adapter. WWNs are 16-digit hexadecimal numbers used to identify host bus adapters.
WWN Name	Edit a WWN name. Use up to 64 alphanumeric characters and some symbols for a WWN name.

Edit WWN confirmation window

Use this window to confirm the edited HBA WWN and WWN Name and to assign a task name to the editing task.



Monitored WWNs table

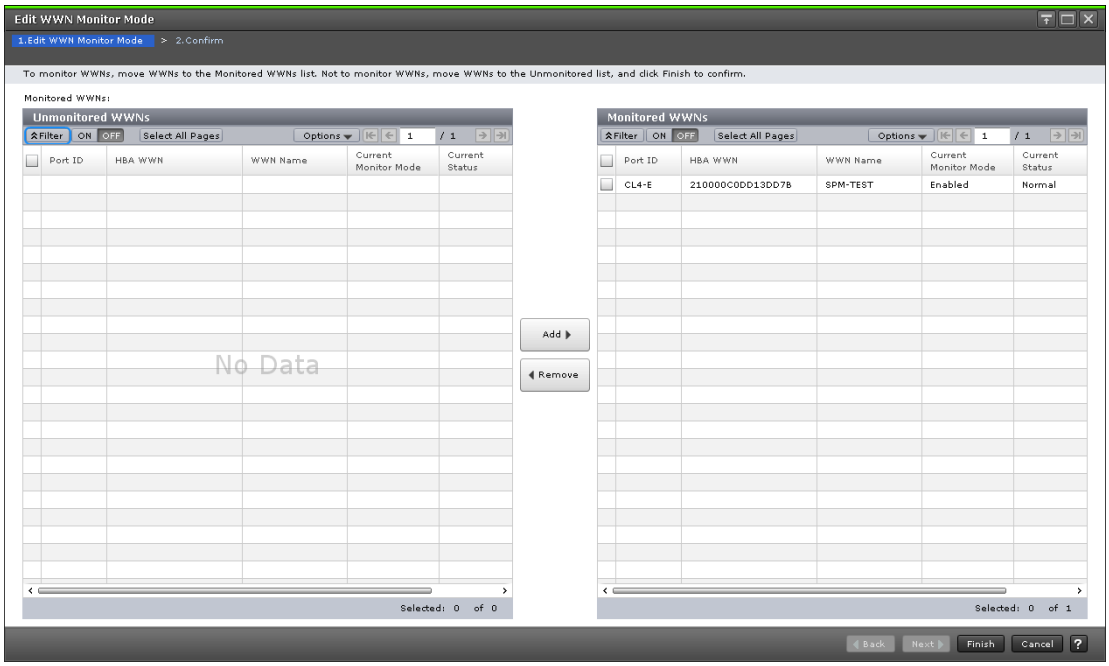
Confirm the information about the WWNs to be monitored.

Item	Description
HBA WWN	HBA WWNs to be applied.
WWN Name	WWN Names to be applied.

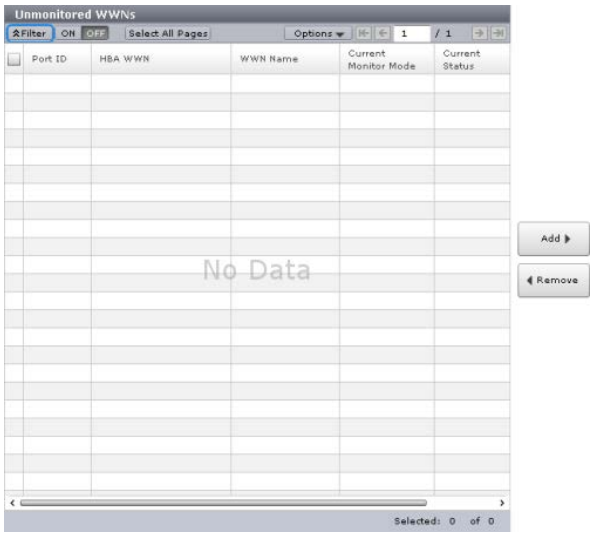
Edit WWN Monitor Mode wizard

Edit WWN Monitor Mode window

Use this window to specify WWNs to be monitored or not to be monitored.



Unmonitored WWNs table



A table of WWNs that are going to be unmonitored.

Item	Description
Port ID	Name of the port.
HBA WWN	Worldwide name of the host bus adapter
WWN Name	A WWN name is up to 64 alphanumeric characters and some signs.

Item	Description
Current Monitor Mode	Monitoring modes indicate whether WWNs are monitoring target objects or not. Enabled: The WWN is the monitoring target object. Disabled: The WWN is not the monitoring target object.
Current Status	Status of the port connected with WWN. Normal: All WWNs connected with the port are monitoring target objects. Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.

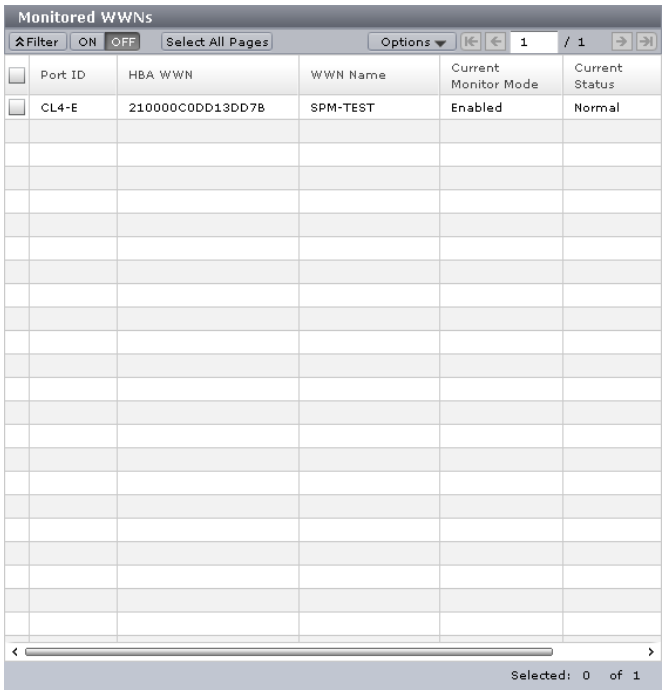
Add

Click to add WWNs to the Monitored WWNs table.

Remove

Click to remove WWNs from the Monitored WWNs table.

Monitored WWNs table

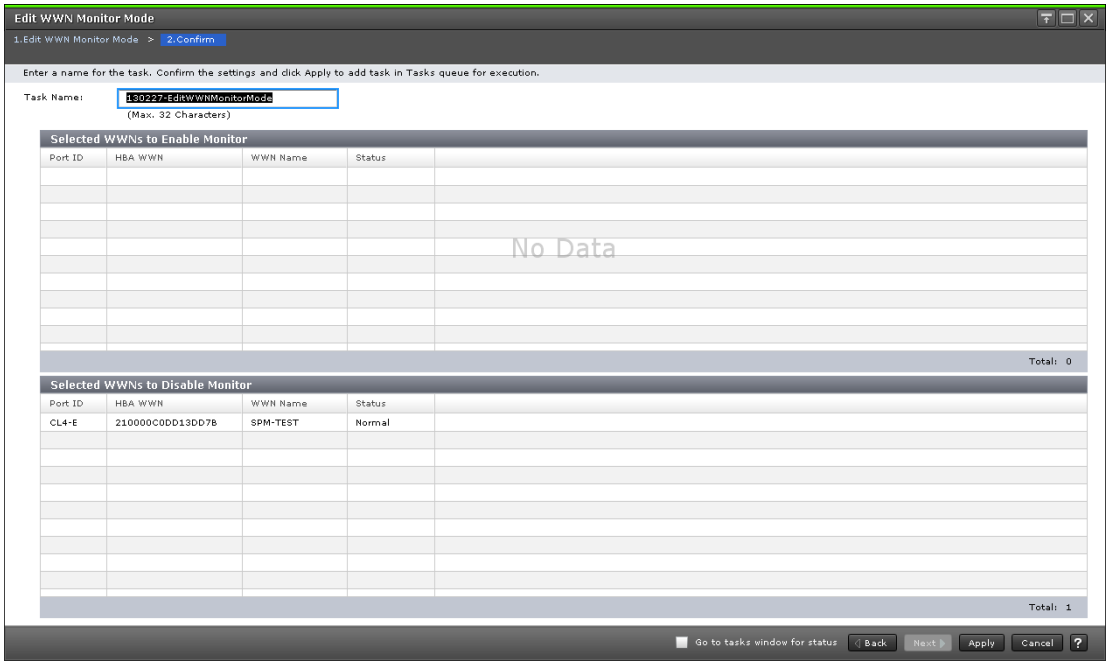


A table of WWNs that are going to be unmonitored.

Item	Description
Port ID	Name of the port.
HBA WWN	Worldwide name of the host bus adapter.
WWN Name	A WWN name is up to 64 alphanumeric characters and some signs.
Current Monitor Mode	Monitoring modes indicate whether WWNs are monitoring target objects or not. Enabled: The WWN is the monitoring target object. Disabled: The WWN is not the monitoring target object.
Current Status	Status of the port connected with WWN. Normal: All WWNs connected with the port are monitoring target objects. Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.

Edit WWN Monitor Mode confirmation window

Use this window to confirm the edited monitoring information and to assign a task name to the editing task.



Selected WWNs to Enable Monitor table

Confirm the information about the WWNs to be monitored.

Item	Description
Port ID	Port name to be added and monitored.
HBA WWN	Worldwide name of the host bus adapter to be monitored.
WWN Name	Nickname of WWN to be monitored. The name consists of up to 64 alphanumeric characters and some signs.
Status	Status of a WWN to be monitored. Normal: WWN connected with a port is the monitoring target object. Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.

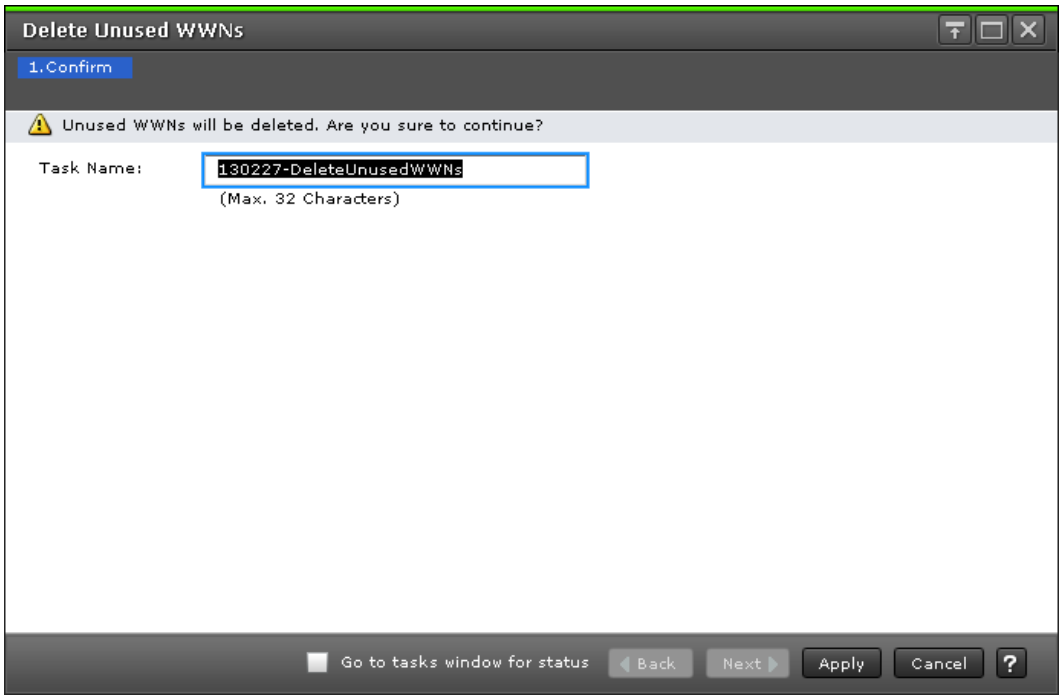
Selected WWNs to Disable Monitor table

Confirm the information about the WWNs not to be monitored.

Item	Description
Port ID	Port name not to be monitored.
HBA WWN	Worldwide name of the host bus adapter not to be monitored.
WWN Name	Nickname of WWN not to be monitored. The name consists of up to 64 alphanumeric characters and some signs.
Status	Status of a WWN not to be monitored. Normal: The WWN connected with a port is the monitoring target object. Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.

Delete Unused WWNs window

Use this window to name the task for deleting unused WWNs.

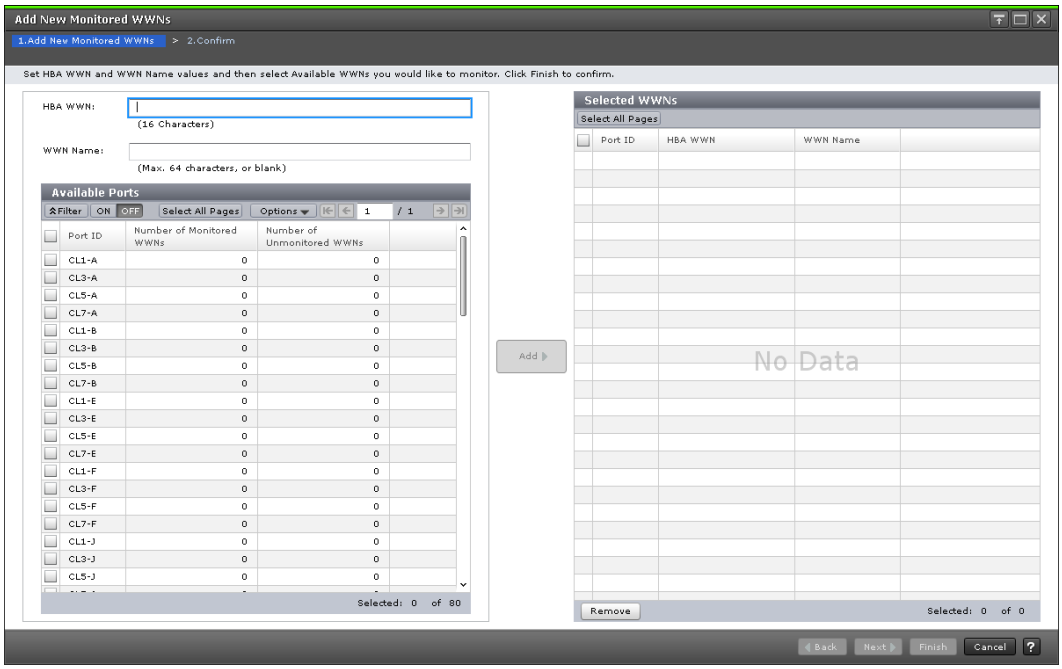


Item	Description
Task Name	Specify the task name. You can enter up to 32 alphanumeric characters and symbols in all, except for \ / : , ; * ? " < > |. The characters are case-sensitive. "date-window name" is entered as a default.

Add New Monitored WWNs wizard

Add New Monitored WWNs window

Use this window to add new WWNs to be monitored.



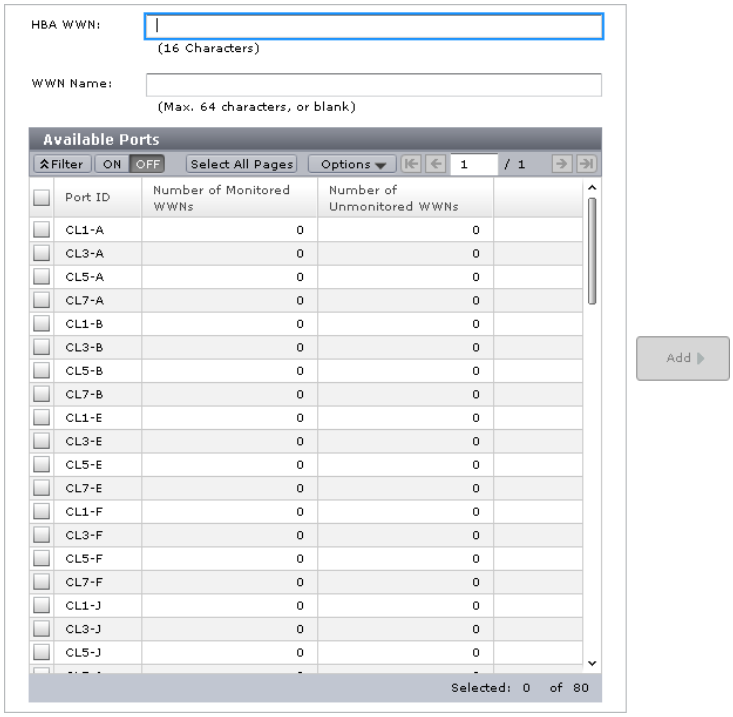
HBA WWN

Specify a worldwide name of the host bus adapter. WWNs are 16-digit hexadecimal numbers used to identify host bus adapters.

WWN Name

Specify a worldwide name using up to 64 characters for a WWN name.

Available Ports table

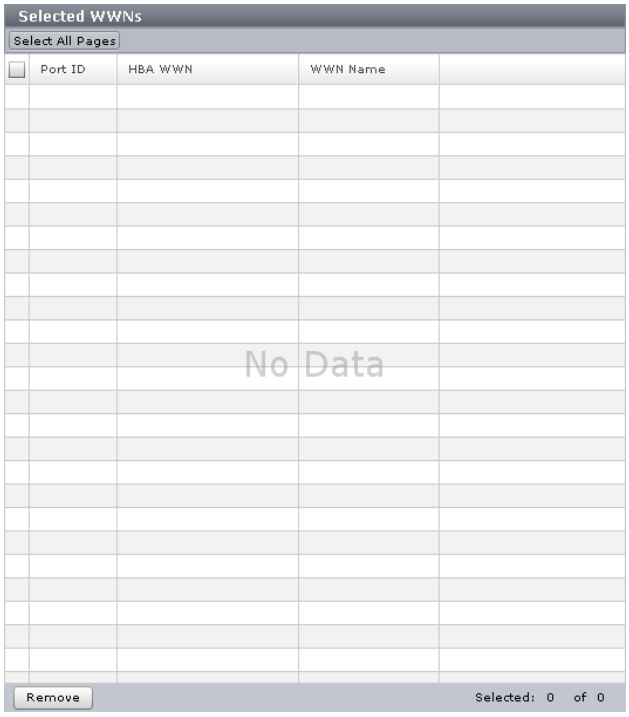


Item	Description
Port ID	Name of the port available in the storage system.
Number of Monitored WWNs	Number of monitored WWNs in the port.
Number of Unmonitored WWNs	Number of unmonitored WWNs in the port.

Add

Select ports, then click Add to add the combinations of HBA WWN and the selected ports into the Selected WWNs table.

Selected WWNs table



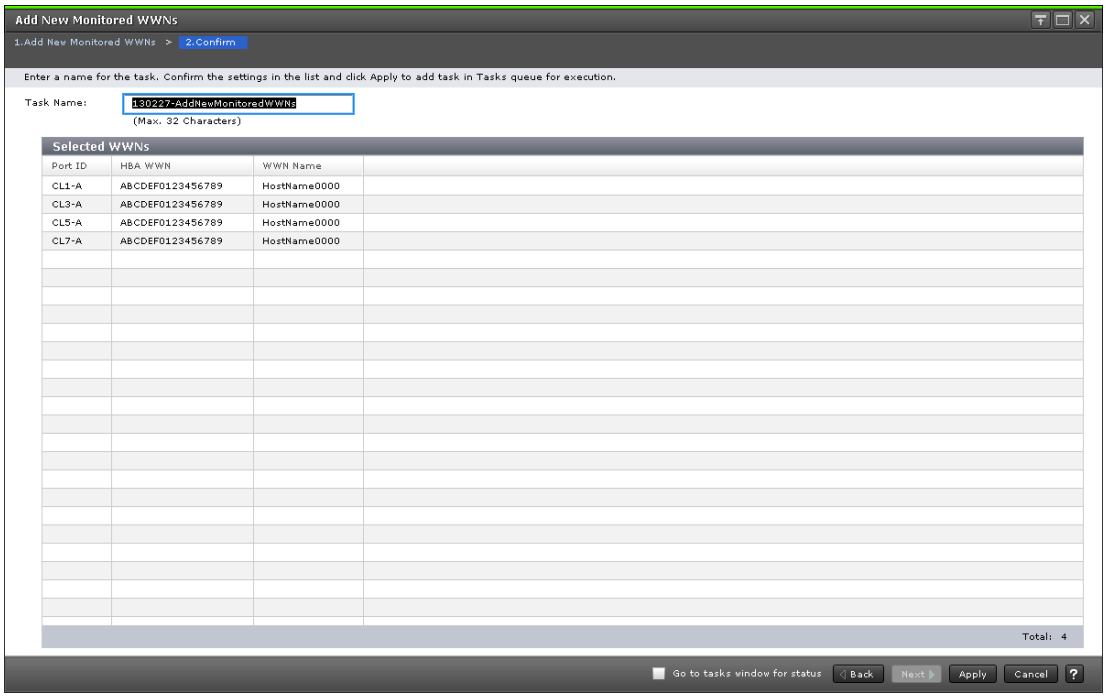
A list of WWNs to be monitored.

Item	Description
Port ID	Name of the port selected for monitoring.
HBA WWN	WWN selected for monitoring.
WWN Name	WWN name is up to 64 alphanumeric characters and some signs.

Item	Description
Remove	Select the row to be deleted. Click to remove a row from the table.

Add New Monitored WWNs confirmation window

Use this window to confirm the new monitoring information and to assign a task name to the editing task.



Selected WWNs table

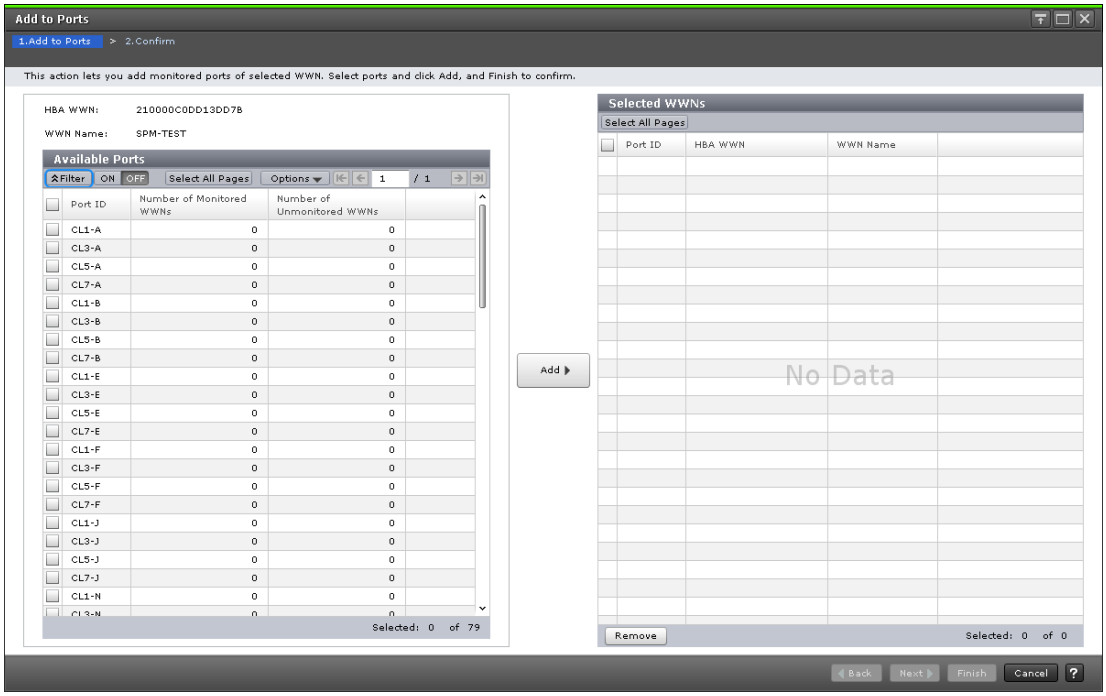
Confirm the list of combinations of ports and WWNs added as monitoring target objects.

Item	Description
Port ID	Name of the port selected for monitoring.
HBA WWN	WWN selected for monitoring.
WWN Name	WWN name is up to 64 alphanumeric characters and some signs.

Add to Ports wizard

Add to Ports window

Use this window to add a WWN to the port.



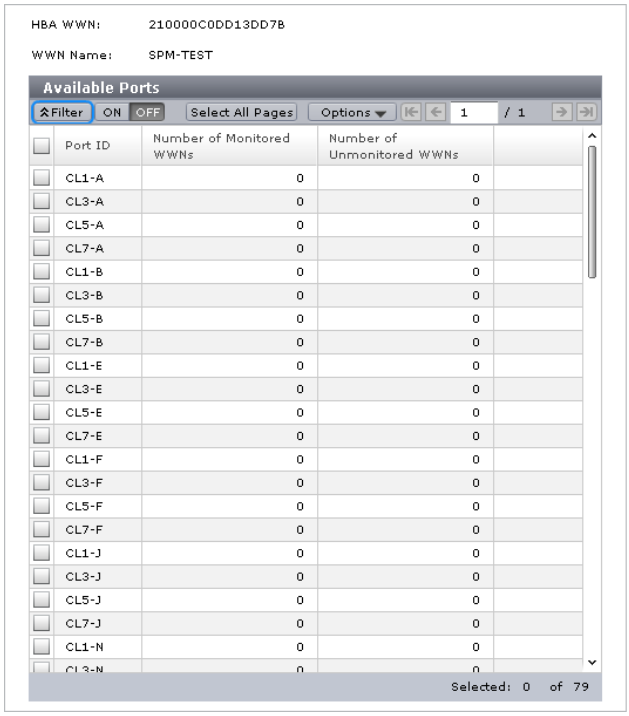
HBA WWN

Specify a worldwide name of the host bus adapter. WWNs are 16-digit hexadecimal numbers used to identify host bus adapters.

WWN Name

Specify a worldwide name using up to 64 characters for a WWN name.

Available Ports table



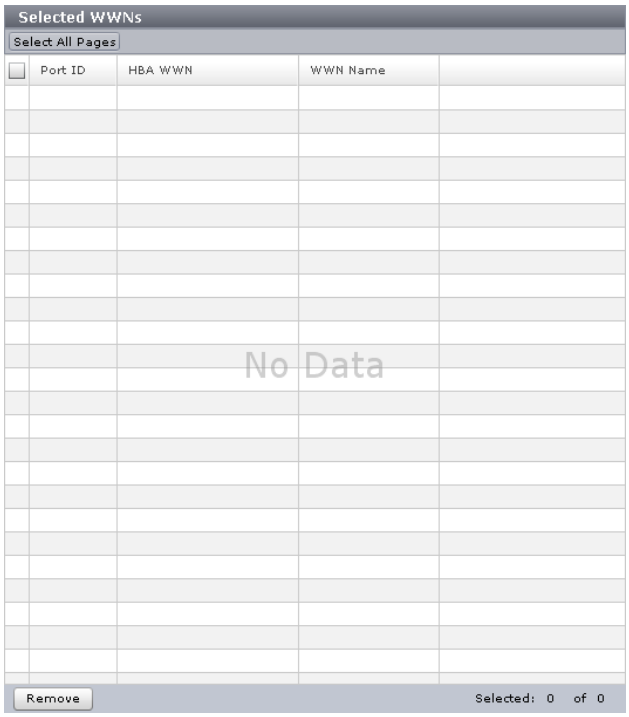
A list of available ports in the storage system.

Item	Description
Port ID	Name of the port available in the storage system.
Number of Monitored WWNs	Number of monitored WWNs in the port.
Number of Unmonitored WWNs	Number of unmonitored WWNs in the port.

Add

Select ports, then click Add to add the combinations of HBA WWN and the selected ports into the Selected WWNs table.

Selected WWNs table

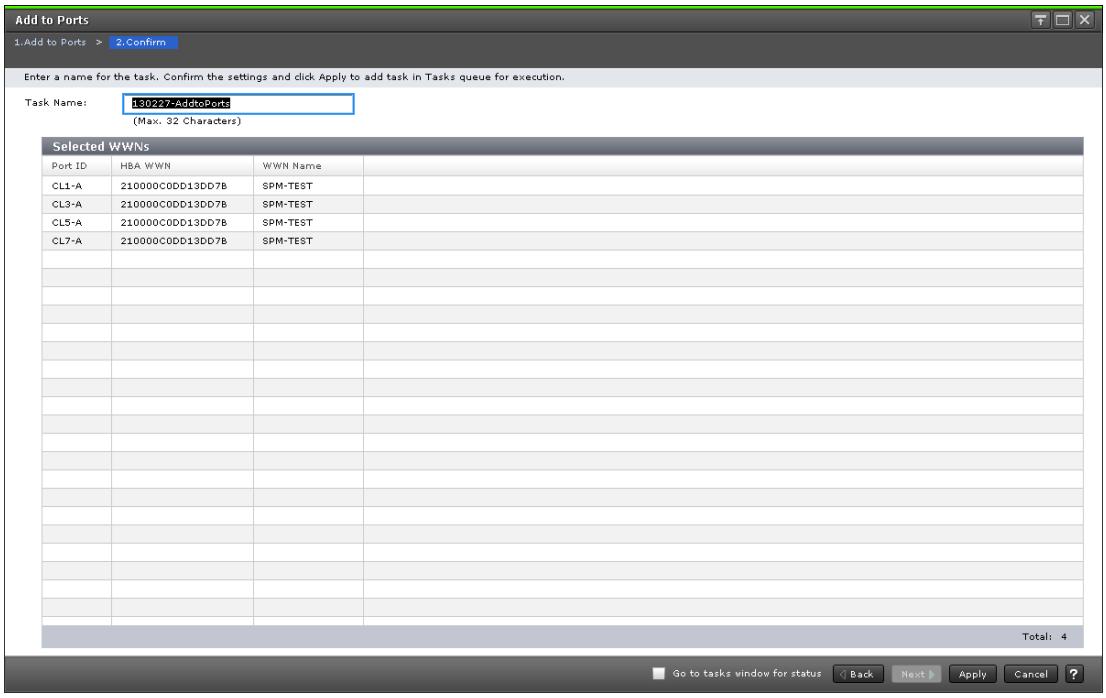


A list of WWNs to be monitored.

Item	Description
Port ID	Name of the port selected for monitoring
HBA WWN	The WWN selected for monitoring.
WWN Name	The WWN name is up to 64 alphanumeric characters and some signs.
Remove	Select the row to be deleted. Click to remove a row from the table.

Add to Ports confirmation window

Use this window to confirm new WWNs related to ports and to assign a task name to the editing task.



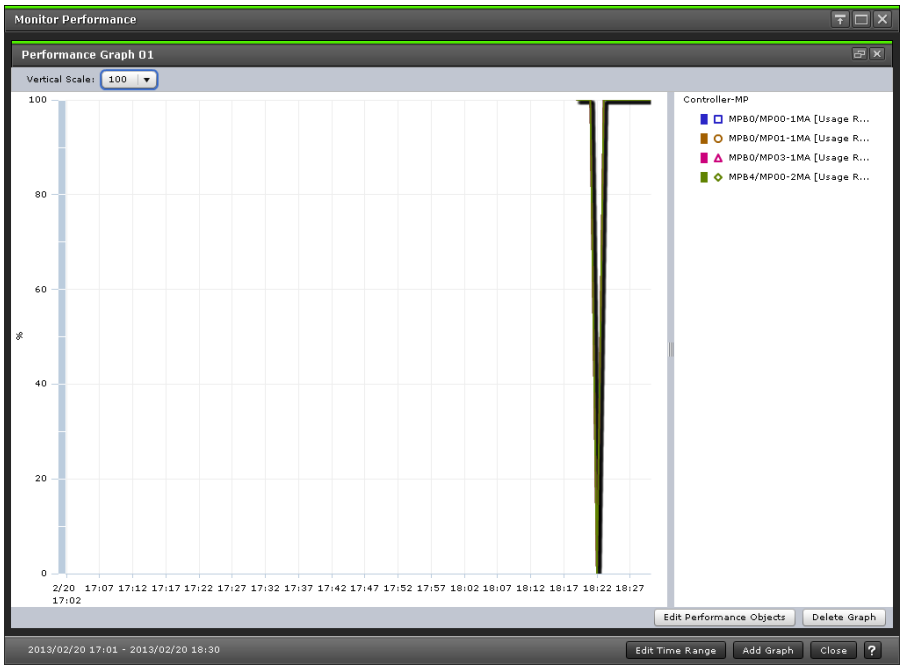
Selected WWNs table

Confirm the information of the WWNs to become the monitoring target objects.

Item	Description
Port ID	Name of the port selected for monitoring
HBA WWN	WWN selected for monitoring.
WWN Name	WWN name is up to 64 alphanumeric characters and some signs.

Monitor window

Use this window to view line graphs of monitored objects.



Item	Description
Graph panel	Shows line graphs. The line graph is displayed at the left of the graph panel, and explanatory notes are displayed at the right of the graph panel. The following operations can be performed. ▪ If you put the mouse cursor over a point on the graph, a tool tip with more information appears. ▪ When you click a note on the right of the graph panel, you can show or hide points on the graph panel. However, if the graph displays only one point on the X axis, the graph is always displayed on the screen. In this case, the graph cannot be displayed by clicking the icon that is displayed in the explanatory notes. ▪ Up to eight graphs can be displayed in one graph panel. ▪ You can view up to 16 graphs across a total of four panels. ▪ (VSP G1x00 and VSP F1500) When Time Range is Use Real Time, and an MP blade is displayed in the legend to the right of the graph panel, the name of the MP blade is displayed as a link. If you click the link, a maximum of top 20 resource usage rates associated with the MP blade are displayed. For details, see MP Properties window (VSP G1x00 and VSP F1500) (on page 309).

Item	Description
Graph display area	Shows graph panels.

Graph panel

Shows line graphs of monitored objects.

Item	Description
Vertical Scale:	By using the list on the upper left of the graph screen, adjust the scale to display the maximum value of the graph. If the graph is too big, the display may not be able to show properly. For example, the line of the graph is too thick, or the graph panel is painted out in the color of the graph.
The button in the upper right of the graph panel	The graph panel can be maximized or minimized if you click the button in the upper right of the graph panel.
Edit Performance Objects	Opens the **Edit Performance Objects** window where you can change the objects to be monitored.
Delete Graph	Deletes the graph panel.

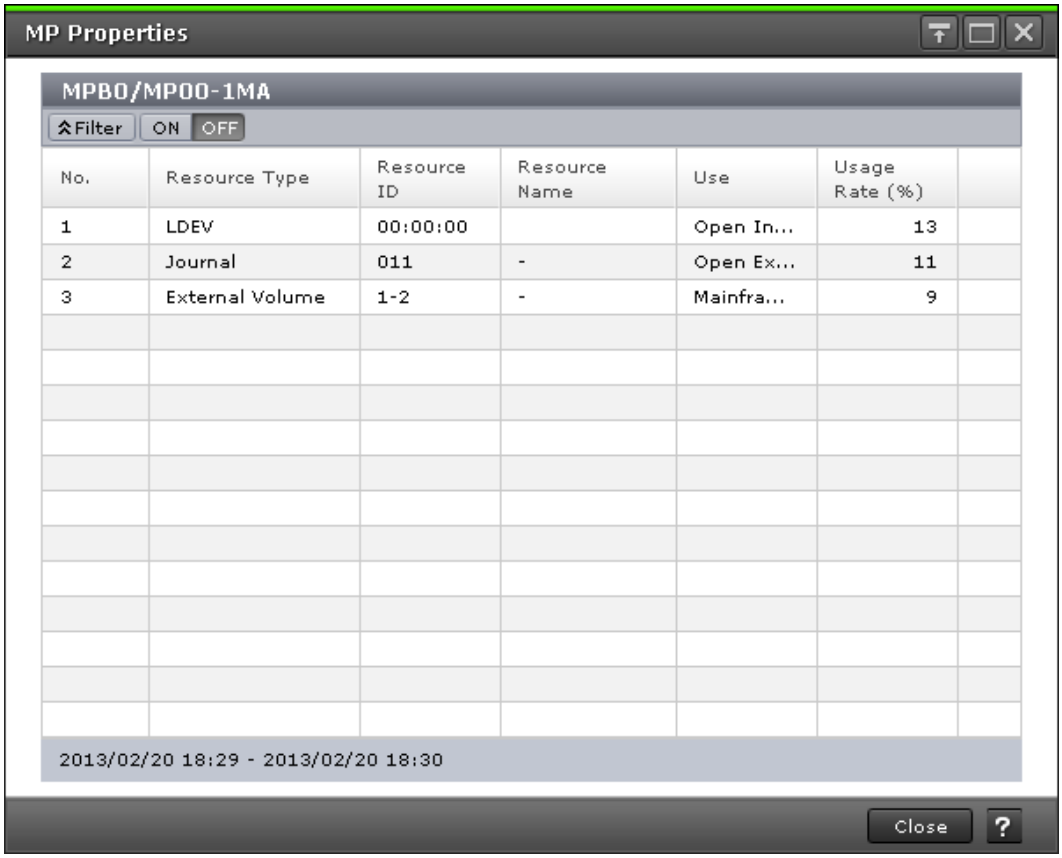
Graph display area

Shows graph panels.

Item	Description
Monitoring Term	Shows the monitor period in the bottom left corner of this window. The first monitored time and the latest time are shown. If Use Real Time is selected, the interval and the date of last update are also shown. The following icon and the message are displayed while changing the configuration: ⚠ Graphs cannot be updated due to the configuration changing. Wait for a while.
Edit Time Range	Opens the **Edit Time Range** window where you can edit the time range for monitoring statistics.
Add Graph	Opens the **Add Graph** window to add a new graph.

MP Properties window (VSP G1x00 and VSP F1500)

Use this window to display the resources assigned to an MP blade of top 20 in usage rates.



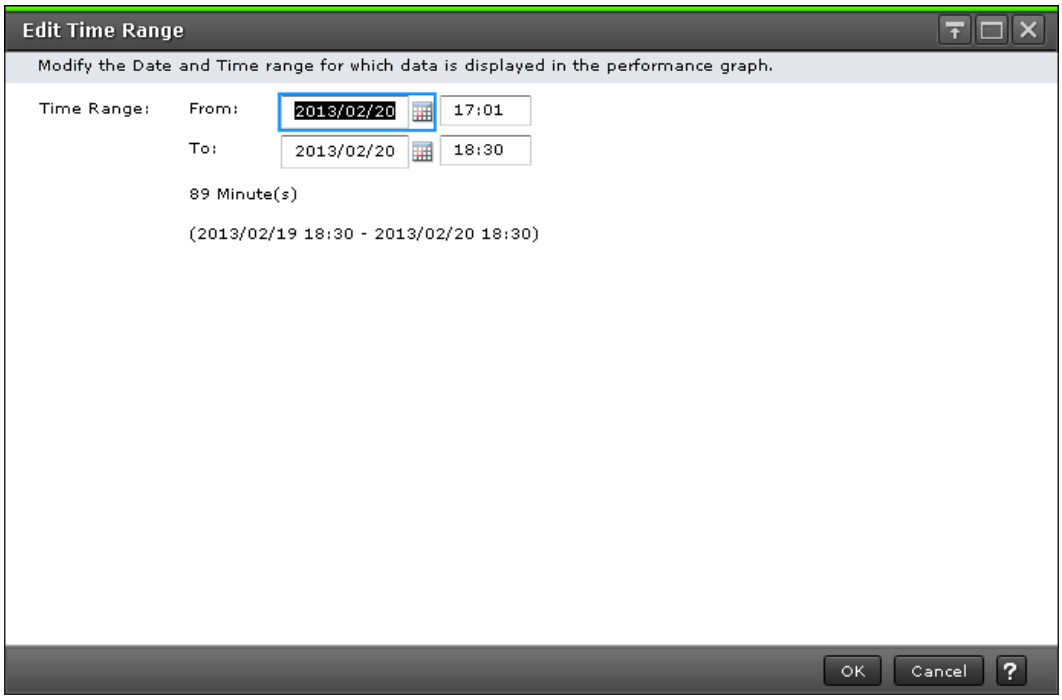
MP names table

Item	Description
No.	Shows the order of high usage rates of resources.
Resource Type	Shows the resource type as follows: LDEV: Indicates an LDEV. External Volume: Indicates an external volume assigned to the storage system. Journal: Indicates a journal.
Resource ID	Shows the ID of the resource.
Resource Name	Shows the name of the following resources: LDEV: An LDEV name is displayed.

Item	Description
	External Volume: A hyphen (-) is displayed because an external volume has no name. Journal: A hyphen (-) is displayed because a journal has no name.
Use	Shows a kernel type of a resource as follows: Open Target: Indicates that this resource is used on the front end for the open system. Open External: Indicates that this resource is used by the external storage system for the open system. Open Initiator: Indicates that this resource is used by the initiator for the open system. Mainframe Target: Indicates that this resource is used on the front end for the mainframe. Mainframe External: Indicates that this resource is used by the external storage system for the mainframe. Back-end: Indicates that this resource is used on the back end. System: Indicates that this resource is used by the maintenance and other functions.
Usage Rate (%)	Shows a usage rate of a resource. The rate (%) of a resource processed in the latest monitoring period is displayed.

Edit Time Range window

Use this window to select a date and time range for displaying monitoring data in a performance graph.

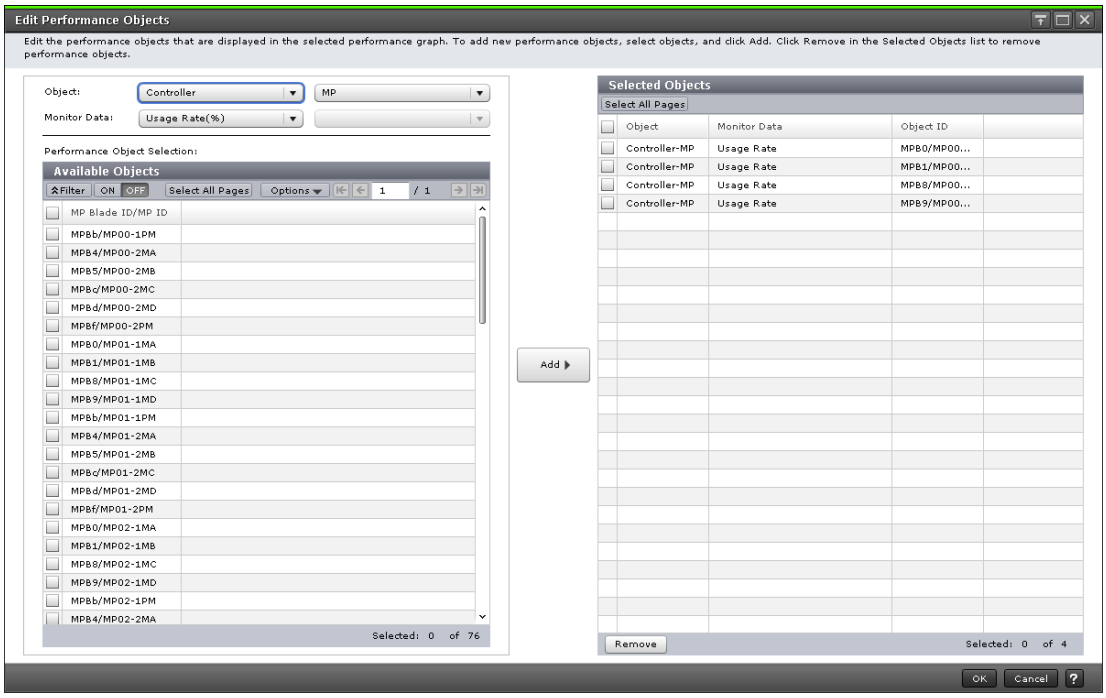


Setting fields

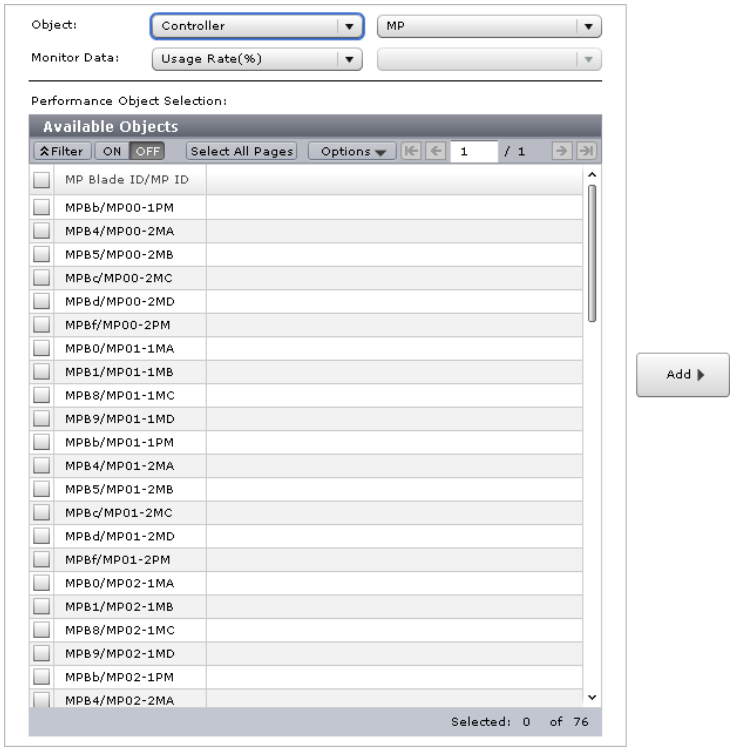
Item	Description
Time Range	Specify dates in the From and To fields to define a time range for displaying monitoring data in a performance graph. You can input directly or select from the calendar. When you specify a time range, Performance Monitor calculates the length of the specified period and displays the total time in hours and minutes.
From	Specify the date and time to start monitoring performance.
To	Specify the date and time to stop monitoring performance.

Edit Performance Objects window

Use this window to select the monitoring object for displaying in a performance graph.



Object



Object types to display graphs. The list on the left specifies a large classification of monitoring objects. The list on the right specifies a small classification of monitoring objects.

Monitor Data

Performance data specified in the Object field. The list on the left specifies a large classification of performance data. The list on the right specifies a small classification of performance data.

For the combination of items of Object and Monitor Data fields, see Object and Monitor Data combinations (on page 314) .

Performance Object Selection

Objects that can be displayed in graphs.

Available Objects table

The columns depend on the object selected. For details, see Available Objects table (on page 326) .

Add

Adds objects to display the graph.

Selected Objects table

Objects to display the graph.

Item	Description
Object	Object to display the graph.

Item	Description
Monitor Data	Type of monitoring data.
Object ID	ID of the monitoring object.
Remove	Remove the object in this table.

Object and Monitor Data combinations

The following table shows the possible Object and Monitor Data combinations that can be selected in the Performance Objects area of the **Monitor Performance** window.

- If Controller is selected on the left side of the Object field, the item on the right side of Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
MP	Usage Rate	%
DRR (VSP G1x00 and VSP F1500)	Usage Rate	%

- If Cache is selected on the left side of the Object field, the item on the right side of the Monitor Data is blank field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Usage Rate	%
None	Write Pending Rate	%

- (VSP G1x00 and VSP F1500) If Access Path is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
CHA-Cache	Usage Rate	%
DKA-Cache	Usage Rate	%
MP Blade-Cache	Usage Rate	%

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Cache	Usage Rate	%

- (VSP G1x00 and VSP F1500) If Fibre Port is selected on the left side of the Object field, the item on the right side of the Object and Monitor Data fields is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
None	Data Trans.	MB/s
None	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If Fibre Port is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP G1x00 and VSP F1500) If Mainframe Fibre Port is selected on the left side of the Object field, the item on the right side of the Object field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Throughuput	None	IOPS
Data Trans.	Total	MB/s
	Read	MB/s

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Write	MB/s
Response Time	None	ms
CMR delay Time	None	ms
Disconnected Time	None	ms
Connected Time	None	ms
HTP Port open exchanges	None	count/sec

- (VSP G1x00 and VSP F1500) If iSCSI Port is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If iSCSI Port is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If NAS Platform (User LU) or NAS Platform (System LU) is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- If WWN is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
WWN	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Port	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- Logical Device is selected on the left side of the Object field or Base is selected on the right of the Object field.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate[1]	None	%
Drive Access Rate[1]	Read (Sequential)	%
	Read (Random)	
	Write (Sequential)	
	Write (Random)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
ShadowImage[1,2]	None	%

1. Only information about internal volumes is displayed. Information about the following is not displayed:
   - external volumes
   - (VSP G1x00 and VSP F1500) FICON DM volumes
2. (VSP G1x00 and VSP F1500) Information for ShadowImage for Mainframe is included.

- If Logical Device is selected on the left side of the Object field and if TC/TCz/GAD is selected on the right side of the Object field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If Logical Device is selected on the left side of the Object field and if UR/URz is selected on the right side of the Object field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Parity Group is selected on the left side of the Object field, the item on the right side of the Object field is blank. A parity group is displayed only when the CU number of each LDEV within the parity group is to be monitored.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate*	None	%
* Only information about internal volumes is displayed. Information about the following is not displayed: ▪ external volumes ▪ (VSP G1x00 and VSP F1500) FICON DM volumes		

- If LUN is selected on the left side of the Object field and if Base is selected on the right of the Object field, the following items can be selected.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	

- If LUN is selected on the left side of the Object field and if TC/GAD is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If LUN is selected on the left side of the Object field and if UR is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Journal is selected on the left side of the Object field, UR/URz is selected on the right side of the Object field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%
	Meta Data Usage Rate	%
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%
	Meta Data Usage Rate	%

- If Entire Storage System is selected on the left side of the Object field and if TC/TCz/GAD is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Data Trans.	MB/s
	Response Time	ms

- If Entire Storage System is selected on the left side of the Object field and if UR/URz is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms

- If External Storage is selected on the left side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Logical Device	Data Trans.	Total	MB/s
		Read	
		Write	

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Response Time	Total	ms
		Read	
		Write	
Parity Group*	Data Trans.	Total	MB/s
		Read	
		Write	
	Response Time	Total	ms
		Read	
		Write	
(VSP G1x00 and VSP F1500) * A parity group is displayed only when the CU number of each LDEV within the parity group is to be monitored. Parity groups in which all CUs are not subject to monitoring are not displayed.			

Available Objects table

The items appearing in the Available Objects table depend on the objects selected in the Performance Objects fields.

Monitoring object	Item	Description
Fibre Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
iSCSI Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
Mainframe Fibre Port (VSP G1x00 and VSP F1500)	Port ID	Name of the port. Only the ports assigned to the user are displayed.

Monitoring object	Item	Description
WWN/WWN	HBA WWN	Worldwide name of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter. Only the WWNs that correspond to the ports assigned to the user are displayed.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
WWN/Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
	HBA WWN	WWN of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
Logical Device/Base	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Logical Device/TC/TCz/GAD	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.

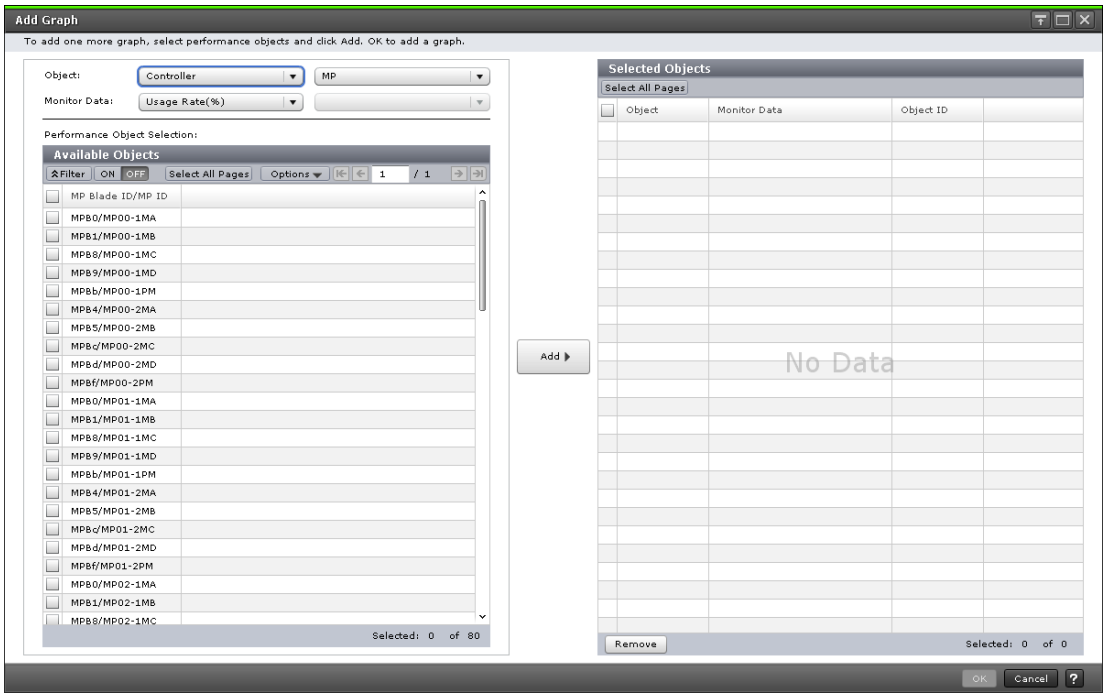
Monitoring object	Item	Description
Logical Device/UR/URz	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Parity Group	Parity Group ID	ID of the parity group. Only the parity groups assigned to the user are displayed.
LUN/Base	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/TC/GAD	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.

Monitoring object	Item	Description
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/UR	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
External Storage/Logical Device	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
External Storage/Parity Group	Parity Group ID	Parity group ID of the external volume. Only the parity groups assigned to the user are aisplayed.
Controller/MP	MP blade or unit ID/MP ID	ID of an MP blade or unit and processor.
Controller/DRR (VSP G1x00 and VSP F1500)	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP blade or unit ID	ID of an MP blade or unit.
	Cache	Name of the cache.

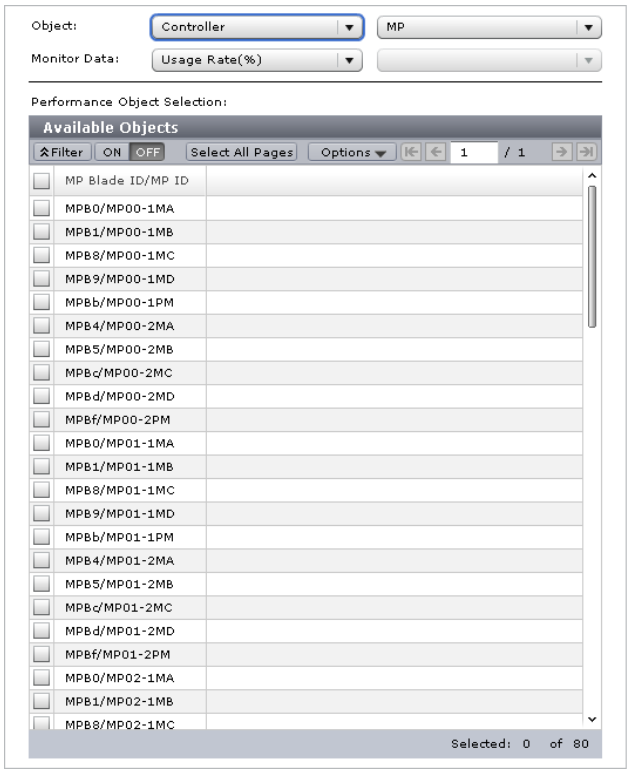
Monitoring object	Item	Description
Access Path/CHA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/DKA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/MP Blade-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Entire Storage System/TC/TCz/GAD	Object	Item for entire storage system.
Entire Storage System/UR/URz	Object	Item for entire storage system.
Journal/UR/URz	Journal ID	ID of the journal.

Add Graph window

Use this window to add the monitoring object to display a graph.



Object



Object types to display graphs. The list on the left specifies a large classification of monitoring objects. The list on the right specifies a small classification of monitoring objects.

Monitor Data

Performance data specified in the Object field. The list on the left specifies a large classification of performance data. The list on the right specifies a small classification of performance data.

For the combination of items of Object and Monitor Data fields, see Object and Monitor Data combinations (on page 333) .

Performance Object Selection

Objects that can be displayed in graphs.

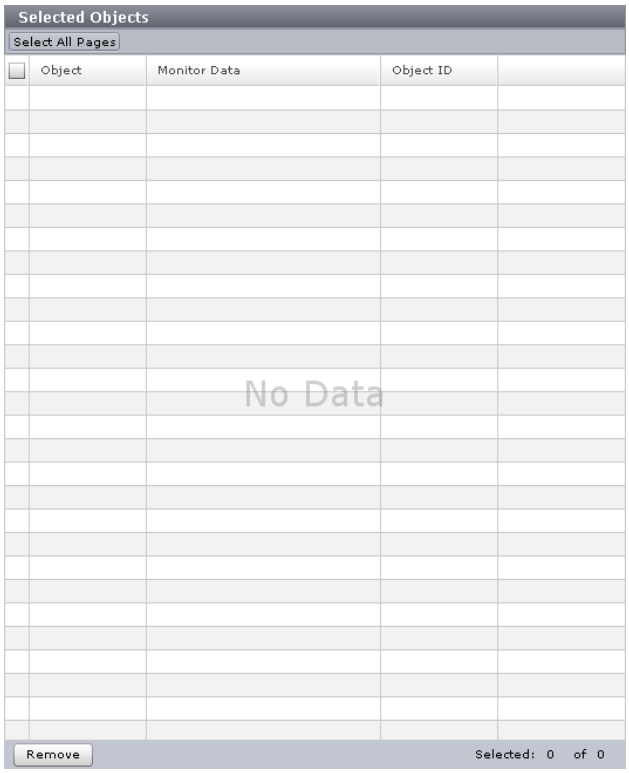
Available Objects table

The columns depend on the object selected. For details, see Available Objects table (on page 345) .

Add

Adds objects to display the graph.

Selected Objects table



Item	Description
Object	Object to display the graph.
Monitor Data	Type of monitoring data.
Object ID	ID of the monitoring object.
Remove	Remove the object in this table.

Object and Monitor Data combinations

The following table shows the possible Object and Monitor Data combinations that can be selected in the Performance Objects area of the **Monitor Performance** window.

- If Controller is selected on the left side of the Object field, the item on the right side of Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
MP	Usage Rate	%
DRR (VSP G1x00 and VSP F1500)	Usage Rate	%

- If Cache is selected on the left side of the Object field, the item on the right side of the Monitor Data is blank field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Usage Rate	%
None	Write Pending Rate	%

- (VSP G1x00 and VSP F1500) If Access Path is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
CHA-Cache	Usage Rate	%
DKA-Cache	Usage Rate	%
MP Blade-Cache	Usage Rate	%
Cache	Usage Rate	%

- (VSP G1x00 and VSP F1500) If Fibre Port is selected on the left side of the Object field, the item on the left side of the Object and Monitor Data fields is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
None	Data Trans.	MB/s
None	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If Fibre Port is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP G1x00 and VSP F1500) If Mainframe Fibre Port is selected on the left side of the Object field, the item on the right side of the Object field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Throughuput	None	IOPS
Data Trans.	Total	MB/s
	Read	MB/s
	Write	MB/s
Response Time	None	ms
CMR delay Time	None	ms
Disconnected Time	None	ms
Connected Time	None	ms
HTP Port open exchanges	None	count/sec

- (VSP G1x00 and VSP F1500) If iSCSI Port is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
None	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If iSCSI Port is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- (VSP Gx00, VSP Fx00, and VSP Nx00) If NAS Platform (User LU) or NAS Platform (System LU) is selected on the left side of the Object ield, the item on the right side of the Monitor Data ield is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- If WWN is selected on the left side of the Object field, the item on the right side of the Monitor Data field is blank.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
WWN	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Port	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- If Logical Device is selected on the left side of the Object field and if Base is selected on the right of the Object field, the following items can be selected.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate[1]	None	%
Drive Access Rate[1]	Read (Sequential)	%
	Read (Random)	
	Write (Sequential)	
	Write (Random)	
ShadowImage[1,2]	None	%

Notes:

1. Only information about internal volumes is displayed. Information about the following is not displayed:
   - external volumes
   - (VSP G1x00 and VSP F1500) FICON DM volumes
2. (VSP G1x00 and VSP F1500) Information for ShadowImage for Mainframe is included.

- If Logical Device is selected on the left side of the Object field and if TC/TCz/GAD is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If Logical Device is selected on the left side of the Object field and if UR/URz is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Parity Group is selected on the left side of the Object field, the item on the right side of the Object field is blank. A parity group is displayed only when the CU number of each LDEV within the parity group is to be monitored.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	
Drive Usage Rate*	None	%
* Only information about internal volumes is displayed. Information about the following is not displayed: ▪ external volumes ▪ (VSP G1x00 and VSP F1500) FICON DM volumes		

- If LUN is selected on the left side of the Object field and if Base is selected on the right of the Object field, the following items can be selected.

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Total Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	(VSP G1x00 and VSP F1500) CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	(VSP G1x00 and VSP F1500) Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	(VSP G1x00 and VSP F1500) Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	
Back Trans.	Total	count/sec
	Cache To Drive	
	Drive To Cache (Sequential)	
	Drive To Cache (Random)	

- If LUN is selected on the left side of the Object field and if TC/GAD is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If LUN is selected on the left side of the Object field and if UR is selected on the right of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s

- If Journal is selected on the left side of the Object field, UR/URz is selected on the right side of the Object field.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	Meta Data Usage Rate	%
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
	Data Usage Rate	%
	Meta Data Usage Rate	%

- If Entire Storage System is selected on the left side of the Object field and if TC/TCz/GAD is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
RIO	Total	count
	Write	
	Error	
Pair Synchronization Rate	None	%
Differential Track	None	count
Initial Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms
Update Copy	Throughput	count
	Data Trans.	MB/s
	Response Time	ms

- If Entire Storage System is selected on the left side of the Object field and if UR/URz is selected on the right side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
Write Host I/O	Throughput	IOPS
	Data Trans.	MB/s
Initial Copy	Cache Hit	%
	Data Trans.	MB/s
Master Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s
	Response Time	ms

- If External Storage is selected on the left side of the Object field, the following items can be selected.

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
Logical Device	Data Trans.	Total	MB/s
		Read	
		Write	
	Response Time	Total	ms
		Read	
		Write	
Parity Group*	Data Trans.	Total	MB/s
		Read	
		Write	
	Response Time	Total	ms

Item on right side of Object field	Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
		Read	
		Write	
(VSP G1x00 and VSP F1500) * A parity group is displayed only when the CU number of each LDEV within the parity group is to be monitored. Parity groups in which all CUs are not subject to monitoring are not displayed.			

Available Objects table

The items appearing in the Available Objects table depend on the objects selected in the Performance Objects fields.

Monitoring object	Item	Description
Fibre Port (VSP G1x00 and VSP F1500) Fibre Port/Target and Fibre Port/Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
Mainframe Fibre Port (VSP G1x00 and VSP F1500)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
iSCSI Port (VSP G1x00 and VSP F1500) iSCSI Port/Target and iSCSI Port/Initiator (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
NAS Platform (User LU) / Target (VSP Gx00, VSP Fx00, and VSP Nx00)	Port ID	Name of the port. Only the ports assigned to the user are displayed.
NAS Platform (System LU) / Target (VSP Gx00, VSP Fx00, and VSP Nx00)		

Monitoring object	Item	Description
WWN/WWN	HBA WWN	Worldwide name of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter. Only the WWNs that correspond to the ports assigned to the user are displayed.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
WWN/Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
	HBA WWN	WWN of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
Logical Device/Base	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Logical Device/TC/TCz/GAD	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only theLDEVs assigned to the user aredisplayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.

Monitoring object	Item	Description
Logical Device/UR/URz	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
Parity Group	Parity Group ID	ID of the parity group. Only the parity groups assigned to the user are displayed.
LUN/Base	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/TC/GAD	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.

Monitoring object	Item	Description
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
LUN/UR	Port ID ▪ Item: Type ▪ Description: Type of port	Name of the port.
	Host Group Name/iSCSI Target Alias ▪ Item: iSCSI target name ▪ Description: Name of the iSCSI target	Name of the host group or iSCSI target alias.
	LUN	ID of the LUN. Only the LUNs that correspond to the host groups and LDEVs assigned to the user are displayed.
External Storage/Logical Device	LDEV ID	ID of the volume, in the following format: LDKC:CU:LDEV. Only the LDEVs assigned to the user are displayed.
	LDEV Name	Name of the LDEV. LDEV Name is the combination of fixed characters and numbers.
External Storage/Parity Group	Parity Group ID	Parity group ID of the external volume. Only the parity groups assigned to the user are displayed.
Controller/MP	MP blade or unit ID/MP ID	ID of an MP blade or unit and processor.
Controller/DRR (VSP G1x00 and VSP F1500)	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP blade or unit ID	ID of an MP blade or unit.
	Cache	Name of the cache.

Monitoring object	Item	Description
Access Path/CHA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/DKA-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/MP Blade-Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Access Path/Cache (VSP G1x00 and VSP F1500)	Access Path	Name of the access path.
Entire Storage System/ TC/TCz/GAD	Object	Item for entire storage system.
Entire Storage System/ UR/URz	Object	Item for entire storage system.
Journal/UR/URz	Journal ID	ID of the journal.

Wizard buttons

These standard buttons are used to set information in and navigate among the monitoring windows.

Item	Description
Go to tasks window for status	Check to go to the task window after clicking Apply.
Back	Click to move to the previous task.
Next	Click to move to the next task.
Apply	Click to apply the settings to the storage system.
Finish	Finishes the task.
Cancel	Cancels the current task and closes this window.
Help	Opens the help topic for this window.

Navigation buttons

These standard buttons are used to control the information appearing the monitoring windows.

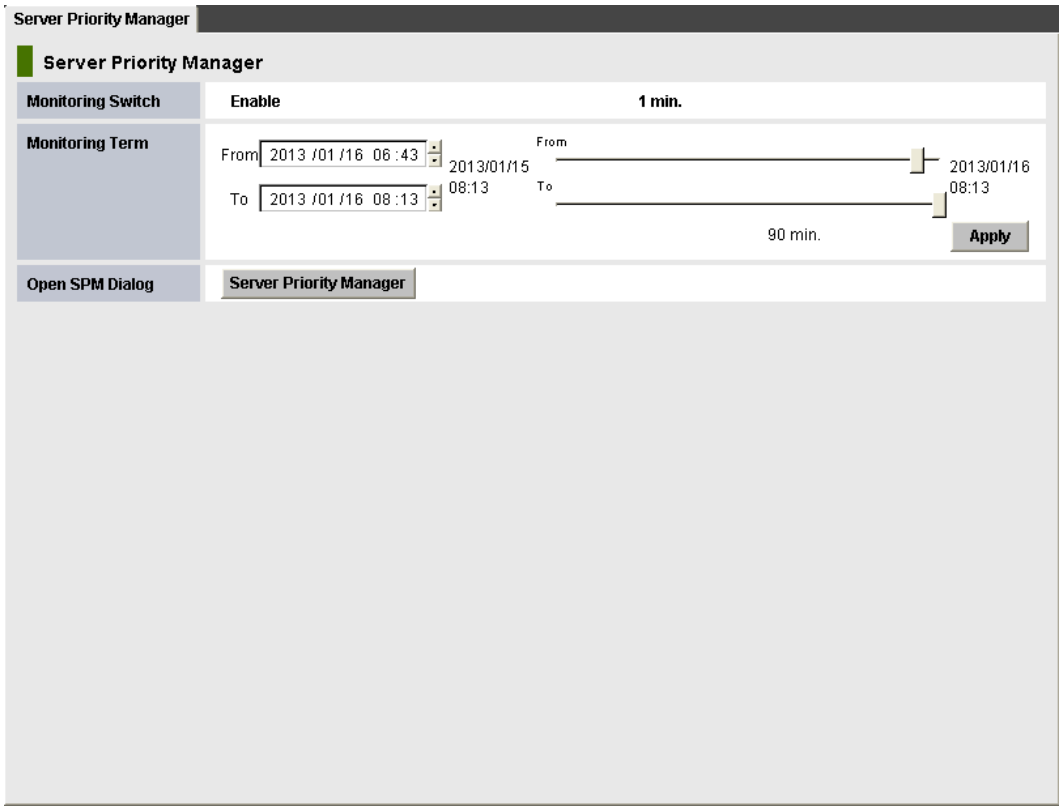
Item	Description
Filter	▪ ON: Click to activate the filter. ▪ OFF: Click to cancel the filter.
Select All Pages	Click to select all pages.
Options	Click to specify options for how the table displays information.
|<	Click to view the first page.
<	Click to view the previous page.
Page	Page numbers in N/M format, where N indicates the number of the current page and M indicates total number of pages.
>	Click to view the next page.
>|	Click to view the last page.

Appendix B: Server Priority Manager GUI reference

This chapter provides detailed information about the Server Priority Manager GUI.

Server Priority Manager window

The Server Priority Manager window displays the status of performance monitoring, allows you to set the monitoring term, and provides access to the Server Priority Manager main window.

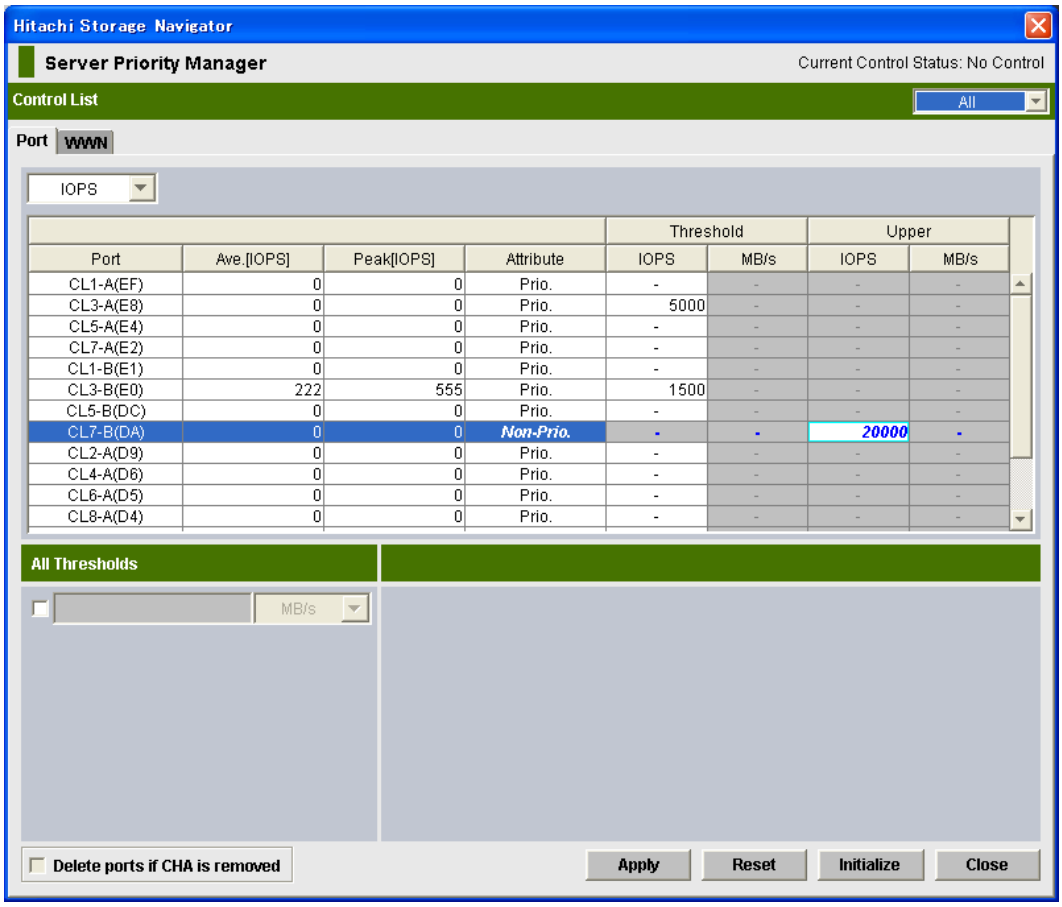


Item	Description
Monitoring Switch	Enable: Performance Monitor is monitoring the storage system Disable: The storage system is not being monitored.

Item	Description
Monitoring Term	Specify a period in which to collect monitoring data and display in Server Priority Manager main window. A day is set by default. To set a date and time in the From and To fields, do either of the following: ▪ Move the sliders to the left or to the right to adjust the date and time. ▪ In the text box, select a date or time unit that you want to change and then use the up or down arrows. Starting and ending times for collecting statistics are displayed on both sides of the slide bars. Performance Monitor stores the monitoring data between these times. For example, if you want to view usage statistics within the range of 10:30 July 1 2013 to 22:30 July 31 2013, you set `2013/07/01 10:30` in the From field, set `2013/07/31 22:30` in the To field, and then click Apply. When you specify dates and time in the From and To fields, Performance Monitor calculates and displays the length of the specified period. The length of the period is in days. From and To are unavailable if Server Priority Manager is in View mode or the monitoring data (that is, usage statistics) is not stored in the storage system.
Open SPM Dialog	Click Server Priority Manager to open the Server Priority Manager main window.

Port tab of the Server Priority Manager main window

Use this tab to set the limit on the performance of non-prioritized ports and set the threshold on the performance of prioritized ports.



Item	Description
Current Control Status	Shows the current control status of the system. ▪ Port Control indicates the system is controlled by the upper limits and threshold specified on the Port tab. ▪ WWN Control indicates the system is controlled by the upper limits and threshold specified on the WWN tab. ▪ No Control indicates the system performance is not controlled by Server Priority Manager. **Tip:** If WWN Control is displayed when the Port tab is active, click Apply to switch control so that Port Control is displayed. **Tip:** To return the control status to No Control, specify Prio. for attributes of all ports and then click Apply.
Control List	Allows you to narrow ports appearing in the list: ▪ If All is selected, all ports appear in the list. ▪ If Prioritize is selected, only the prioritized ports appear in the list. ▪ If Non-Prioritize is selected, only the non-prioritized ports appear in the list.

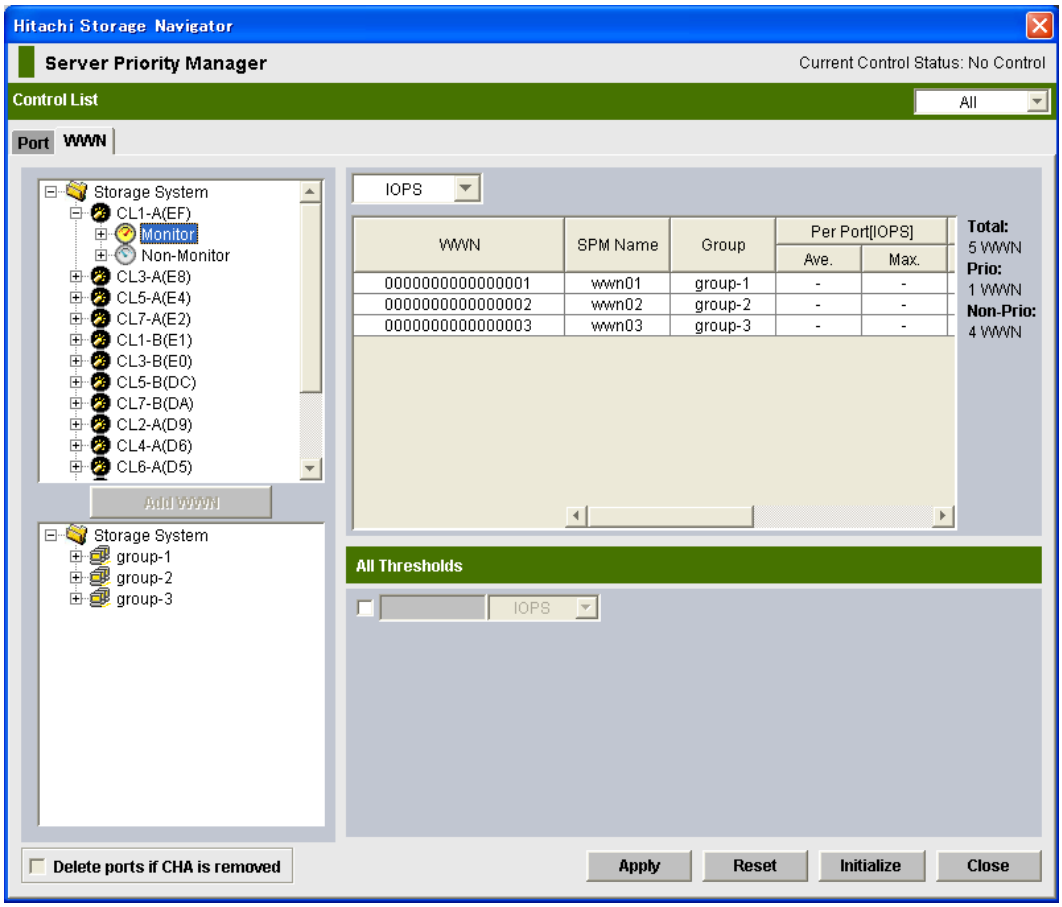
Item	Description
	If you change settings of a port, that port remains in the list regardless of the selection in the list.
Statistic type list	Allows you to change the type of performance statistics to be displayed in the list. ▪ If IOPS (I/Os per second) is selected, the list displays I/O rates for ports. The I/O rate indicates the number of I/Os per second. ▪ If MB/s (megabytes per second) is selected, the list displays the transfer rates for ports. The transfer rate indicates the size of data transferred via a port in one second.
Ports table	A list of ports, including the I/O rate or the transfer rate for each port. You can specify the port attributes, and the threshold and upper limit of the port traffic. The measurement unit for the values in the list can be specified by the drop-down list above this table. The port traffic (I/O rate and transfer rate) is monitored by Performance Monitor. To specify the monitoring period, use the Monitoring Term area of Performance Monitor. The table contains these columns: ▪ Port indicates ports on the storage system. ▪ Ave.[IOPS] indicates the average I/O rate or the average transfer rate for the specified period. ▪ Peak[IOPS] indicates the peak I/O rate or the peak transfer rate of the ports for the specified period. This value means the top of the Max. line in the detailed port-traffic graph drawn in the **Monitor Performance** window. For details, see Data collected by Hitachi Performance Monitor (on page 41). ▪ Attribute indicates the priority of each port. Prio indicates a prioritized port. Non-Prio indicates a non-prioritized port.

Item	Description
	▪ Use the Threshold columns to specify the threshold for the I/O rate and the transfer rate for each prioritized port. Either the IOPS or MB/s column in the list is activated depending on the selection from the list above. Use the IOPS column to specify the threshold for I/O rates. Use the MB/s column to specify the threshold for transfer rates. To specify a threshold, double-click a cell to display the cursor in the cell. If you specify a value in either the IOPS or MB/s column, the other column is unavailable. You can specify thresholds for I/O rates and transfer rates all together for different prioritized ports. Even if you use the type of rate for the threshold different from that used for the upper limit values, the threshold control can work for all ports. ▪ Use the Upper columns to specify the upper limit on the I/O rate and the transfer rate for each non-prioritized port. Either the IOPS or MB/s column in the list is activated depending on the selection from the list above. Use the IOPS column to specify the upper limit for I/O rates. Use the MB/s column to specify the upper limit for transfer rates. To specify an upper limit, double-click a cell to display the cursor in the cell. If you specify a value in either of the IOPS or MB/s column, the other column is unavailable. You can specify upper limit values for I/O rates and transfer rates all together for different non-prioritized ports.
All Thresholds	If you select this check box and enter a threshold value in the text box, the threshold value is applied to the entire storage system. To specify the threshold for the I/O rate, select IOPS from the list on the right of the text box. To specify the threshold for the transfer rate, select MB/s from the list. For example, if you specify 128 IOPS in All Thresholds, the upper limits on non-prioritized ports are disabled when the sum of I/O rates for all prioritized ports is below 128 IOPS. Even if you use the different type of rate (IOPS or MB/s) for the threshold as that used for the upper limit values, the threshold control can work for all ports.
Delete ports if CHA is removed	If you check this check box, Server Priority Manager deletes, from SVP, the setting information of Server Priority Manager on ports in channel adapters that have been removed. When a channel adapter is removed, the port and its settings are removed from the Server Priority Manager main window automatically, but they remain in SVP. This may cause the old setting for Server Priority Manager to be applied to a different channel adapter than the one newly-installed on the same location.

Item	Description
	The Delete ports if CHA is removed check box is available only when the following Server Priority Manager settings on ports in a removed channel adapter remains on SVP: ▪ The setting of prioritized ports or non-prioritized ports. ▪ The setting of prioritized WWNs or non-prioritized WWNs.
Apply	Applies the settings in this window to the storage system.
Reset	Restores the last applied settings in the window. When you click this button, all changes displayed with the blue text in the window are canceled.
Initialize	Changes the settings in this window as explained below, and then applies the resulting settings to the storage system: ▪ All ports become prioritized ports. ▪ The threshold value for all ports becomes 0 (zero). ▪ The window will display a hyphen (-) instead of 0 (zero). ▪ If the All Thresholds check box is checked, the check mark disappears.
Close	Closes the Server Priority Manager main window.

WWN tab of the Server Priority Manager main window

Use this tab to set the limit on the performance of non-prioritized WWNs and set the threshold on the performance of prioritized WWNs.



Item	Description
Current Control Status	The current system control. ▪ Port Control: The system is controlled by the upper limits and threshold specified on the Port tab. ▪ WWN Control: The system is controlled by the upper limits and threshold specified on the WWN tab. ▪ No Control: The system performance is not controlled by Server Priority Manager. **Tip:** If Port Control appears when the WWN tab is active, click Apply to switch control so that WWN Control is displayed. **Tip:** To return the control status to No Control, specify Prio. for attributes of all host bus adapters and then click Apply.
Control List	Allows you to narrow WWNs in the list: ▪ If All is selected, all WWNs appear in the list. ▪ If Prioritize is selected, only the prioritized WWNs appear in the list. ▪ If Non-Prioritize is selected, only the non-prioritized WWNs appear in the list.

Item	Description
Upper-left tree	Ports and the host bus adapters connected to these ports in the storage system. Ports on the storage system are shown below the Storage System folder. The ports are indicated by icons such as and . When you double-click on a port, the tree expands to display two items: Monitor and Non-Monitor. The host bus adapters that are connected to the specified port are displayed below Monitor or Non-Monitor. ▪ If you double-click Monitor, the host bus adapters ( ) whose traffic with the specified port is monitored are displayed below Monitor. ▪ If you double-click Non-Monitor, the host bus adapters whose traffic with the specified port is not monitored are displayed below Non-Monitor. The WWN and SPM names of the host bus adapters are displayed on the right of the host bus adapter icon ( ) below Monitor. WWNs (Worldwide Name) are 16-digit hexadecimal numbers used to uniquely identify host bus adapters. SPM names are nicknames assigned by the system administrator so that they can easily identify each host bus adapter. Only the WWN is displayed on the right of the host bus adapter icon ( ) below Non-Monitor. When many-to-many connections are established between host bus adapters (HBAs) and ports, make sure that all traffic between HBAs and ports is monitored. Therefore, make sure that all connected HBAs are displayed below Monitor. For details on how to move an HBA displayed below Non-Monitor to below Monitor, see Monitoring all port-HBA traffic: many-to-many connections (on page 189). The list on the right of the tree changes depending on the item you select in the tree as follows. ▪ When you select a port or Monitor icon, the list shows the information of host bus adapters that are connected to the ports and monitored by Performance Monitor. ▪ When you select the Monitor icon or the Storage System folder, the list becomes blank.

Item	Description
Lower-left tree	SPM groups and host bus adapters (WWNs) in each SPM group: ▪ SPM groups ( ), which contain one or more WWNs, appear below the Storage System folder. For details on SPM groups, see Working with SPM groups (on page 199) . ▪ If you double-click an SPM group, host bus adapters in that group expand in the tree. The WWN and SPM name appear to the right of the host bus adapter icon ( ). If the WWN of a host bus adapter (HBA) appears in red in the tree, the host bus adapter is connected to two or more ports, but the traffic between the HBA and some of the ports is not monitored by Performance Monitor. When many-to-many connections are established between HBAs and ports, make sure that all traffic between HBAs and ports is monitored. For details on the measures when a WWN is displayed in red, see Monitoring all port-HBA traffic: many-to-many connections (on page 189) . The list on the right of the tree changes depending on the item you selected in the tree as follows: ▪ When you select the Storage System folder, the WWN list shows the information of SPM groups. ▪ When you select an SPM group icon ( ), the WWN list shows the information of host bus adapters ( ) contained in that SPM group.
Add WWN	Adds a host bus adapter to an SPM group. Before using this button, you must select a host bus adapter ( ) from the upper-left tree and also select an SPM group ( ) from the lower-left tree. You can add a host bus adapter that appears below Monitor and is not yet registered on any other SPM group. If you select a host bus adapter below Non-Monitor or a host bus adapter already registered on an SPM group, the Add NNW button is unavailable.
Statistic type	Allows you to change the type of performance statistics to be displayed in the WWN list. ▪ If IOPS (I/Os per second) is selected, the list displays I/O rates for ports. The I/O rate indicates the number of I/Os per second. ▪ If MB/s (megabytes per second) is selected, the list displays the transfer rates for ports. The transfer rate indicates the size of data transferred via a port in one second.

Item	Description
WWN list	A list of WWNs and the I/O rate or the transfer rate for each host bus adapter corresponding to the selection in the upper-left tree or lower-left tree. Use this list to specify the host bus adapter attributes and the upper limit of the host bus adapter traffic. The measurement unit for the values in the list can be specified by the list at the upper left corner of the list. The displayed items will change depending on the selected tree and item. The host bus adapter traffic (I/O rate and transfer rate) is monitored by Performance Monitor. To specify the monitoring period, use the Monitoring Term area of Performance Monitor. On the right side of the list appear total number of WWNs, the number of prioritized WWNs, and the number of non-prioritized WWNs. The list contains the following columns (use the slide bar to view all of the columns): ▪ WWN: column indicates WWNs of host bus adapters. This column does not appear when you select the Storage System folder in the lower-left tree. ▪ SPM Name: SPM names of host bus adapters. Use Server Priority Manager to assign an SPM name to each host bus adapter so that you can easily identify each host bus adapters in the Server Priority Manager main window. This column does not appear when you select the Storage System folder in the lower-left tree. ▪ Group: The SPM group to which the host bus adapter belongs. This column appears when a port is selected in the upper-left tree and does not appear when an SPM group is selected in the lower-left tree.

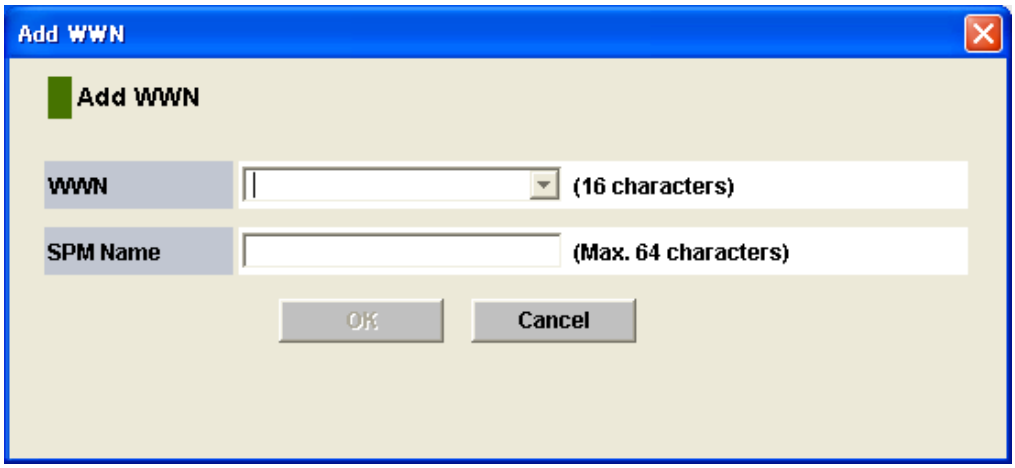
Item	Description
	▪ Per Port [IOPS]: The traffic (I/O rate or transfer rate) between the host bus adapter and the port selected in the upper-left tree. This item is displayed only when you select an icon in the upper-left tree. The Per Port column contains the following: Ave.: Average I/O rate or the average transfer rate for the specified period. Max.: Maximum I/O rate or the maximum transfer rate for the specified period. ▪ WWN Total[IOPS]: The sum of the traffic (I/O rate or transfer rate) between the host bus adapter and all ports connected to the host bus adapter. This value means the total traffic of that host bus adapter. This item is displayed only when you select an icon in the upper-left tree. Whichever port you select in the tree, the WWN Total column shows the sum of the traffic to all ports. ▪ The WWN Port column contains the following: Ave.: Indicates the average I/O rate or the average transfer rate for the specified period. The Ave. column is also displayed when you select an icon in the lower-left tree. In this case, the Ave. column shows the average value same as that of WWN Total. When you select the Storage System folder in the lower-left tree, the Ave. column shows the sum of the traffic of the host bus adapters registered on each SPM group. Max.: Indicates the maximum I/O rate or the maximum transfer rate for the specified period. The Max. column is also displayed when you select an icon in the lower-left tree. In this case, the Max. column shows the maximum value same as that of WWN Total. When you select the Storage System folder in the lower-left tree, the Max. column shows the sum of the traffic of the host bus adapters registered on each SPM group. ▪ Attribute: The priority of each WWN. Prio. indicates a prioritized WWN. Non-Prio. indicates a non-prioritized WWN. For details on how to change the priority, see Setting priority for WWNs: many-to-many connections (on page 188). If one host bus adapter connects to multiple ports, the attribute setting of the host bus adapter is common to all of the ports. Therefore, if you specify a host bus adapter as a prioritized WWN or a non-prioritized WWN for one port, the setting is applied to all of the other connected ports automatically.

Item	Description
	▪ The Upper columns let you specify the upper limit on the I/O rate and the transfer rate for each host bus adapter. Either of the IOPS or MB/s column in the list is activated depending on the selection from the list above. Use the IOPS column to specify the upper limit for I/O rates. Use the MB/s column to specify the upper limit for transfer rates. To specify an upper limit, double-click a cell to display the cursor in the cell. If you specify a value in either the IOPS or MB/s column, the other column is unavailable. You can specify upper limit values for I/O rates and transfer rates all together for different non-prioritized WWNs. **Notes:** ▪ If one host bus adapter connects to multiple ports, the setting of the upper limit value for a non-prioritized WWN is common to all of the ports. Therefore, if you specify an upper limit value of non-prioritized WWN for one port, the setting is applied to all of the other connected ports automatically. ▪ You cannot change the upper limit value of a host bus adapter that has registered on an SPM group. The upper limit value of such a host bus adapter is defined by the setting of the SPM group to which the host bus adapter is registered. For details on setting the upper limit value of an SPM group, see Setting an upper-limit value to HBAs in an SPM group (on page 202). ▪ The Upper columns will not appear if an SPM group ( ) or a host bus adapter ( )is selected in the lower-left tree.
All Thresholds	If you select this check box and enter a threshold value in the text box, the threshold value will be applied to the entire storage system. To specify the threshold for the I/O rate, select IOPS from the list on the right of the text box. To specify the threshold for the transfer rate, select MB/s from the list. For example, if you specify 128 IOPS in All Thresholds, the upper limits on non-prioritized WWNs are disabled when the sum of I/O rates for all prioritized WWNs is below 128 IOPS. Even if you use the different type of rate (IOPS or MB/s) for the threshold as that used for the upper limit values of the non-prioritized WWNs, the threshold control can work for all WWNs. On the WWN tab, you cannot specify individual thresholds for each host bus adapter.
Delete ports if CHA is removed	If checked, Server Priority Manager will delete, from SVP, the setting information of Server Priority Manager on ports in channel adapters that have been removed.

Item	Description
	If checked, when a channel adapter is removed, the port and its settings are removed from the Server Priority Manager main window automatically, but remain in SVP. This may cause the old settings for Server Priority Manager to be applied to a different channel adapter that is newly installed on the same location. This check box is available only when the following Server Priority Manager settings on ports in a removed channel adapter remain on the SVP: ▪ The setting of prioritized ports or non-prioritized ports. ▪ The setting of prioritized WWNs or non-prioritized WWNs.
Apply	Applies the settings in this window to the storage system.
Reset	Restores the last applied settings in the window. When you click this button, all changes displayed in blue text in the window are canceled.
Initialize	Changes the settings in this window, as explained below, and then applies the resulting settings to the storage system: ▪ All host bus adapters become prioritized WWNs. ▪ If the All Thresholds checkbox is checked, the check mark disappears.
Close	Closes the Server Priority Manager main window.

Add WWN window

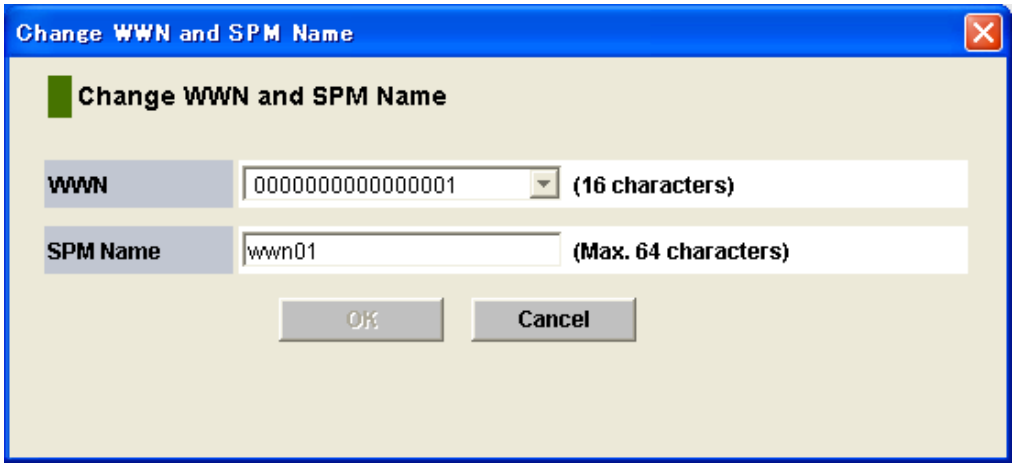
Use this window to set the WWN and SPM name.



Item	Description
WWN	When you click here, the host bus adapter (WWN) that is out of monitoring target displays. Select WWN from the drop down list.
SPM Name	Enter SPM name (maximum of 64 characters).

Change WWN and SPM Name window

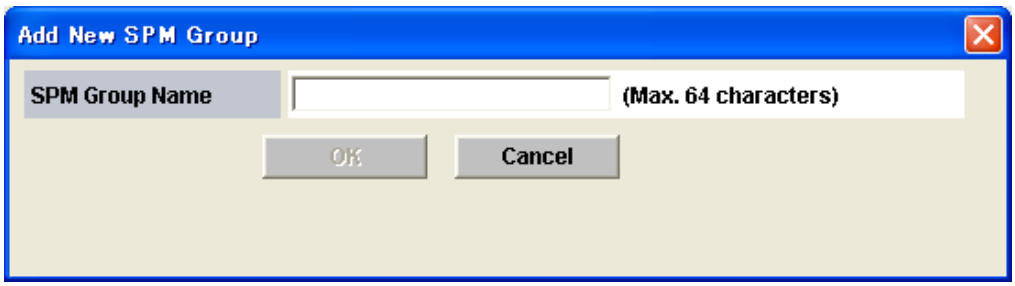
Use this window to change WWN and SPM name.



Item	Description
WWN	When you click here, the host bus adapter (WWN) connected to the port displays. Select WWN from the drop down list.
SPM Name	Enter the SPM name (maximum of 64 characters).

Add New SPM Group window

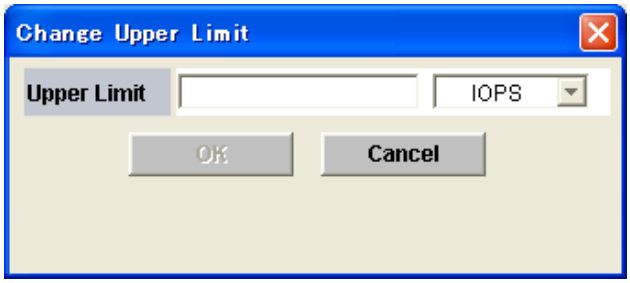
Use this window to add a new SPM group.



Item	Description
SPM Group Name	Enter SPM group name (maximum of 64 characters).

Change Upper Limit window

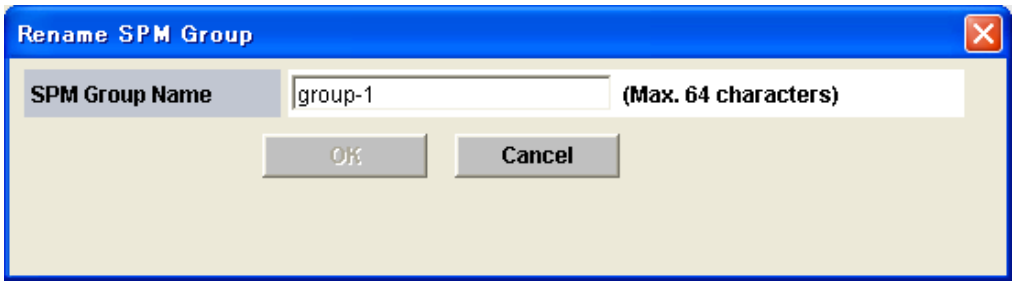
Use this window to change the upper limit.



Item	Description
Upper Limit	Enter the upper limit value. If you want to set the upper limit value of the I/O rate, enter the upper limit value in the text box and select IOPS. If you want to set the upper limit value of the transfer rate, enter the upper limit value in the text box and select MB/s.

Rename SPM Group window

Use this window to rename the SPM group.



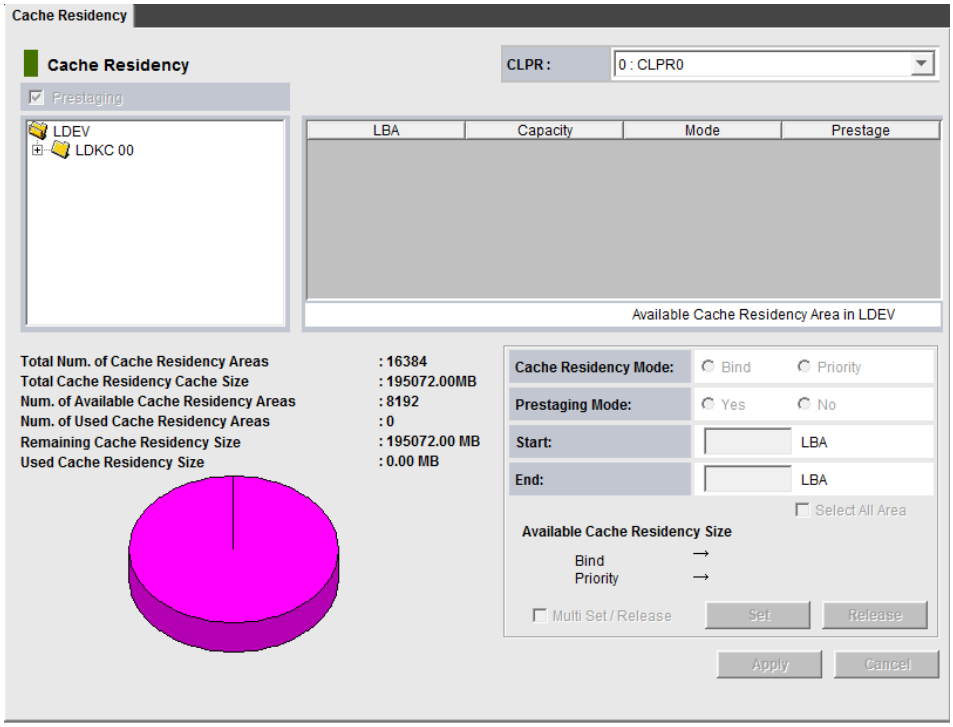
Item	Description
SPM Group Name	Enter SPM group name (maximum of 64 characters).

Appendix C: Cache Residency Manager GUI reference (VSP G1x00 and VSP F1500)

This chapter provides detailed information about the Cache Residency Manager GUI.

Cache Residency window

This window provides the Cache Residency Manager information for your connected storage system and provides access to all Cache Residency Manager operations.



Item	Description
Prestaging	Enables and disables the prestaging function for Cache Residency Manager. If you select the Prestaging check box and click Apply, a Yes/No confirmation is displayed. To perform a Cache Residency Manager operation followed by a prestaging operation, click Yes. To perform only the Cache Residency Manager operation, click No.

Item	Description
	If you clear the Prestaging check box and click Apply, only a Cache Residency Manager operation is performed. If you select this check box later and click Apply, a Yes/No confirmation is displayed. If you click Yes, only the prestaging operation is performed. The Prestaging check box is selected by default. The Prestaging check box is unavailable when the Prestaging Mode is set to No for each cache area. The Prestaging check box can be selected only when you are logged in to Device Manager - Storage Navigator as a storage administrator.
Tree	Lists the LDEVs that are available for Cache Residency Manager operations. The LDEVs are identified by LDKC number, CU number, and LDEV number. For example, LDEV 00:01:48 is LDEV 48 in CU 01 in LDKC 00. An LDEV number ending with # (for example, 00:00:01#) is an external volume. Only the volumes belonging to the selected CLPR are shown. Volumes that are reserved for Volume Migration and Compatible Hyper PAV alias volumes are not shown, because these volumes are not available for Cache Residency Manager operations. The CU:LDEV Tree uses these icons: : Indicates an open/expanded folder. An open LDKC folder shows the CUs that belong to that LDKC. An expanded CU folder shows the LDEVs that belong to that CU. : Indicates an unopened/unexpanded LDKC or CU folder. :Indicates that the LDEV is an internal volume for which Cache Residency Manager is not set or an external volume whose Cache mode is set to Enable. : Indicates that the LDEV is an internal volume for which Cache Residency Manager is set or an external volume whose Cache mode is set to Enable. : Indicates that the LDEV is an external volume where Cache Residency Manager is not set to Disable but Cache mode is set to Disable.

Item	Description
	: Indicates that the LDEV is an external volume that has Cache Residency Manager set to Enable but Cache mode set to Disable.
CLPR	Select the cache logical partition (CLPR) containing the desired CUs and LDEVs. The CLPR is displayed as *CLPR-ID* : *CLPR-name*. The **Cache Residency** window then shows the cache information for the selected CLPR and the CUs and volumes belonging to the selected CLPR. If you administer more than one CLPR, use the CLPR list to select a CLPR by name and number. If you administer only one CLPR, the CLPR list shows only the CLPR that you have access to and does not allow you to select other CLPRs.
LDEV ID	Provides detailed information and Cache Residency Manager settings for the LDEV selected in the CU:LDEV tree. ▪ DKC:CU:LDEV: ("#" after the LDEV number indicates an external volume). ▪ Emulation type ▪ Volume capacity in GB for open-systems LDEVs, in cylinders and tracks for mainframe LDEVs ▪ RAID level
LDEV information	The LDEV information table provides detailed information and Cache Residency Manager settings for the LDEV selected in the CU:LDEV tree.LDEV (see LDEV Information table (on page 369) for details).
Cache information	The cache information area provides information on the cache usage. The cache information area also indicates when prestaging operations and cache residency operations are in progress (see Cache Information (on page 369) for details).
Operations	Use add data to and release data from Cache Residency Manager cache (see Operations box (on page 370) for details).
Apply	Starts the requested operations with or without prestaging.
Cancel	Cancels the requested operations and closes the dialog box.

LDEV Information table

Items in the LDEV Information table are described in the following table.

Item	Description
LBAs for open-systems LDEVs, CC HH for mainframe LDEVs	Data location on the LDEV indicated by starting and ending addresses. A data location n blue italics indicates a requested operation.
Capacity	Capacity of the data stored in Cache Residency Manager cache: MB for open-systems LDEVs, cylinders and tracks for mainframe LDEVs. A capacity in blue italics indicates a requested operation.
Mode	Cache Residency Manager cache mode: ▪ PRIO: Priority mode. ▪ BIND: Bind mode. ▪ A dash (-) indicates that the area is not allocated for Cache Residency Manager cache. A cache mode in blue italics indicates a requested operation.
Prestage	Setting for the prestaging function: ▪ Blank: Indicates that the prestaging function is not set. ▪ ON: The prestaging function is set. A prestaging mode in blue italics indicates a requested operation.
Available Cache Residency Area in LDEV	Available number of cache areas in the specified LDEV (maximum: 16,384).

Cache Information

Item	Description
Total Num. of Cache Residency Areas	If you are logged in to Device Manager - Storage Navigator as a storage administrator, this field shows the total number of Cache Residency Manager cache areas that can be set in the selected CU group (maximum: 16,384).
Total Cache Residency Cache Size	If you are logged in to Device Manager - Storage Navigator as a storage administrator, this field shows the total capacity (in MB) of Cache Residency Manager cache areas in the selected CU group (maximum: 512 GB).

Item	Description
Num. of Available Cache Residency Areas	Unused Cache Residency Manager cache area, calculated by subtracting the number of installed Cache Residency Manager cache areas in the CLPR from the maximum number of Cache Residency Manager cache areas (16,384).
Num. of Used Cache Residency Areas	Number of Cache Residency Manager cache areas that are used in the CLPR.
Remaining Cache Residency Size	Amount of Cache Residency Manager cache available for use in the CLPR (pink area on the pie chart).
Used Cache Residency Size	Capacity of Cache Residency Manager cache used in the CLPR (the total of the blue and yellow areas in the pie chart).
Pie chart	Blue indicates cache that has been used. Yellow indicates the increase in the specified size of the cache. Pink indicates the remaining amount of available cache.

Operations box

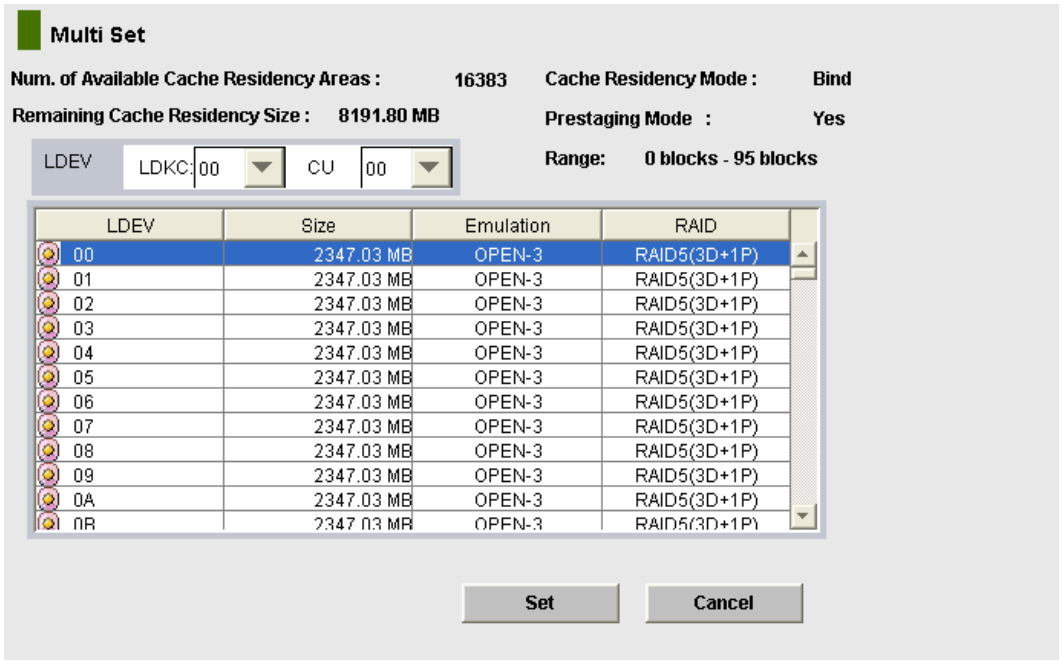
Item	Description
Cache Residency Mode	Selects the mode for the data to be added to Cache Residency Manager cache: ▪ Bind: Sets the bind mode. Bind mode is not available to external volumes whose cache mode is set to Disable (which is the mode that disables the use of the cache when there is an I/O request from the host). ▪ Priority: Sets priority mode. Once you have requested a Cache Residency Manager operation, the mode options are unavailable. To change the mode for a requested operation, cancel the requested operation and request the operation again with the desired mode selected.
Prestaging Mode	Enables or disables the prestaging mode for the requested operation: ▪ Yes: Enables prestaging mode. ▪ No: Disables prestaging mode. The Prestaging Mode options are unavailable when the Prestaging check box is unchecked.

Item	Description
	Once you have requested a Cache Residency Manager operation, the Prestaging Mode options become unavailable. To change the mode for a requested operation, cancel the requested operation and request the operation again with the desired mode selected.
Start and End	Enter the starting and ending addresses for the data to be placed in cache, specified in LBAs for open-systems LDEVs, and in CC HH numbers for mainframe LDEVs. For OPEN-V LUs, logical areas are defined in units of 512 blocks. If you enter 0 or 1 as the starting LBA and a value less than 511 as the ending LBA, Cache Residency Manager automatically changes the ending LBA value to 511.
Select All Area	Selects all data areas in the selected LDEV for Cache Residency Manager cache. This check box can be selected only if no data areas in the selected LDEV are assigned to Cache Residency Manager cache. If checked, the starting address and ending address (From and To) fields are cleared.
Available Cache Residency Size	Cache size available for Cache Residency Manager data: ▪ Bind: The available size for bind mode. ▪ Priority: The available size for priority mode.
Multi Set / Release	Requests Cache Residency Manager operations for more than one LDEV. When checked, the **Multi Set** or **Multi Release** window opens to allow you to set data into or release data from Cache Residency Manager cache for more than one LDEV. When checked, the operation can be applied to multiple LDEVs. When unchecked, the operation is applied to only one LDEV. This feature does not allow you to select and cancel an individual Cache Residency Manager data area specified for an LDEV. You must perform a Release operation to cancel an individual data area.
Set	Adds the requested set operation (place data in Cache Residency Manager cache) to the LDEV information table. This button is available when you select a data area that is not in cache in the LDEV table.

Item	Description
	This button is unavailable when Cache Residency Manager operations to release data from cache have been requested. To enable the Set, either perform the requested release operations, or cancel the requested release operations.
Release	Adds the requested release operation (remove data from Cache Residency Manager cache) to the LDEV information table. This button is available when you select a data area that is in cache in the LDEV table. This button is unavailable when Cache Residency Manager operations to set data into cache have been requested. To enable the Release, either perform the requested set operations, or cancel the requested set operations.

Multi Set dialog box

Use this dialog box to select multiple LDEVs with data that you want to place into Cache Residency Manager cache. The items shown on the Multi Set dialog box reflect the options selected on the **Cache Residency** window. Only volumes belonging to the selected CLPR are shown.



Item	Description
Num.of Available Cache Residency Areas	Number of Cache Residency Manager cache areas that can be created.
Remaining Cache Residency Size	Size of unused Cache Residency Manager caches.
Cache Residency Mode	Cache Residency Manager mode (priority or bind) specified by the Cache Residency Mode option on the **Cache Residency** window.
Prestaging Mode	Prestaging mode (yes or no) specified by the Prestaging Mode option on the **Cache Residency** window.
Range	Range of data to be placed into Cache Residency Manager cache. The data range is specified using the Start and End fields on the **Cache Residency** window. All is displayed if the Select All Area box was checked.
LDKC	Selects the LDKC that contains the desired CU and LDEVs.
CU	Selects the CU image that contains the desired LDEVs. Only CUs owned by the selected CLPR are displayed in the Multi Set dialog box.
LDEV	LDEVs in the selected CU image that are available for the Multi Set function. The LDEV table shows only those volumes that are both owned by the CLPR and are selected from the CLPR list in the **Cache Residency** window. For detail of items, see Multi Set LDEV table (on page 373)).
Set	Saves the requested Set operations, and closes the dialog box.
Cancel	Closes the dialog box without saving the requested operations.

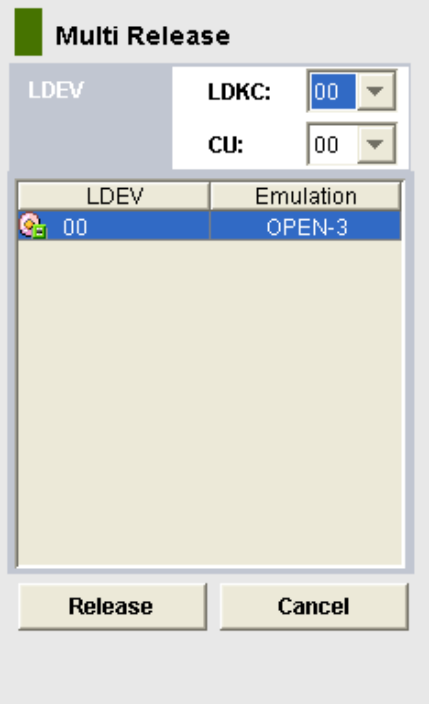
Multi Set LDEV table

Item	Description
LDEV	LDEV number. An LDEV number ending with # (for example, 01#) is an external volume.
Size	Size of the LDEV.
Emulation	Emulation type of the LDEV.

Item	Description
RAID	RAID level of the LDEV. A dash (-) indicates the LDEV is an external volume.

Multi Release dialog box

Use this dialog box to release Cache Residency Manager data from cache for more than one LDEV. To open this dialog box, in the **Cache Residency** window, select an LDEV that has all data stored in Cache Residency cache, check the Multi Set/Release box, and then click Release. The Multi Release function applies only to LDEVs that have all data stored in Cache Residency Manager cache. To release an individual cache area, select the cache area in the LDEV information table, and then click Release.



Item	Description
LDKC	Selects the LDKC containing the desired CU and LDEVs.
CU	Selects the CU image containing the desired LDEVs. Only CUs owned by the selected CLPR are available.
LDEV	LDEVs in the selected CU image that are available for the Multi Release function. The only available volumes are those that are both owned by the CLPR and are selected from the CLPR: list in the **Cache Residency** window.

Item	Description
	For detail of items, see Multi-Release LDEV table (on page 375) .
Release	Saves the requested Release operations, and closes the dialog box.
Cancel	Closes the dialog box without saving the requested operations.

Multi-Release LDEV table

Item	Description
LDEV	LDEV num. An LDEV number ending with # (for example, 01#) is an external volume.
Emulation	Emulation type of the LDEV.

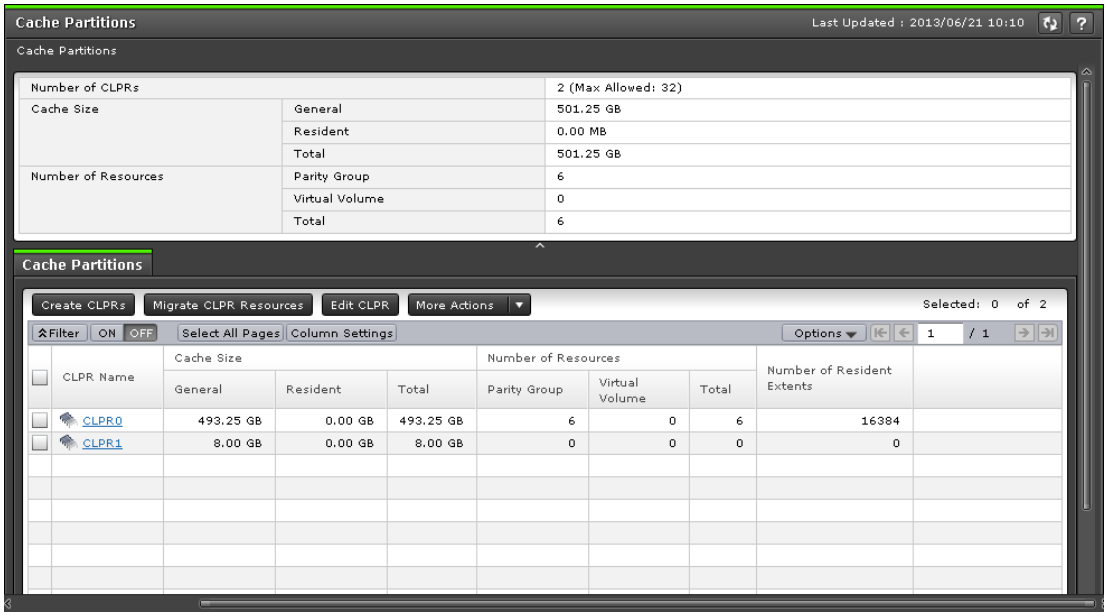
Appendix D: Virtual Partition Manager GUI reference

This chapter provides detailed information about the Virtual Partition Manager GUI.

Cache Partition window

This is the top window that appears when Cache Partitions is selected in Administration.

- Summary
- Cache Partitions tab

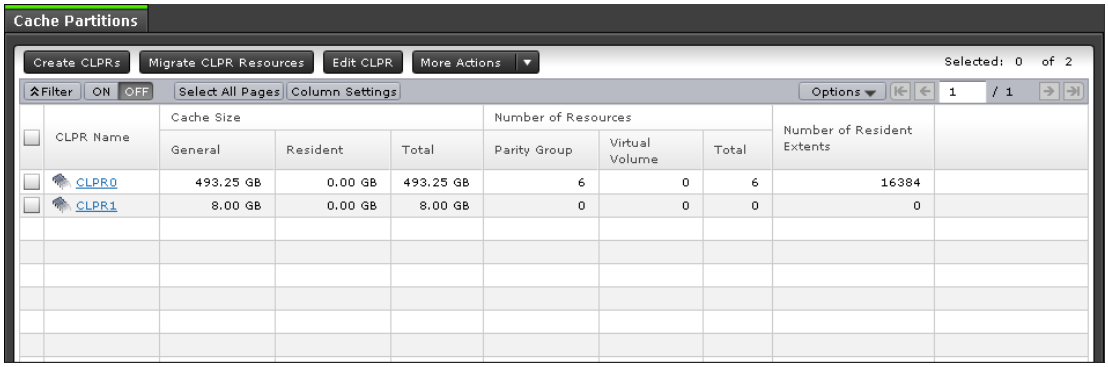


Summary

Item	Description
Number of CLPRs	Displays the number of CLPRs in the storage system.

Item	Description
Cache Size	Displays the cache capacities in the storage system: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resources	Displays the number of resources already assigned to CLPRs: ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources already assigned to CLPRs

Cache Partitions tab



Item	Description
CLPR Name	Displays the CLPR names. Click the CLPR name to open the window in which the CLPR is selected.
CLPR ID[1]	Displays CLPR IDs.
Cache Size	Displays the cache capacities in the storage system: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resources	Displays the number of resources already assigned to CLPRs: ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources already assigned to CLPRs

Item	Description
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident extents in the storage system.
Create CLPRs	Opens the Create CLPRs wizard.
Migrate CLPR Resources	Opens the Migrate CLPR Resources wizard.
Edit CLPR	Opens the Edit CLPR wizard.
Delete CLPRs[2]	Opens the Delete CLPRs window.
Export[2]	Opens the window for outputting the table information.

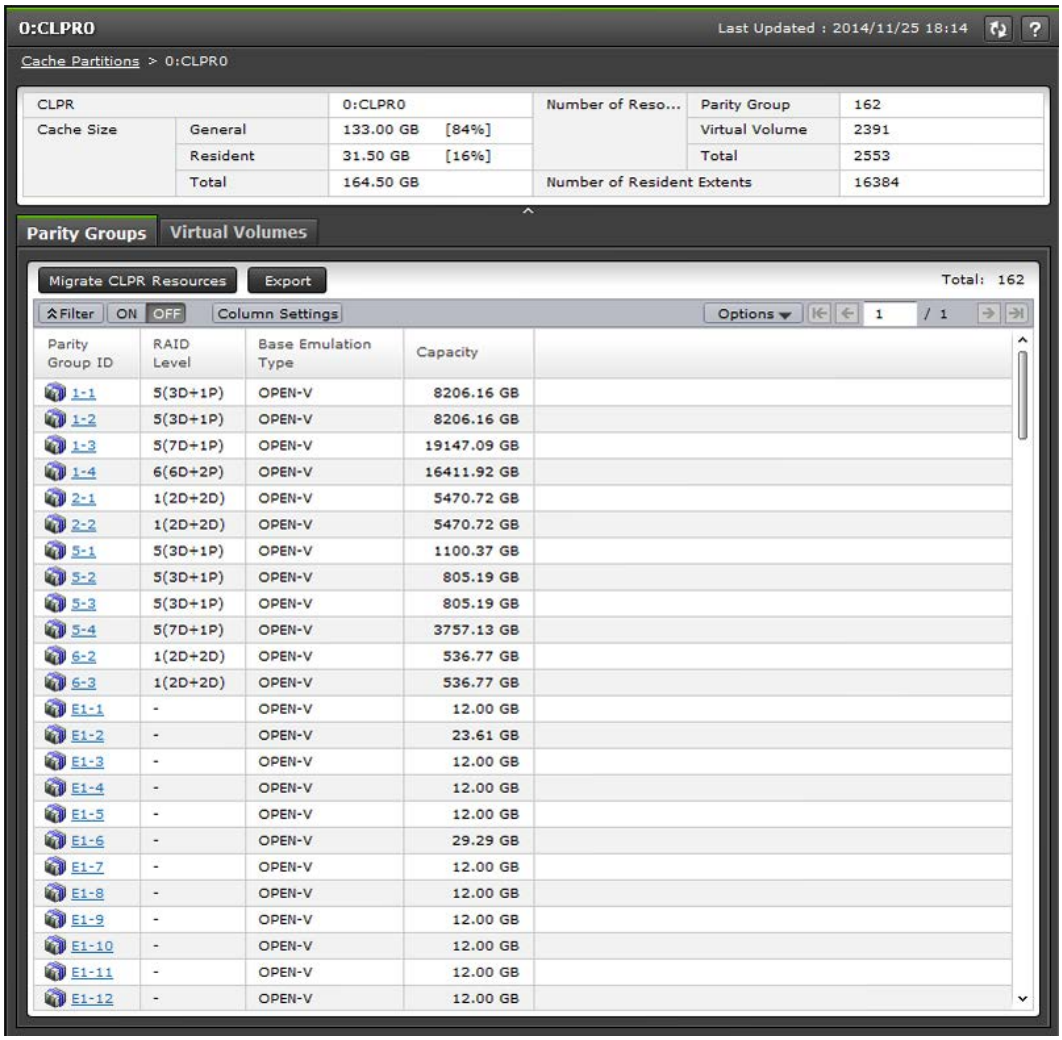
Notes:

1. This item is not shown in the table by default. To display the item, use the Column Settings window. For details, see the *System Administrator Guide* of your storage system.
2. Click More Actions to display these items.

Individual CLPR window

This window appears when a CLPR is selected in Cache Partitions.

- Summary
- Parity Groups tab
- Virtual Volumes tab

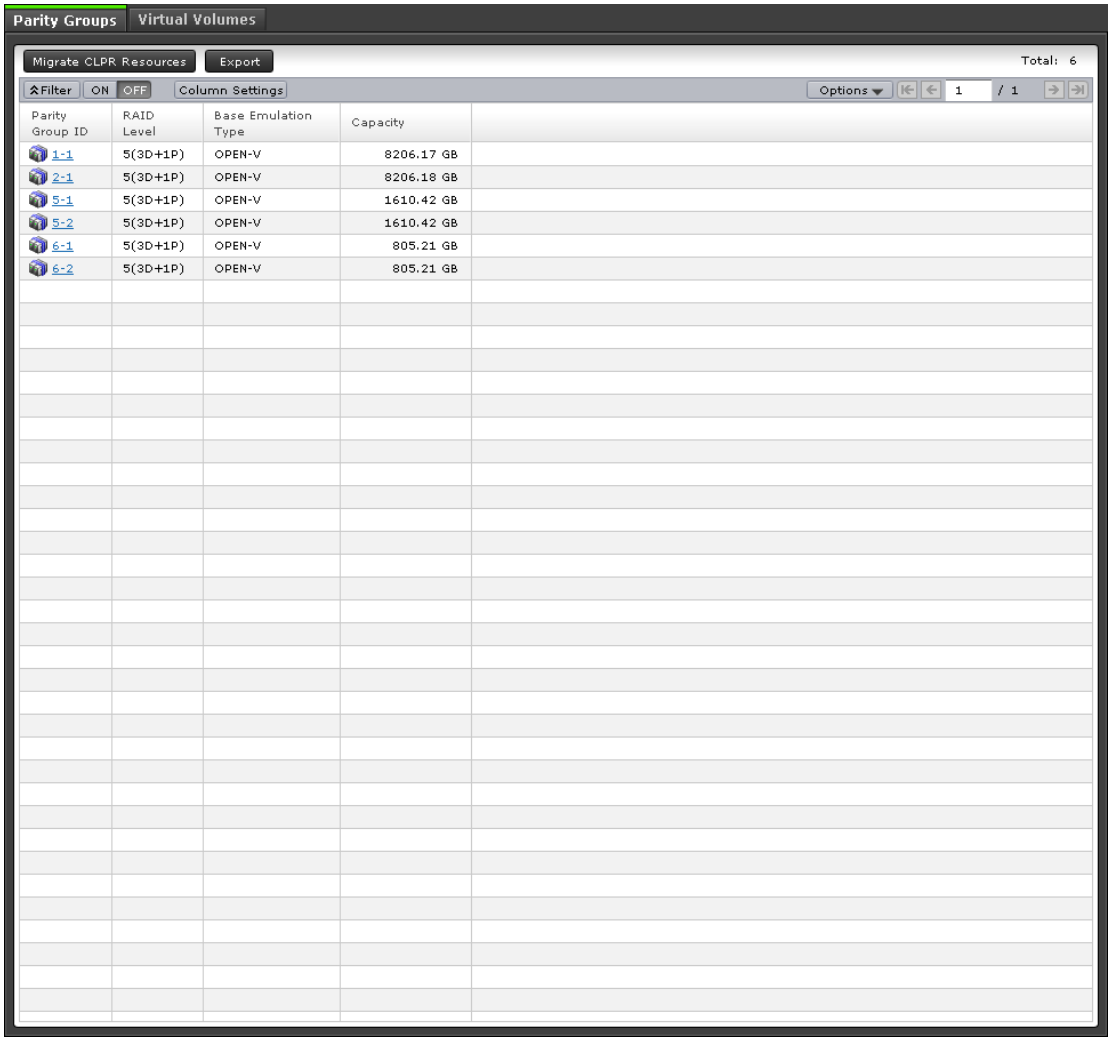


Summary

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resources	Displays the number of resources already assigned to CLPRs: ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources already assigned to CLPRs

Item	Description
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system.

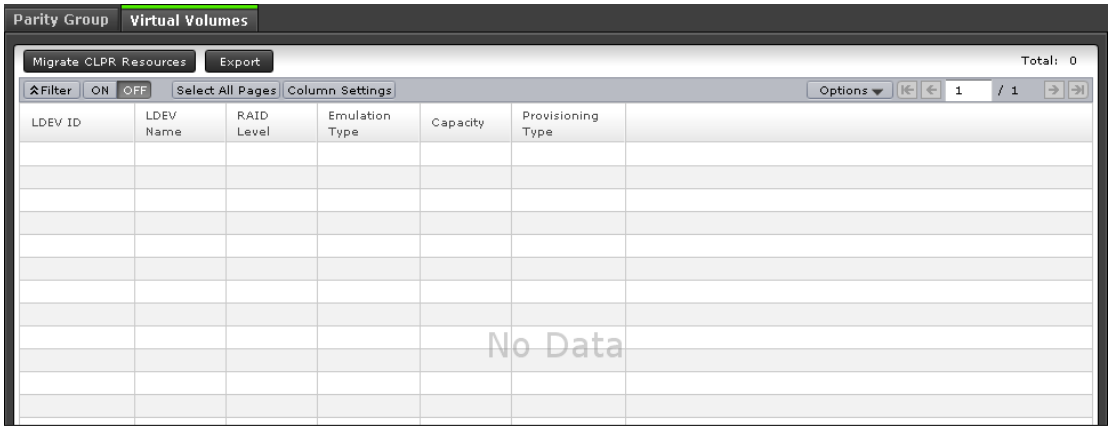
Parity Groups tab



Item	Description
Parity Group ID	Displays the parity group IDs. Click the parity group ID to open the window in which the parity group is selected.
RAID Level	Displays the RAID level.

Item	Description
Base Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation type of the parity group.
Capacity	Displays the capacity.
Migrate CLPR Resources	Opens the Migrate CLPR Resources window.
Export	Opens the window for outputting the table information.

Virtual Volumes tab



Item	Description
LDEV ID	Displays the LDEV IDs. Click the LDEV ID to open the properties window of each LDEV.
LDEV Name	Displays the LDEV name.
RAID Level	Displays the RAID level.
Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation type of the virtual volume.
Capacity	Displays the capacity.
Provisioning Type	Displays the LDEV type.
Attribute (VSP Gx00, VSP Fx00, and VSP Nx00)	Displays the LDEV attribute.

Item	Description
Virtual Storage Machine*	Displays information about the virtual storage machine: ▪ Model type/Serial number*: Displays the model type and serial number of the virtual storage machine of the LDEV. ▪ LDEV ID*: Displays the virtual LDEV ID of the LDEV. A blank displays when no virtual LDEV ID is assigned. ▪ Device Name*: Displays the virtual device name of the LDEV. The virtual device name is displayed as a combination of the following: • (VSP G1x00 and VSP F1500) virtual emulation type • virtual LUSE volume number • virtual CVS attribute The above values appear only for items that have been set, and if they are not set this column is blank. If the virtual CVS attribute is set, CVS is attached as the suffix to the device name. ▪ SSID*: Displays the virtual SSID of the LDEV. A blank displays when no virtual SSID is specified.
Migrate CLPR Resources	Opens the Migrate CLPR Resources window.
Export	Opens the window for outputting the table information.
* These items are not shown in the table by default. To display these items, use the Column Settings window. For details, see the *System Administrator Guide* of your storage system.	

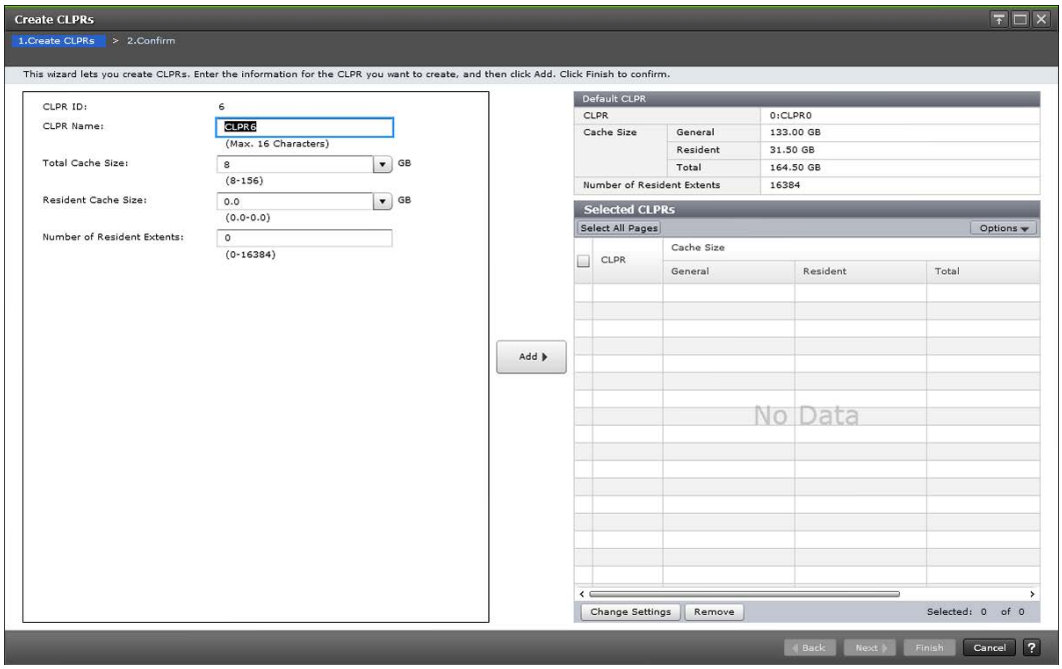
Create CLPRs wizard

The Create CLPRs wizard includes the following windows:

- Create CLPRs window (on page 382)
- Create CLPRs confirmation window (on page 385)

Create CLPRs window

This window appears when you click Create CLPRs on the **Cache Partition** window.



Create CLPR settings

Use the left side of this window to create CLPRs.

Item	Description
CLPR ID	Displays the smallest CLPR ID of available CLPR IDs. Displays a blank if no CLPR ID is available.
CLPR Name	Enables you to enter the CLPR name. You can use up to 16 alphanumeric characters but cannot specify CLPR names that are already reserved. A blank is displayed if no CLPR ID is available. For details see CLPR names (on page 205) .
Cache Size (VSP Gx00, VSP Fx00, and VSP Nx00)	Enables you to select the cache capacity of CLPR. A blank is displayed if no CLPR ID is available. You can select 4 GB or higher value for the cache capacity of the CLPR, and the desired value can be selected in increments of 2 GB. The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.
Total Cache Size (VSP G1x00 and VSP F1500)	Enables you to select the cache capacity of CLPR. You can select 8 GB or higher value in the cache capacity of CLPR. A blank is displayed if no CLPR ID is available.

Item	Description
	The default is 8 GB, and the desired value can be selected in increments of 4 GB. The maximum value is 2,022 GB (subtract 8 GB from the cache capacity of storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. The remaining capacity (subtract the resident cache size from the total cache size) must be 8 GB or more. Ensure that the remaining capacity is 8 GB or more in CLPR0 when selecting the total cache size or resident cache size.
Resident Cache Size (VSP G1x00 and VSP F1500)	Enables you to select the resident cache capacity. You can select 0 GB or higher value in the resident cache size. A blank is displayed if no CLPR ID is available. The default is 0 GB, and the desired value can be selected in increments of 0.5 GB. The maximum value is 2,014 GB (cache residency capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.
Number of Resident Extents (VSP G1x00 and VSP F1500)	You can enter the number of resident caches. A blank is displayed if no CLPR ID is available. The default is 0, and 0 to 16384 can be specified. The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.
Add	You can add the CLPR set in the left side of the window to the Selected CLPRs table.

Default CLPR table

Displays the information about CLPR 0.

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system.The values change depending on the created CLPR. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity

Item	Description
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system. The value changes depending on the created CLPR.

Selected CLPRs table

Displays the information about the CLPRs to be created.

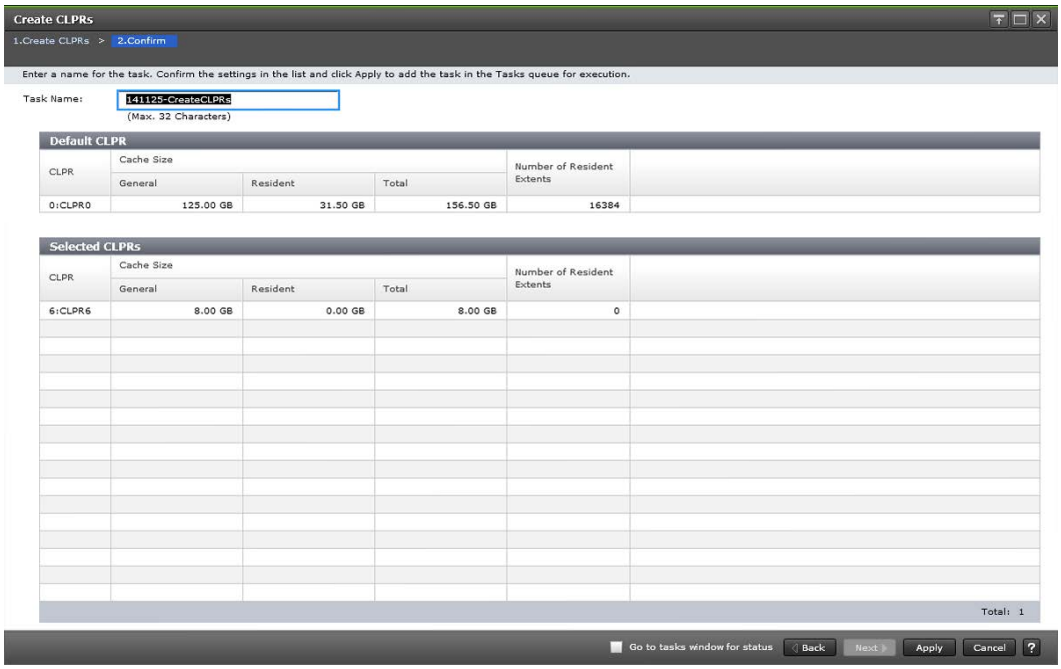
Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500)Total: Total cache capacity
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches.

Buttons

Item	Description
Change Settings	Opens the Change Settings window.
Remove	Enables you to delete the selected CLPRs from the Selected CLPRs table.

Create CLPRs confirmation window

Use this window to confirm the CLPRs to be created and to assign a name to the create CLPR task.



Task Name field

Item	Description
Task Name	Enables you to enter a name (up to 32 alphanumeric characters) for the specified create CLPR task.

Default CLPR table

Displays the information about CLPR 0.

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system.

Selected CLPRs table

Use this table to view the information of CLPR to be created.

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system.

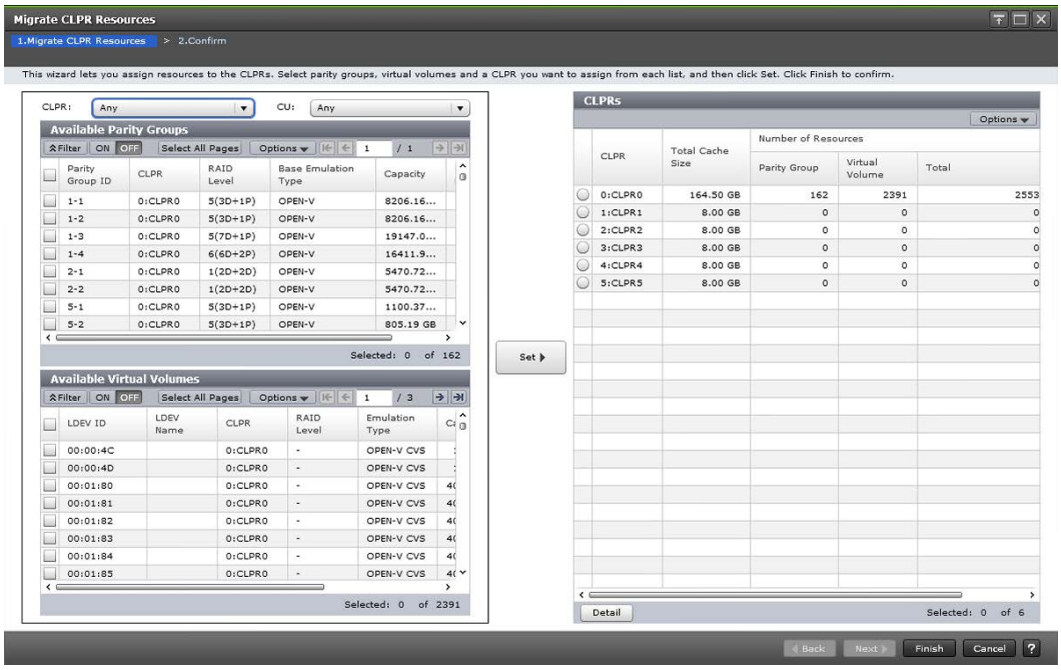
Migrate CLPR Resources wizard

The Migrate CLPR Resources wizard includes the following windows:

- Migrate CLPR Resources window (on page 387)
- Migrate CLPR Resources confirmation window (on page 390)

Migrate CLPR Resources window

This window appears when you click Migrate CLPR Resources on the **Cache Partition** window.



CLPR and CU filters for parity group and virtual volume tables

Item	Description
CLPR	Enables you to filter the Available Parity Groups table or the Available Virtual Volumes table. Any is selected by default.
CU	Enables you to filter the Available Virtual Volumes table. Any is selected by default.

Available Parity Groups table

Item	Description
Parity Groups ID	Displays the parity group ID.
CLPR	Displays the CLPR ID and CLPR name.
RAID Level	Displays the RAID Level.
Base Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation type of the parity group.
Capacity	Displays the total capacity of the parity group.
Resource Group Name (ID)	Displays the name and the ID of the resource group of the parity group. The ID is displayed in parentheses.

Available Virtual Volumes table

Item	Description
LDEV ID	Displays the LDEV IDs.
LDEV Name	Displays the LDEV names.
CLPR	Displays the CLPR IDs and CLPR names.
RAID Level	Displays the RAID levels.
Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation types of the virtual volumes.
Capacity	Displays the capacities.
Provisioning Type	Displays the LDEV types.
Resource Group Name (ID)	Displays the name and the ID of the resource group of the LDEV.The ID is displayed in parentheses.

Button

Item	Description
Set	Adds the resources assigned at the left area of the window to the CLPR selected in the CLPRs table.

CLPRs table

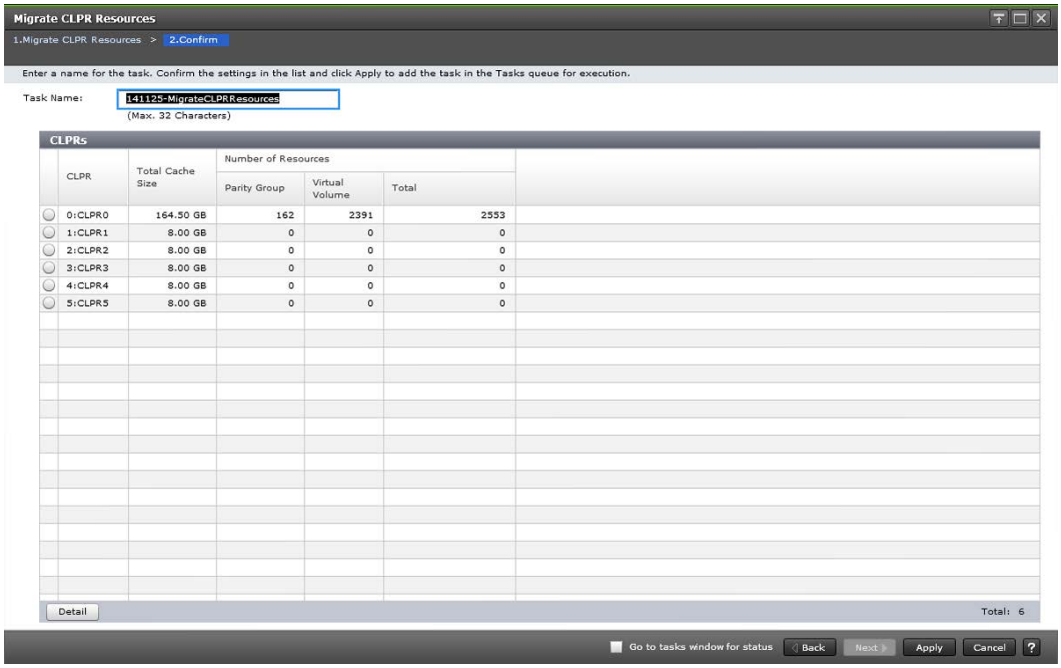
Displays the information about the resources to assign to CLPRs.

Item	Description
CLPR	Displays the CLPR IDs and CLPR names.
Total Cache Size (VSP G1x00 and VSP F1500) Cache Size (VSP Gx00, VSP Fx00, and VSP Nx00)	Displays the total cache capacities.

Item	Description
Number of Resources	Displays the number of resources assigned to CLPRs. The value changes depending on the resources. ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources assigned to CLPRs
Detail	Opens the CLPR Properties window for the selected CLPR.

Migrate CLPR Resources confirmation window

Use this window to confirm the CLPR resources to be migrated and to assign a name to the migrate CLPR resources task.



CLPRs table

Displays the information about the CLPRs to be migrated.

Item	Description
CLPR	Displays the CLPR IDs and CLPR names.
Total Cache Size (VSP G1x00 and VSP F1500)	Displays the total cache capacities of the CLPRs.

Item	Description
Cache Size (VSP Gx00, VSP Fx00, and VSP Nx00)	
Number of Resources	Displays the number of resources assigned to CLPRs. ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources assigned to the CLPR

Task Name field

Item	Description
Task Name	Enables you to enter a name (up to 32 alphanumeric characters) for the specified migrate CLPR task.

Button

Item	Description
Detail	Opens the CLPR Properties window.

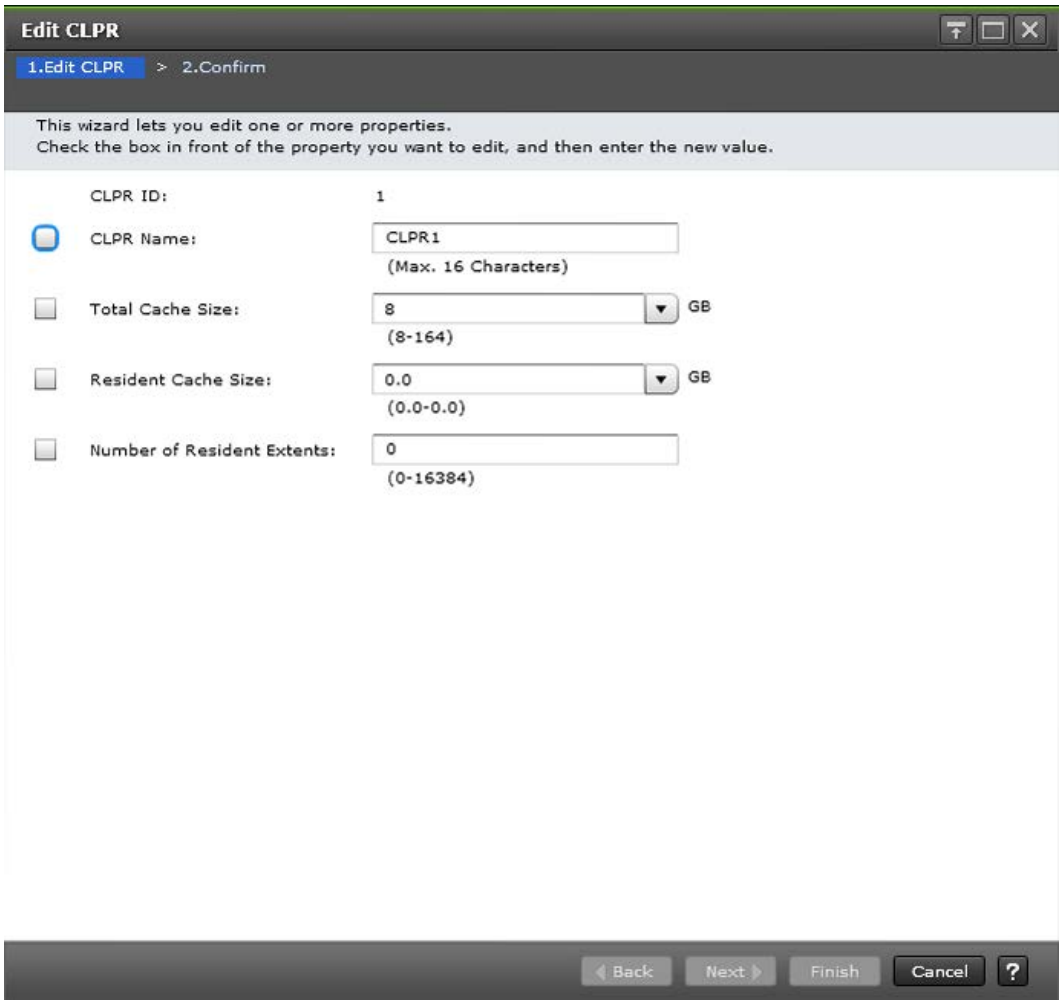
Edit CLPR wizard

The Edit CLPR wizard includes the following windows:

- Edit CLPR window (on page 391)
- Edit CLPR confirmation window (on page 394)

Edit CLPR window

This window appears when you click Edit CLPR on the **Cache Partition** window.



Edit CLPR settings

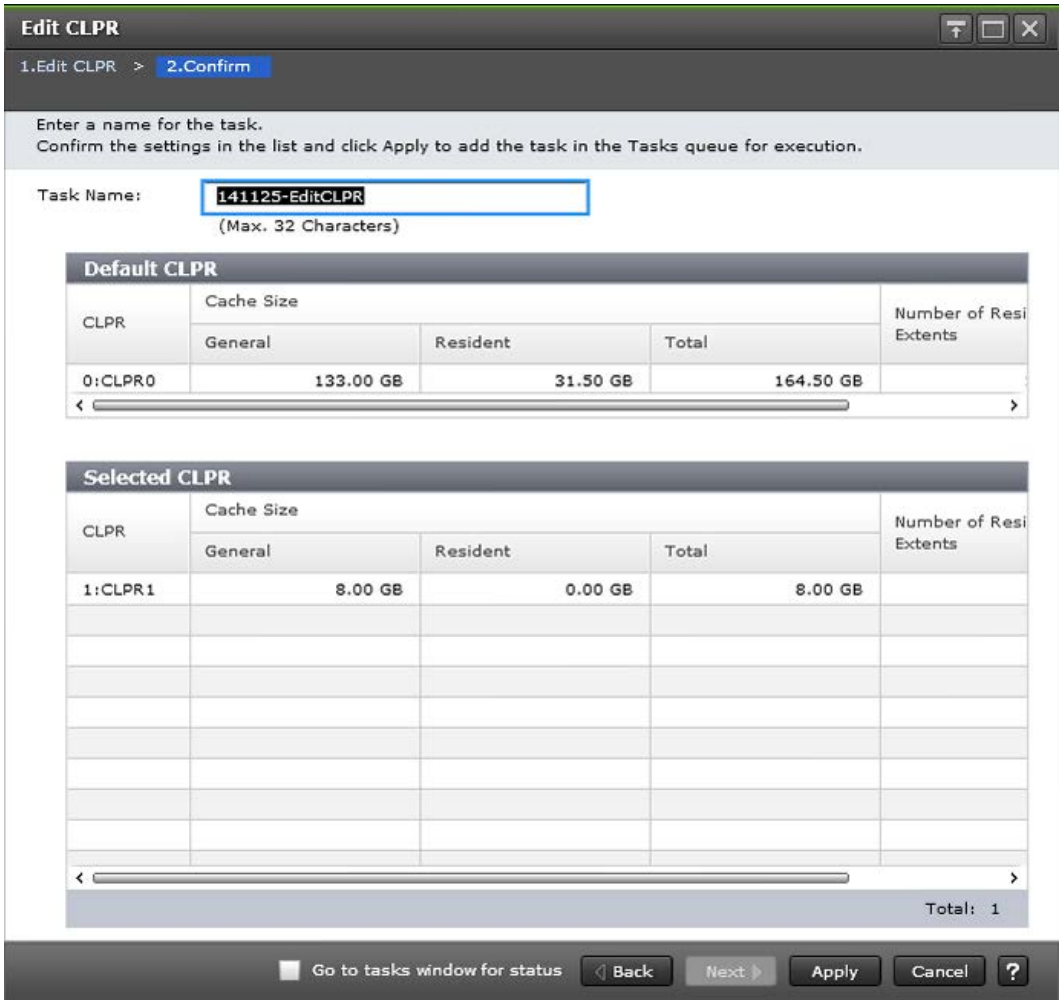
Item	Description
CLPR ID	Displays the CLPR ID.
CLPR Name	Displays the CLPR name set at the time of the CLPR creation, and enables you to edit the name. You can use up to 16 alphanumeric characters but cannot specify CLPR names that are already reserved. For details see CLPR names (on page 205) .
Total Cache Size (VSP G1x00 and VSP F1500)	Displays the cache capacity set at the time of the CLPR creation, and enables you to edit the cache capacity. When you select the CLPR0, this item is inactive.

Item	Description
	You can select 8 GB or higher value in the cache capacity of the CLPR. The value can be selected in increments of 4 GB. The maximum value is 2,022 GB (subtract 8 GB from the cache capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. The remaining capacity (subtract the resident cache size from the total cache size) must be 8 GB or more. For details about cache residency, see the *Performance Guide*. Ensure that the remaining capacity is 8 GB or more in CLPR0 when selecting the total cache size or resident cache size. When you reduce the value of Total Cache Size, the resident cache size before change may not be applied in some cases. If so, ensure the value of the resident cache size, and check the Resident Cache Size check box.
Cache Size (VSP Gx00, VSP Fx00, and VSP Nx00)	Displays the cache capacity set at the time of the CLPR creation, and enables you to edit the cache capacity. When you select the CLPR0, this item is inactive. You can select 4 GB or higher value in the cache capacity of the CLPR. The value can be selected in increments of 2 GB. The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value.
Resident Cache Size (VSP G1x00 and VSP F1500)	Displays the resident cache capacity set at the time of the CLPR creation, and enables you to edit the resident cache capacity. When you select the CLPR0, this item is inactive. You can select 0 GB or higher value in the resident cache capacity. The value can be selected in increments of 0.5 GB. The maximum value is 2,014 GB (cache residency capacity of the storage system), but the maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. If resident cache exists in the selected CLPR and the selected resident cache size is smaller than the resident cache capacity that is already set, an error occurs. Before selecting the size, check the resident cache capacity set in the selected CLPR.
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches set at the time of the CLPR creation, and enables you to edit the number. You can specify 0 to 16384. The maximum available capacity (subtract the total usage capacity of other CLPRs from the total capacity of the storage system) is displayed as the upper limit value. When you select the CLPR0, this item is inactive.

Item	Description
	If a resident cache exists in the selected CLPR and the entered number of resident extents is smaller than the number of resident extents that are already set, an error occurs. Before changing the value, check the number of resident extents set in the selected CLPR.

Edit CLPR confirmation window

Use this window to confirm the CLPR to be edited and to assign a name to the edit CLPR task.



Default CLPR table

Displays the information about CLPR 0.

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system.

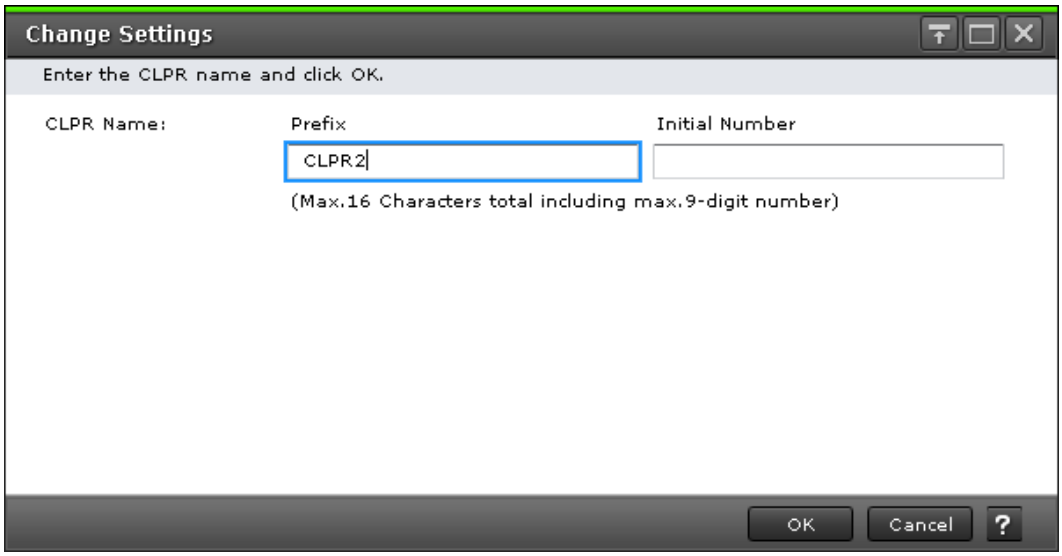
Selected CLPR table

Displays information about CLPRs to be edited.

Item	Description
CLPR	Displays the CLPR IDs and CLPR names.
Cache Size	Displays the cache capacities: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches.

Change Settings window

This window appears when you click Change Settings on the **Create CLPRs** window.

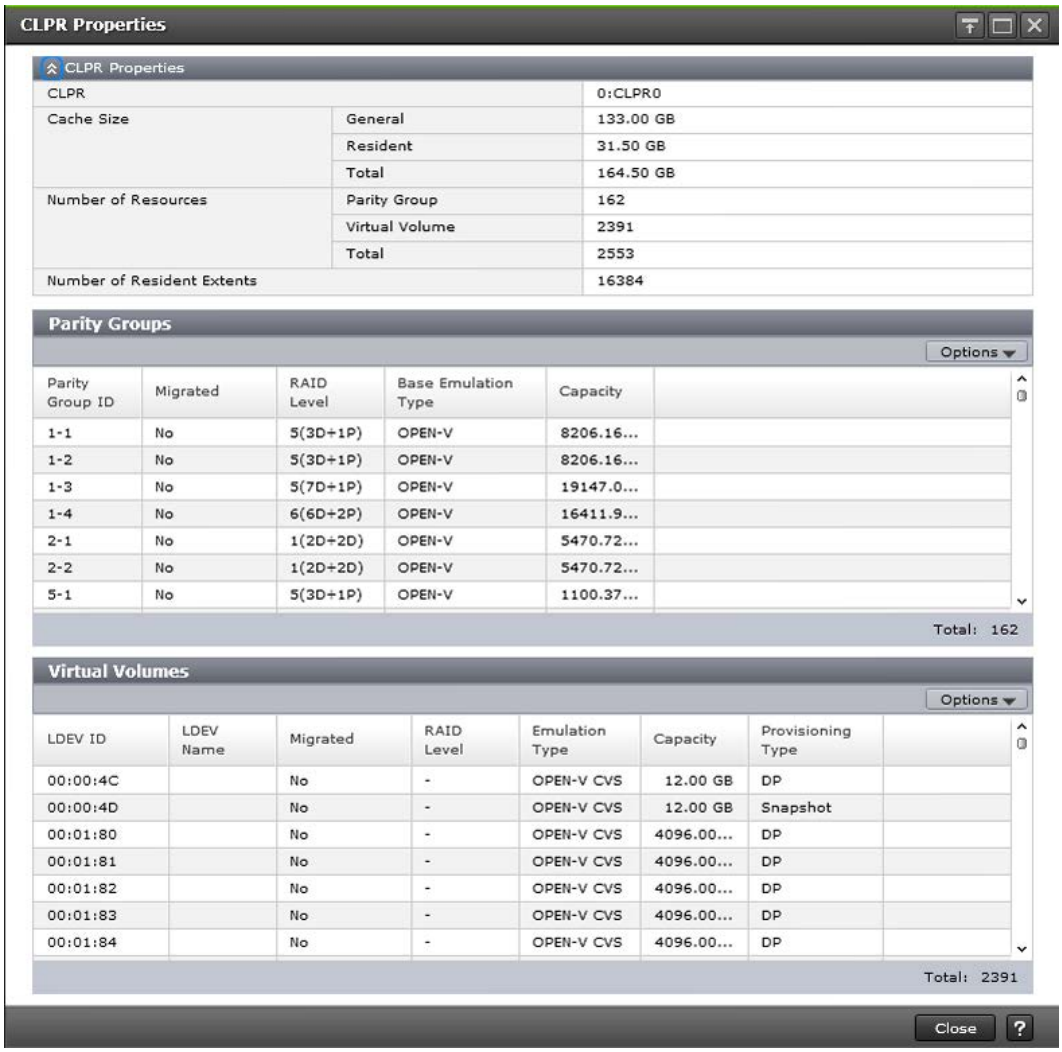


CLPR Name field

Item	Description
CLPR Name	Displays the CLPR name set at the time of the CLPR creation, and enables you to edit the name. ▪ Prefix: You can use up to 16 alphanumeric characters but cannot specify CLPR names that are already reserved. For details see CLPR names (on page 205) . ▪ Initial number: You can use numbers 0 to 9, and a blank is set by default. Up to 9 characters can be used. The maximum number of characters for CLPR name is 16, including both Prefix and Initial number, not 25 (16+9).

CLPR Properties window

This window appears when you click Detail on the **Migrate CLPR Resources** window.



CLPR Properties table

Item	Description
CLPR	Displays the CLPR ID and CLPR name.
Cache Size	Displays the cache capacities in the storage system. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resources	Displays the number of resources already assigned to CLPRs. ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources assigned to the CLPR

Item	Description
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident extents.

Parity Groups table

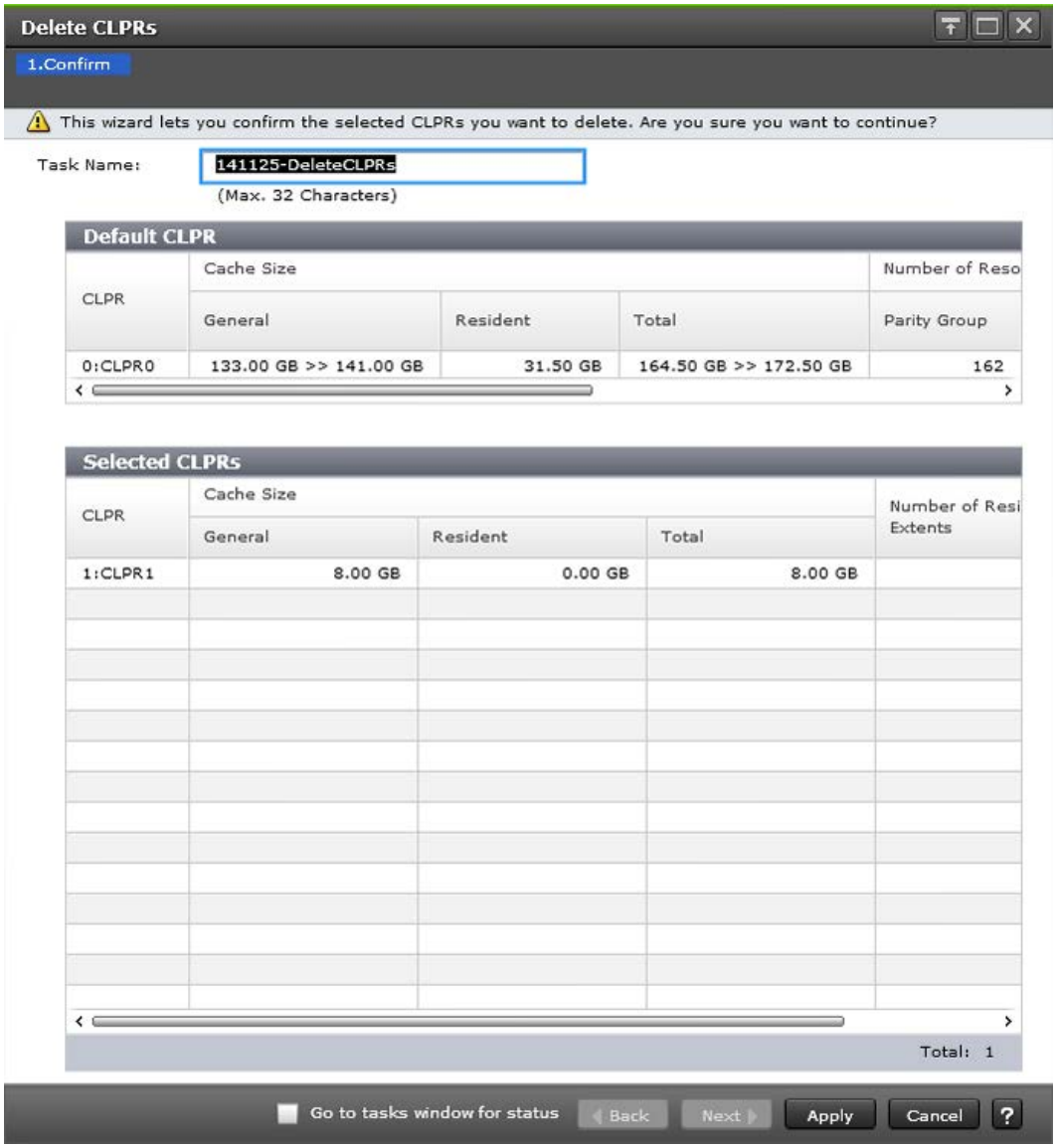
Item	Description
Parity Group ID	Displays the parity Group IDs.
Migrated	Indicates whether there is a change by CLPR allocation: ▪ Yes: There is a change by CLPR allocation. ▪ No: There is not a change by CLPR allocation.
RAID Level	Displays the RAID levels.
Base Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation types of parity groups.
Capacity	Displays the capacity.

Virtual Volume table

Item	Description
LDEV ID	Displays the LDEV IDs.
LDEV Name	Displays the LDEV names.
Migrated	Indicates whether there is a change by CLPR allocation: ▪ Yes: There is a change by CLPR allocation. ▪ No: There is not a change by CLPR allocation.
RAID Level	Displays the RAID levels.
Emulation Type (VSP G1x00 and VSP F1500)	Displays the emulation types of the virtual volumes.
Capacity	Displays the capacities.
Provisioning Type	Displays the LDEV types.

Delete CLPRs window

This window appears when you click Delete CLPR on the **Cache Partition** window.



Default CLPR table

Displays the information about CLPR 0.

Item	Description
CLPR	Displays the CLPR ID and CLPR name.

Item	Description
Cache Size	Displays the cache capacities in the storage system. ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacity ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacity ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacity
Number of Resources	Displays the number of resources already assigned to the CLPR. ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources assigned to CLPRs
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches in the storage system.

Selected CLPRs table

Displays information about CLPRs to be deleted.

Item	Description
CLPR	Displays the CLPR IDs and CLPR names.
Cache Size	Displays the cache capacities: ▪ (VSP G1x00 and VSP F1500) General: CLPR cache capacities ▪ (VSP G1x00 and VSP F1500) Resident: Resident cache capacities ▪ (VSP G1x00 and VSP F1500) Total: Total cache capacities
Number of Resident Extents (VSP G1x00 and VSP F1500)	Displays the number of resident caches.

Glossary

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 adapter (DKA) or disk board (DKB).

bind mode

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

cache logical partition (CLPR)

Virtual cache memory that is set up to be allocated to hosts that are in contention for cache memory. CLPRs can be used to segment storage system cache that is assigned to parity groups.

CCI

Command Control Interface

CHA

See channel adapter.

channel adapter (CHA)

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

CLPR

See cache logical partition.

control unit (CU)

Created in an enterprise-class storage system. Also called a CU image. The LDEVs created in a storage system are connected to a single CU, and a number is assigned to each CU for identifying its LDEVs. Therefore, volumes (LDEVs) in a storage system are specified by the CU number (CU#) and LDEV number.

CU

See control unit.

CVS

custom volume size

DKA

disk adapter. Another name for a back-end director (BED).

DKC

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

DKCMAIN

Disk controller main

DP-VOL

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

external volume

A logical volume whose data resides on drives that are physically located in an externally connected storage system.

FED

See front-end director.

front-end director (FED)

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

HBA

See host bus adapter.

host bus adapter (HBA)

One or more dedicated adapter cards that are installed in a host, have unique WWN addresses, and provide Fibre Channel I/O connectivity to storage systems, typically through Fibre Channel switches. Unlike general-purpose Ethernet adapters, which handle a multitude of network protocols, host bus adapters are dedicated to high-speed block transfers for optimized I/O performance.

internal volume

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

IOPS

I/Os per second

LDEV

See logical device.

LDKC

Logical disk controller

logical device (LDEV)

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

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

modify mode

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

P-VOL

See primary volume.

parity group

See *RAID group*.

primary volume (P-VOL)

In a volume pair, the source volume that is copied to another volume using the volume replication functionality of a storage system. The data on the P-VOL is duplicated synchronously or asynchronously on the secondary volume (S-VOL).

prio

priority mode. Used in Cache Residency Manager.

RAID group

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

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

S-VOL

See secondary volume.

secondary volume (S-VOL)

After a backup, the volume in a copy pair that is the copy of the original data on the primary volume (P-VOL). Recurring differential data updates keep the data in the S-VOL consistent with the data in the P-VOL.

service information message (SIM)

A message generated by the storage system when it detects an error or a service requirement.

service processor (SVP)

The computer inside a RAID storage system that hosts the Device Manager - Storage Navigator software and is used by service personnel for configuration and maintenance of the storage system.

SIM

See service information message.

V-VOL

See *virtual volume*.

view mode

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

virtual volume (V-VOL)

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

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