

Hitachi Virtual Storage Platform 5000 Series

Hitachi Virtual Storage Platform E990

Hitachi Virtual Storage Platform G130, G/ F350, G/F370, G/F700, G/F900

SVOS RF 9.4

Performance Guide

The performance management software products, Performance Monitor, Server Priority Manager, and Virtual Partition Manager, enable you to monitor and tune your storage system to improve storage utilization and optimize performance.

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Preface

This document describes and provides instructions for performing Performance Monitor, Server Priority Manager, Quality of Service, and Virtual Partition Manager operations on the Virtual Storage Platform 5000 series (VSP 5000 series), Virtual Storage Platform E series (VSP E990), and Virtual Storage Platform G130, G/F350, G/F370, G/F700, G/F900 (VSP G130, G/F350, G/F370, G/F700, G/F900) 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 representatives, and authorized service providers who install, configure, and operate the VSP 5000 series, VSP E990, and VSP G130, G/F350, G/F370, G/F700, G/F900 storage systems.

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* for your storage system.
- The Hardware Guide for your storage system model.
- Concepts of performance monitoring for enterprise storage arrays.
- Use of command-line-interface (CLI) software.

Product version

This document revision applies to the following product versions:

- VSP 5000 series: 90-04-04 or later
- VSP E series: 93-02-03 or later
- VSP G130, G/F350, G/F370, G/F700, G/F900: 88-06-02 or later
- SVOS RF 9.4 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 support for Export Tool on the SVP with the runWinOnSvp.bat file. (See [Requirements for Export Tool \(on page 66\)](#) and [Preparing a batch file \(on page 79\)](#)).
- Added support for certificate registration using Export Tool on Windows and UNIX. (See [SSL communications using Export Tool \(on page 69\)](#) and [Requirements for Export Tool \(on page 66\)](#)).
- Updated QoS descriptions for lower limit control (See [Overview of QoS operations \(on page 191\)](#)).

Document conventions


This document uses the following storage system terminology conventions:




Convention	Description
VSP 5000 series	Refers to the following storage systems: <ul style="list-style-type: none"> ▪ Hitachi Virtual Storage Platform 5100 ▪ Hitachi Virtual Storage Platform 5100H ▪ Hitachi Virtual Storage Platform 5500 ▪ Hitachi Virtual Storage Platform 5500H
VSP E series	Refers to the following storage systems: <ul style="list-style-type: none"> ▪ Hitachi Virtual Storage Platform E990

This document uses the following typographic conventions:

Convention	Description
Bold	<ul style="list-style-type: none"> Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click OK. Indicates emphasized words in list items.
<i>Italic</i>	<ul style="list-style-type: none"> 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: <pre>pairdisplay -g group</pre> <p>(For exceptions to this convention for variables, see the entry for angle brackets.)</p>
Monospace	Indicates text that is displayed on screen or entered by the user. Example: <code>pairdisplay -g oradb</code>
< > angle brackets	Indicates variables in the following scenarios: <ul style="list-style-type: none"> Variables are not clearly separated from the surrounding text or from other variables. Example: <pre>Status-<report-name><file-version>.csv</pre> 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.

Icon	Label	Description
	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: <ul style="list-style-type: none"> ▪ OPEN-V: 960 KB ▪ Others: 720 KB
1 KB	$1,024 (2^{10})$ bytes

Logical capacity unit	Value
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.

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Thank you!

Chapter 1: Performance management

This chapter provides an overview of performance management of your storage system and lists and describes the system requirements for using the performance management functions of your storage system.

Overview of performance management

The performance management software products for Virtual Storage Platform 5000 series (VSP 5000 series), Virtual Storage Platform E series (VSP E series), and Virtual Storage Platform G130, G/F350, G/F370, G/F700, G/F900 (VSP G130, G/F350, G/F370, G/F700, G/F900) enable you to monitor and tune storage system performance to improve and optimize storage utilization and performance.

- **Performance Monitor (PerfMon):** 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.
- **Server Priority Manager (SPM):** 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.
- **Quality of Service (QoS):** Enables you to monitor and control I/O processing at the volume level to ensure that performance and quality requirements are met for individual volumes (The QoS function is available in SVOS RF 9.3 and later for VSP 5000 series, and in SVOS RF 9.4 and later for VSP G130, G/F350, G/F370, G/F700, G/F900). *Note:* The QoS functionality will be enhanced in future releases and is intended to replace SPM. SPM will continue to be supported but not enhanced.
- **Virtual Partition Manager (VPM):** 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 (CCI). For details about CCI, see the *Command Control Interface User and Reference Guide*.

Requirements for using performance functions

The following lists and describes the system requirements and permissions for using the performance management functions.

- **License keys for performance management:** The license keys for the following software products must be installed on the storage system:
 - Performance Monitor
 - Server Priority Manager
 - Virtual Partition Manager

For details about installing license keys, see the *System Administrator Guide*.

- **Access privileges for Device Manager - Storage Navigator:** Administrator access for 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. You need specific administrator roles to use the following functions:
 - Performance Monitor: Storage Administrator (Performance Management)
 - Server Priority Manager, Virtual Partition Manager: Storage Administrator (System Resource Management)
- **Java:** Java is required to use Server Priority Manager on the Device Manager - Storage Navigator computer. For details about installing Java and configuring Device Manager - Storage Navigator, see the *System Administrator Guide*.
- **Secondary windows on Device Manager - Storage Navigator:** The secondary windows must be enabled before you can use Server Priority Manager on the Device Manager - Storage Navigator computer. Java and some settings of Device Manager - Storage Navigator are required for the secondary windows. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details about using the secondary windows, see the *System Administrator Guide*.
- **Cache memory for Virtual Partition Manager:** Use of Virtual Partition Manager might require additional cache memory in your storage system.

Enabling the HDvM - SN secondary window

If you plan to use any of the following functions in Device Manager - Storage Navigator (HDvM - SN), you must enable the HDvM - SN secondary window:

- Login Message function
- Data Retention Utility
- Server Priority Manager
- Compatible PAV
- Compatible XRC
- Volume Retention Manager

The HDvM - SN secondary window runs within the Java Runtime Environment (JRE) on the management client. The secondary window is disabled by default in HDvM - SN and must be enabled by using HDvM - SN, or by using Web Console Launcher when Java 11 or later is installed on the HDvM - SN management client. If the secondary window is not enabled, the functions listed above are not accessible in HDvM - SN.

Before you begin

- Required role: Storage Administrator (View Only)

Procedure

1. From the **Settings** menu, click **Environmental Settings > Edit Information Display Settings**.
The **Edit Information Display Settings** window opens.
2. In **Secondary window**, click **Enable**.
3. Click **Apply**.

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:

- You can perform both short-range monitoring and long-range monitoring. For both long-range monitoring and short-range monitoring, the data is collected when Monitoring Switch is set to Enabled, and the data is not collected when Monitoring Switch is set to Disabled. 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:

- 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 \(on page 37\)](#).

Short-range monitoring

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:

- For VSP 5000 series: Up to 64 CUs.
- For VSP G350, G370, G700, G900: Up to 32 CUs.
- If there are this number 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.
- For VSP 5000 series: More than 64 CUs.
- For VSP G350, G370, G700, G900: More than 32 CUs.
- If there are more than this number of 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 32 (for VSP G350, G370, G700, G900) or 64 (for VSP 5000 series) 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):

$$1 \text{ minute} \times 1440 = 1440 \text{ minutes} = 24 \text{ hours} = 1 \text{ day}$$

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

$$15 \text{ minutes} \times 1440 = 21600 \text{ minutes} = 360 \text{ hours} = 15 \text{ days}$$

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 32 (for VSP G350, G370, G700, G900) or 64 (for VSP 5000 series) CUs to be monitored, the 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):

$$5 \text{ minutes} \times 288 = 1440 \text{ minutes} = 24 \text{ hours} = 1 \text{ day}$$

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

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

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. 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. 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 \(on page 33\)](#).

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 \(on page 64\)](#).

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 \(on page 25\)](#).

- **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 \(on page 26\)](#), [Adding WWNs to ports \(on page 27\)](#), and [Connecting WWNs to ports \(on page 29\)](#).



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

- **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.

- **firmware replacement**

- After the 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

- **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.

- **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 \(on page 25\)](#).

- **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.

- 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 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 \(on page 25\)](#).
3. Start performance monitoring. For instructions, see [Starting monitoring \(on page 25\)](#).
4. Add the WWNs that you want to monitor. For instructions, see [Monitoring WWNs \(on page 26\)](#).
5. Add the CUs that you want to monitor. For instructions, see [Monitoring CUs \(on page 30\)](#).
6. Adjust the sampling interval as needed to increase or decrease the maximum storing period of statistics. For instructions, see [Changing the sampling interval \(on page 32\)](#).
7. View the monitoring data on graphs. For details, see [Using the Performance Monitor data graphs \(on page 33\)](#).
8. Export the monitoring data as needed for analysis and for retention of long-term data. For details, see [Exporting Performance Monitor data \(on page 64\)](#).
9. When you want to stop collecting monitor data, stop monitoring by disabling the monitoring switch. For details, see [Stopping monitoring \(on page 32\)](#).

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:

- 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).

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. 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.
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**.
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

You can monitor 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 \(on page 269\)](#).
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 view 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 \(on page 274\)](#).

- 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. Ports connected to mainframe hosts are not displayed, because they are not supported for Performance Monitor.

- Click **Add**. The added WWN is displayed in **Selected WWNs**.
- If you need to remove a WWN from the **Selected WWNs** list, select the WWN and click **Remove**.
- When you are done adding WWNs, click **Finish**.
- 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

- Select **Analytics** in **Explorer**, and select **Performance Monitor** in the tree to open the **Performance Monitor** window.
- Click the **Monitored WWNs** tab to see the list of WWNs being monitored.
- Select the WWN to edit. You can edit only one WWN at a time. If you select multiple WWNs, an error will occur.
- On the **Monitored WWNs** tab click **Edit WWN** to open the [Edit WWN window \(on page 268\)](#).
- 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.

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 registered WWNs in unimplemented ports

When WWNs are registered in an unimplemented port, the following procedure describes how to delete the 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

You can monitor 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 \(on page 64\)](#).



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 \(on page 30\)](#).

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 \(on page 239\)](#).
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 unit in real time (Time Range is set to Use Real Time), the MP unit names are displayed as text links. Click the text link to display the resources assigned to an MP 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.
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.
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 \(on page 33\)](#).
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 \(on page 35\)](#).
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 \(on page 33\)](#).
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 \(on page 33\)](#).
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 \(on page 33\)](#).
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 \(on page 33\)](#).
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 \(on page 33\)](#).
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:

- The sampling interval is 1 to 15 minutes for Short Range and 15 minutes for Long Range.

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 \(on page 33\)](#).

Object of monitoring	Monitoring data	Necessary resources
Controller	Usage rates of MPs (%)	None
	Usage rates of DRR (%)	
Cache	Usage rates of cache (%)	None
	Write pending rates (%)	
Access path	Usage rates of access path between HIEs and ISWs (%)	None
	Usage rates of access path between MP units and HIEs (%)	
Fibre port (Target)	Throughput (IOPS)	Port
	Data transfer (MB/s)	

Object of monitoring	Monitoring data	Necessary resources
	Response time (ms)	
Fibre port (Initiator)	Throughput (IOPS)	Port
	Data transfer (MB/s)	
	Response time (ms)	
Mainframe fibre port	Throughput (IOPS)	Port
	Data transfer (MB/s)	
	Response time (ms)	
	CMR delay time (ms)	
	Disconnected time (ms)	
	Connected time (ms)	
	HTP port open exchange (count/sec)	
iSCSI Port (Target)	Throughput (IOPS)	Port
	Data transfer (MB/s)	
	Response time (ms)	
iSCSI port (Initiator)	Throughput (IOPS)	Port
	Data transfer (MB/s)	
	Response time (ms)	
WWN	Throughput of WWN (IOPS)	Port
	Data transfer of WWN (MB/s)	
	Response time of WWN (ms)	
	Throughput of port (IOPS)	
	Data transfer of port (MB/s)	
	Response time of port (ms)	
LDEV (base)	Total throughput (IOPS)	LDEV
	Read throughput (IOPS)	
	Write throughput (IOPS)	
	Cache hit (%)	

Object of monitoring	Monitoring data	Necessary resources
	Data transfer (MB/s) 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) Write host I/O data transfer (MB/s) Initial copy cache hit (%) Initial copy data transfer (MB/s)	LDEV
LDEV (TC/TCz/GAD)	RIO (count) Pair Synchronized (%) Differential track (count) Initial copy throughput (count) Initial copy data transfer (MB/s) Initial copy response time (ms) Update copy throughput (count) Update copy data transfer (MB/s) Update copy response time (ms)	LDEV
Parity group	Total throughput (IOPS) Read throughput (IOPS) Write throughput (IOPS) Cache hit (%) Data transfer (MB/s) Response time (ms) Back transfer (count/sec) Drive usage rate (%) ¹	Parity group

Object of monitoring	Monitoring data	Necessary resources
LUN (base)	Total throughput (IOPS)	<ul style="list-style-type: none"> ▪ Host group ▪ LDEV
	Read throughput (IOPS)	
	Write throughput (IOPS)	
	Cache hit (%)	
	Data transfer (MB/s)	
	Response time (ms)	
	Back transfer (count/sec)	
LUN (UR) ³	Write host I/O throughput (IOPS)	<ul style="list-style-type: none"> ▪ Host group ▪ LDEV
	Write host I/O data transfer (MB/s)	
	Initial copy cache hit (%)	
	Initial copy data transfer (MB/s)	
LUN (TC/ GAD) ³	RIO (count)	<ul style="list-style-type: none"> ▪ Host group ▪ LDEV
	Pair Synchronized (%)	
	Differential track (count)	
	Initial copy throughput (count)	
	Initial copy data transfer (MB/s)	
	Initial copy response time (ms)	
	Update copy throughput (count)	
	Update copy data transfer (MB/s)	
	Update copy response time (ms)	
External storage	Data transfer between the storage system and external storage per logical device (MB/s)	LDEV
	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 (MB/s)	Parity group
	Response time between the storage system and external storage per external volume group (ms)	
Entire storage	RIO (count)	None

Object of monitoring	Monitoring data	Necessary resources
system (TC/TCz/GAD)	Pair Synchronized (%)	
	Differential track (count)	
	Initial copy throughput (count)	
	Initial copy data transfer (MB/s)	
	Initial copy response time (ms)	
	Update copy throughput (count)	
	Update copy data transfer (MB/s)	
	Update copy response time (ms)	
Journal (UR/URz)	Write host I/O throughput (IOPS)	None
	Write host I/O data transfer (MB/s)	
	Initial copy cache hit (%)	
	Initial copy data transfer (MB/s)	
	Master journal throughput (IOPS)	
	Master journal journal (count/sec)	
	Master journal data transfer (MB/s)	
	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 (MB/s)	
	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 (MB/s)	
	Initial copy cache hit (%)	

Object of monitoring	Monitoring data	Necessary resources
	Initial copy data transfer (MB/s)	
	Master journal throughput (IOPS)	
	Master journal journal (count/sec)	
	Master journal data transfer (MB/s)	
	Master journal response time (ms)	
	Restore journal throughput (IOPS)	
	Restore journal journal (count/sec)	
	Restore journal data transfer (MB/s)	
	Restore journal response time (ms)	
<p>Note:</p> <ol style="list-style-type: none"> 1. Only information on internal volumes is displayed. Information on external volumes and FICON® DM volumes is not displayed. 2. 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 unit.

Storing period

Short-Range (from 1 to 15 minutes) or Long-Range (fixed at 15 minutes) 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	MP	Usage Rate (%)	None

Usage rate of DRRs

Function

A data recovery and reconstruction processor (DRR) is a microprocessor (located on the DKBs and CHBs) 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, contact customer support.

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, the window displays the usage rates about the cache memory for the specified period of 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
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

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
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

- Cache fast write (CFW) mode
- Total value in the above-mentioned modes

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
Fibre port ¹	Target Initiator	Throughput (IOPS)	None
Mainframe fibre port ¹	None	Throughput (IOPS)	None
iSCSI Port ¹	Target Initiator	Throughput (IOPS)	None
WWN ¹	WWN	Throughput (IOPS)	None
	Port	Throughput (IOPS)	None
Logical device ¹	Base	Total Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Read Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Write Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ 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)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Read Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Write Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
LUN ³	Base	Total Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Read Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
		Write Throughput (IOPS)	<ul style="list-style-type: none"> ▪ Total ▪ Sequential ▪ Random ▪ CFW
	TC/GAD	Initial copy	Throughput (count) ²
		Update copy	Throughput (count) ²
	UR	Write host I/O	Throughput (IOPS)
	Journal	UR/URz	Write host I/O
Master journal			Throughput (IOPS)
Restore journal			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
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:		
<ol style="list-style-type: none"> 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

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
Fibre port*	Target Initiator	Data Trans. (MB/s)	None
Mainframe fibre port*	None	Data Trans. (MB/s)	Total
			Read
			Write

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*	Target Initiator	Data Trans. (MB/s)	None
WWN*	WWN	Data Trans. (MB/s)	None
	Port	Data Trans. (MB/s)	None
Logical device*	Base	Data Trans. (MB/s)	Total
			Read
			Write
	TC/TCz/GAD	Data Trans. (MB/s)	Initial Copy
			Update Copy
	UR/URz	Data Trans. (MB/s)	Write Host I/O
Initial Copy			
Parity Group*	None	Data Trans. (MB/s)	Total
			Read
			Write
LUN*	Base	Data Trans. (MB/s)	Total
			Read
			Write
	TC/GAD	Data Trans. (MB/s)	Initial Copy
			Update Copy
	UR	Data Trans. (MB/s)	Write Host I/O
Initial Copy			
External Storage	Parity Group	Data Trans. (MB/s)	Total
			Read
			Write
	Logical Device	Data Trans. (MB/s)	Total
			Read
			Write

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	Write host I/O	Data Trans. (MB/s)	
		Initial copy	Data Trans. (MB/s)	
		Master journal	Data Trans. (MB/s)	
		Restore journal	Data Trans. (MB/s)	
Entire Storage System	TC/TCz/GAD	Initial copy	Data Trans. (MB/s)	
		Update copy	Data Trans. (MB/s)	
	UR/URz	Write host I/O	Data Trans. (MB/s)	
		Initial copy	Data Trans. (MB/s)	
		Master journal	Data Trans. (MB/s)	
		Restore journal	Data Trans. (MB/s)	
	* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

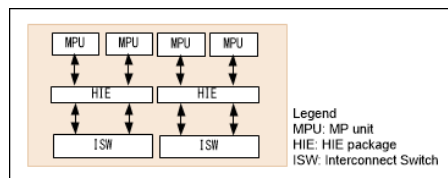
Usage rates of access paths

Function

The access paths are the paths through which data and commands are transferred within a storage system. As shown in the following figure, data is transferred between controllers through the HIE packages in the storage system.

Performance Monitor tracks and displays the usage rate for the following access paths to determine if the transfer route becomes a bottleneck due to the internal transfer.

- Access paths between the MP unit and the HIE package (MPU-HIE)
- Access paths between the HIE package and the Interconnect Switch (HIE-ISW)



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	HIE-ISW	Usage Rate (%)	None
	MP unit-HIE	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

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
Fibre port*	None	Response Time (ms)	None
Mainframe fibre port*	None	Response Time (ms)	None
iSCSI Port*	None	Response Time (ms)	None
WWN*	WWN	Response Time (ms)	None
	Port	Response Time (ms)	None
Logical device*	Base	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	
	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	
			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

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
* Volumes that do not accept I/O from the host, such as pool-VOLs, are not monitored.			

Disconnected time

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

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

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

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.			

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, 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

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
Logical Device*	Base	Cache Hit (%)	<ul style="list-style-type: none"> ▪ Read (Total) ▪ Read (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
			<ul style="list-style-type: none"> ▪ Read (Random) ▪ Read (CFW) ▪ Write (Total) ▪ Write (Sequential) ▪ Write (Random) ▪ Write (CFW)
	UR/URz	Initial Copy	Cache Hit (%)
Parity Group*	None	Cache Hit (%)	<ul style="list-style-type: none"> ▪ Read (Total) ▪ Read (Sequential) ▪ Read (Random) ▪ Read (CFW) ▪ Write (Total) ▪ Write (Sequential) ▪ Write (Random) ▪ Write (CFW)
LUN*	Base	Cache Hit (%)	<ul style="list-style-type: none"> ▪ Read (Total) ▪ Read (Sequential) ▪ Read (Random) ▪ Read (CFW) ▪ Write (Total) ▪ Write (Sequential) ▪ Write (Random) ▪ Write (CFW)
	UR	Initial Copy	Cache Hit (%)
Entire Storage System	UR/URz	Initial Copy	Cache Hit (%)
Journal	UR/URz	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
* 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

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
Logical Device*	Base	Back Trans. (count/sec)	Total
			Cache to Drive
			Drive to Cache (Sequential)
			Drive to Cache (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
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

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
Logical Device*	Base	Drive Usage Rate (%)	None
Parity Group*	None	Drive 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
*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

Long-Range or 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
Logical device*	Base	Drive Access Rate (%)	Read (Sequential)
			Read (Random)
			Write (Sequential)
			Write (Random)
*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

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
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. 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

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
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

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
Logical Device*	TC/TCz/GAD	Pair Synchronized (%)	None
LUN*	TC/GAD	Pair Synchronized (%)	None
Entire Storage System	TC/TCz/GAD	Pair Synchronized (%)	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.			

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

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
Logical Device*	TC/TCz/GAD	Differential track (count)	None
LUN*	TC/GAD	Differential track (count)	None
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

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
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

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
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

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
Journal	UR/URz	Master Journal	Metadata Usage Rate (%)
		Restore Journal	Metadata Usage Rate (%)

Detailed information of resources on top 20 usage rates**Function**

You can view resources of the 20 most-used MP units. The system puts in order of use 20 MP units 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 unit resource details

To view the resources assigned to an individual MP unit, click the link to the name of the MP unit 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
- TrueCopy for Mainframe
- Universal Replicator for Mainframe

Example of a text file

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

Translates of Lus (Filename: LUJOPS.csv)

No.	time	CL1-A.01(1A-G01).0000	CL1-A.02(1A-G02).0000	CL1-A.02(1A-G02).0001	CL1-A.02(1A-G02).0002	CL1-A.02(1A-G02).0003
1	2010/08/31 08:54	0	454	504	413	460
2	2010/08/31 08:55	0	451	495	417	475
3	2010/08/31 08:56	0	452	503	436	480
4	2010/08/31 08:57	0	452	488	407	448

Annotations:

- Serial number : 60001(VSP) indicates that the storage system serial number is 60001. The word in parentheses is a code that indicates the storage system type.
- From : 2010/08/31 08:53 To : 2010/08/31 11:53 indicates that the data was obtained from 08:53 to 11:53 on August 31, 2010.
- sampling rate : 1 indicates that monitoring was performed every minute(at a one-minute interval).
- Indicates monitoring data. If a value is negative value, the value indicates that Performance Monitor failed to obtain the data for some reason. For detailed information, refer to the Causes of Invalid Monitoring Data section later in this appendix.



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*).

- **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. Both Export Tool and the management client for Device Manager - Storage Navigator use the same supported OS version. For more information about the supported OS version on the management client, see the *System Administrator Guide*.



Note: If a firewall exists between the Device Manager - Storage Navigator computer and the SVP, see the *System Administrator Guide*. 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.

You can run Export Tool on the SVP. If the DKCMAIN firmware version is any of the following, the software product media contains the batch file for running Export Tool on the SVP:

- 93-02-03-x0/00 or later
- 88-06-02-x0/00 or later
- 88-05-03-x0/00 or later to 88-05-xx-xx/xx

- **Java Runtime Environment (JRE) or OpenJDK**

To use Export Tool, you must have the JRE software or OpenJDK on your Windows computer or UNIX computer. Both Export Tool and Device Manager - Storage Navigator use the same JRE or OpenJDK version. For the required JRE version, see the *System Administrator Guide*.

If you use the batch file for running Export Tool on the SVP, you do not have to install JRE for Export Tool because necessary JRE has already been installed with the SVP software.



Note: Export Tool can be installed on the management client.

(VSP 5000 series) Export Tool uses the Java Runtime Environment (JRE) command and the keytool command. To run these two commands, you must add the path to the commands in your PATH environment variable. For more information about how to add the path to the PATH environment variable, see the documentation for your operating system.

▪ 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 the *System Administrator Guide*.

▪ Export Tool program

The media for the software contains Export Tool. For information about how to install Export Tool, see [Installing Export Tool \(on page 67\)](#). If you want to run Export Tool on the SVP, install Export Tool by following the procedure for installing Export Tool on Windows computers. For the Export Tool version, see the `Readme.txt` file stored in the software product media.



Note: Export Tool can be run by using two types of the programs: a program installed from the Host PP disk and a program automatically downloaded from the SVP.

Each version can be checked by the following:

- Host PP disk version: specified in `ExportTool Ver` in `Readme.txt`.
- Program version automatically downloaded from the SVP: `ExportTool` version displayed when running Export Tool.

This manual refers to the Host PP disk version unless otherwise specified.

Installing 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 media into the drive.

4. Locate the `\program\monitor\win` folder on the media, and copy the self-extracting file `export.exe` from the media into the new folder you just created.
5. Double-click `export.exe` to start the installation. However, do not install Export Tool directly under the drive (such as `C:\`). Export Tool is installed into the installation directory, and a new folder named "export" is created.



Note: You should delete `runUnix.bat`, `SecurityToolUnix.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.

Installing Export Tool 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 the following files from the installation directory because these files are no longer needed:

- `runWin.bat`, `SecurityToolUnix.bat`, and `delWin.bat`
- `runWinOnSvp.bat` (This file is created only for the following firmware versions):
 - 93-02-03-x0/00 or later
 - 88-06-02-x0/00 or later
 - 88-05-03-x0/00 or later to 88-05-xx-xx/xx

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 media.
4. Go to the `/program/monitor/UNIX` directory on the media, 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.

SSL communications using Export Tool

It is recommended to establish the SSL communications when the monitoring data stored on the SVP is transferred to a PC other than the SVP by using Export Tool. The SSL communications make it possible to improve the communications security by encrypting transferred data.

If you have updated a certificate of the SVP, you can verify the validity of the connection destination by registering a root certificate or a self-signed certificate of the SVP in Export Tool. This verification can be enabled or disabled. If the verification cannot be performed when it is enabled, Export Tool will stop the processing. The verification will be performed even when it is disabled, however even if the verification cannot be performed, Export Tool processing will not be suspended.



Note: To use the verification function, make sure to use Export Tool with the DKCMAIN microcode version 90-04-04-00/00 or later and the SVP microcode version 90-04-03/00 or later:

Export Tool operates as a client, while the SVP operates as a server, and therefore, a certificate of the SVP is described as a server certificate. Make sure to use Export Tool with the required version or later, which can be checked in ExportTool Ver. in the `Readme.txt` file.

If the server certificate on the SVP is a signed public key certificate issued by the Certificate Authority (CA), register the CA root certificate in Export Tool. If the server certificate on the SVP is a self-signed certificate, register the server certificate in Export Tool. The certificate that can be registered in Export Tool must be in X.509 PEM or X.509 DER format. For more information about how to register a root certificate in Export Tool, see [Registering a certificate in Export Tool \(Windows\) \(on page 70\)](#) and [Registering a certificate in Export Tool \(UNIX\) \(on page 72\)](#). For more information about how to set a server certificate on the SVP, see the System Administrator Guide.

The following table shows the verification items and the descriptions. The verification is performed for a server certificate of the SVP.

Verification item	Description	Requirement
Expiration date verification	Verify that a certificate has not expired.	Make sure to verify that a server certificate on the SVP has not expired before enabling the verification.
Revocation verification	Verify that a server certificate has not revoked by using the CRL (list of the digital certificates that have been revoked before the expiration date) or OCSP (online verification).	You need a network environment in which the CRL repository or the OCSP responder can be accessed from Export Tool.

Verification item	Description	Requirement
SAN or CN verification	Verify that a host name (including FQDN) or an IP address (IPv4 or IPv6) entered in subjectAltName (SAN: an additional name of CN) or CommonName (CN) of a server certificate is the same as that of the connected server.	The host name or the IP address of the SVP that is specified as a connected server in Export Tool must be included in SAN or CN of the server certificate on the SVP.
Certificate chain verification	Verify a sequence of a root certificate, an intermediate certificate, and a server certificate in a certificate chain.	If a server certificate is signed by an intermediate CA, all of the intermediate certificates including the server certificate must be registered on the SVP.

If a certificate of the SVP has not been updated from the initial state, when the verification function is enabled, the SAN or CN verification cannot be performed, the communication is suspended, and then the Export Tool operation also cannot be performed. Make sure to update the certificate of the SVP before enabling the verification function by following the System Administrator Guide.

For more information about how to enable or disable the verification function, see [Java \(on page 122\)](#) in [Export Tool command reference \(on page 88\)](#).

Registering a certificate in Export Tool (Windows)

(VSP 5000 series) If a certificate of the SVP has been updated, register a root certificate or a self-signed certificate of the SVP in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Save the certificate file on the PC running Export Tool.
3. Start the command prompt with administrator permissions.
4. Move the current directory to the directory in which Export Tool is installed.
5. Run the following command: **SecurityToolWin.bat import <SVP-alias> <certificate-path>**, where <SVP-alias> is any name that indicates the SVP. <certificate-path> is the path to the certificate file.

Example:

```
SecurityToolWin.bat import SVP1 "C:\monitor\cert.crt"
```

Viewing a certificate registered in Export Tool (Windows)

(VSP 5000 series) View a root certificate or a self-signed certificate registered in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Start the command prompt with administrator permissions.
3. Move the current directory to the directory in which Export Tool is installed.
4. Run the following command: **SecurityToolWin.bat list**

Example:

```
Alias name: test
Creation date: Jun 2, 2020
Entry type: trustedCertEntry

Owner: EMAILADDRESS=svp@str.hitachi.co.jp, CN="Hitachi, Ltd.", OU=IT
Platform Division Group, O="Hitachi, Ltd.", L=Odawara, ST=Kanagawa,
C=JP
Issuer: EMAILADDRESS=svp@str.hitachi.co.jp, CN="Hitachi, Ltd.", OU=IT
Platform Division Group, O="Hitachi, Ltd.", L=Odawara, ST=Kanagawa,
C=JP
Serial number: dc52873fdb5cc76b
Valid from: Thu Apr 17 17:16:04 PDT 2014 until: Wed Apr 17 17:16:04
PDT 2024
Certificate fingerprints:
    MD5: B3:A5:60:17:17:91:9D:0E:F7:31:DC:1C:06:FA:51:CA
    SHA1:
43:14:DF:80:1D:64:AA:09:B8:F3:1C:13:74:2B:7E:95:1D:2F:E9:6F
    SHA256:
9B:A8:68:45:95:91:3C:72:9B:4C:6A:FE:BB:B9:32:F0:04:E5:9E:DF:B1:47:2F:59
:EA:0C:26:1A:BC:70:E8:15
Signature algorithm name: SHA256withRSA
Version: 1
```

Deleting a certificate from Export Tool (Windows)

(VSP 5000 series) Delete a root certificate or a self-signed certificate registered in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Verify the SVP alias that is connected by using a root certificate or a self-signed certificate registered in Export Tool. For more information, see [Viewing a certificate registered in Export Tool \(Windows\) \(on page 71\)](#).
3. Start the command prompt with administrator permissions.

4. Move the current directory to the directory in which Export Tool is installed.
5. Run the following command: **SecurityToolWin.bat delete <SVP-alias>**, where <SVP-alias> is any name that indicates the SVP.

Example:

```
SecurityToolWin.bat delete SVP1
```

Getting help in Export Tool (Windows)

(VSP 5000 series) Get help in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Start the command prompt with administrator permissions.
3. Move the current directory to the directory in which Export Tool is installed.
4. Run the following command: **SecurityToolWin.bat help**

Example:

```
Command Line Syntax
import <alias> <certificate-file-path>
alias: alias of specified certificate
certificate-file-path: relative or absolute certificate file path
delete <alias>
alias: alias of specified certificate
list
help
```

Registering a certificate in Export Tool (UNIX)

(VSP 5000 series) If a certificate of the SVP has been updated, register a root certificate or a self-signed certificate of the SVP in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Save the certificate file on the PC running Export Tool.
3. Move the current directory to the directory in which Export Tool is installed.
4. Run the following command: **SecurityToolUnix.bat import <SVP-alias> <certificate-path>**, where <SVP-alias> is any name that indicates the SVP. <certificate-path> is the path to the certificate file.

Example:

```
SecurityToolUnix.bat import SVP1 /tmp/cert.crt
```


Viewing a certificate registered in Export Tool (UNIX)

(VSP 5000 series) View a root certificate or a self-signed certificate registered in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Move the current directory to the directory in which Export Tool is installed.
3. Run the following command: **SecurityToolUnix.bat list**

Example:

```
Alias name: test
Creation date: Jun 3, 2020
Entry type: trustedCertEntry

Owner: EMAILADDRESS=svp@str.hitachi.co.jp, CN="Hitachi, Ltd.", OU=IT
Platform Division Group, O="Hitachi, Ltd.", L=Odawara, ST=Kanagawa,
C=JP
Issuer: EMAILADDRESS=svp@str.hitachi.co.jp, CN="Hitachi, Ltd.", OU=IT
Platform Division Group, O="Hitachi, Ltd.", L=Odawara, ST=Kanagawa,
C=JP
Serial number: dc52873fdb5cc76b
Valid from: Fri Apr 18 09:16:04 JST 2014 until: Thu Apr 18 09:16:04
JST 2024
Certificate fingerprints:
    MD5:  B3:A5:60:17:17:91:9D:0E:F7:31:DC:1C:06:FA:51:CA
    SHA1:
43:14:DF:80:1D:64:AA:09:B8:F3:1C:13:74:2B:7E:95:1D:2F:E9:6F
    SHA256:
9B:A8:68:45:95:91:3C:72:9B:4C:6A:FE:BB:B9:32:F0:04:E5:9E:DF:B1:47:2F:59
:EA:0C:26:1A:BC:70:E8:15
Signature algorithm name: SHA256withRSA
Subject Public Key Algorithm: 2048-bit RSA key
Version: 1
```

Deleting a certificate from Export Tool (UNIX)

(VSP 5000 series) Delete a root certificate or a self-signed certificate registered in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Verify the SVP alias that is connected by using a root certificate or a self-signed certificate registered in Export Tool. For more information, see [Viewing a certificate registered in Export Tool \(UNIX\) \(on page 73\)](#).
3. Start the command prompt with administrator permissions.

4. Move the current directory to the directory in which Export Tool is installed.
5. Run the following command: **SecurityToolUnix.bat delete <SVP-alias>**, where <SVP-alias> is any name that indicates the SVP.

Example:

```
SecurityToolUnix.bat delete SVP1
```

Getting help in Export Tool (UNIX)

(VSP 5000 series) Get help in Export Tool.

Procedure

1. Log in to the PC running Export Tool.
2. Move the current directory to the directory in which Export Tool is installed.
3. Run the following command: **SecurityToolUnix.bat help**.

Example:

```
Command Line Syntax
import <alias> <certificate-file-path>
alias: alias of specified certificate
certificate-file-path: relative or absolute certificate file path
delete <alias>
alias: alias of specified certificate
list
help
```

Using Export Tool

After installing Export Tool, you must prepare a command file and a batch file before you can export any monitoring data.

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 \(on page 88\)](#).

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

```

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

```

The scripts in this command file are explained as follows:

- `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 \(on page 90\)](#).

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 SVP 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 <code>svpip 158.214.135.57</code> (for IPv4)	9ED68739
Value for the svpip subcommand is <code>svpip 0000:0000:0020:00B4:0000:0000:9ED6:874</code> (for IPv6)	00000000002000B400 0000009ED68740
Value for the svpip subcommand is <code>svpip host01</code> (when the IP address of host01 is 158.214.135.57)	9ED68739

- `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 \(on page 92\)](#).



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 \(on page 66\)](#) 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.

- 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 \(on page 115\)](#).

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 \(on page 93\)](#).

- `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 .

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.

For detailed information about the **group** subcommand, see [group \(on page 94\)](#).

- `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 \(on page 74\)](#), 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 \(on page 74\)](#), 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 \(on page 113\)](#).
- For detailed information about the **longrange** subcommand, see [longrange \(on page 115\)](#).

- `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 \(on page 118\)](#).

- `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 \(on page 118\)](#).

- `apply`

The **apply** subcommand saves monitoring data in files. For detailed information about the **apply** command, see [apply \(on page 119\)](#).

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 following batch files are stored in the installation directory for Export Tool.

Batch file name	Function	Runs on
<code>runWin.bat</code>	Run Export Tool	Windows computers except the SVP
<code>runWinOnSvp.bat</code>	Run Export Tool (call <code>runWin.bat</code>)	SVP
<code>delWin.bat</code>	Delete directories and files that are created by Export Tool	Windows computers including the SVP
<code>runUnix.bat</code>	Run Export Tool	UNIX computers
<code>delUnix.bat</code>	Delete directories and files that are created by Export Tool	UNIX computers



Note: When you run Export Tool on the SVP, use `runWinOnSvp.bat`. This batch file calls `runWin.bat` inside.

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 you run Export Tool on the SVP for which the SVP software is installed on a directory other than the default directory (C:\Mapp), you need to customize runWinOnSvp.bat. In runWinOnSvp.bat, change the SVP_HOME variable to the installation directory for the SVP software.

```
@echo off
REM This file is a special file for those who want to run ExportTool on
SVP.
REM If the installation destination of SVP Software is different from the
environment,
REM match the directory of the following SVP_HOME variable with the
environment.
setlocal
::::::::::::::::::
:: Change to your SVP installation directory
set SVP_HOME=C:\Mapp <-Specify the installation directory of
the SVP here.
::::::::::::::::::
```

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
-Ddel.tool.Xmx=536870912
-Ddmd.command=command.txt
-Ddmd.logpath=log -Ddmd.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
-Ddmd.command=command.txt
-Ddmd.logpath=log -Ddmd.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
-Ddmd.command=command.txt
-Ddmd.logpath=log -Ddmd.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"
-Ddmd.command=command.txt
-Ddel.logpath=log
-Ddel.mode=delete sanproject.getexptool.RJElMain<CR+LF>
```

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

```
#!/bin/sh<LF>
java -classpath "./lib/JSanExportLoader.jar"
-Ddmd.command=command.txt
```

```
-Del.logpath=log
-Del.mode=delete sanproject.getexptool.RJElMain<LF>
```

For detailed information about syntax of the Java command, see [Java \(on page 122\)](#).

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
```



Note: If you run Export Tool on the SVP, run `runWinOnSvp.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:

```
[ 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
```

It might take time after Loading ExportTool is displayed in the command prompt and before Export tool start [Version 90-xx-xx/xx] is displayed. The time elapsed between the two messages varies depending on the communication environment of the computer 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 \(on page 91\)](#).

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:

```
export/lib/SVP-value
JSanExport.jar
JSanRmiApiEx.jar
JSanRmiApiSx.jar
JSanRmiServerEx.jar
JSanRmiServerSx.jar
JSanRmiServerUx.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 `svpip` value 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 \(on page 118\)](#).

For a complete list of files to be saved by Export Tool, see [Using Export Tool \(on page 74\)](#).

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 \(on page 118\)](#).) 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.*
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: <ul style="list-style-type: none"> 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.

Operand for the group subcommand	Estimated time	Description
LU	60 minutes	This estimate assumes that: <ul style="list-style-type: none"> ▪ 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.
<p>* 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.</p> <p>Note:</p> <ul style="list-style-type: none"> ▪ 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 94). 		

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 \(on page 122\)](#).

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 <code>set</code> subcommand (see set (on page 120)) 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: <ul style="list-style-type: none"> ▪ 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 222) .
3	An error occurred due to more than one reason. For example, an attempt to switch to Modify mode failed when the <code>set</code> subcommand (see set (on page 120)) 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.
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 226) .

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 \(on page 91\)](#).

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 \(on page 222\)](#).

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.
5105 8777	A different user is accessing the storage system in Modify mode.
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

Write Export Tool subcommands in your command file and the commands that are used in your batch file. [Subcommand list \(on page 90\)](#) lists and provides links to those subcommands. The Java command is explained in [Java \(on page 122\)](#).

Export Tool command syntax

The following tables explain the syntax of the Export Tool subcommands that you can write in your command file. The following tables also explain the syntax of the Java command that you should use in your batch file.

- [Conventions \(on page 88\)](#)
- [Syntax descriptions \(on page 89\)](#)
- [Writing a script in the command file \(on page 89\)](#)
- [Viewing the online help for subcommands \(on page 89\)](#)

Conventions

Convention	Description
bold	Indicates characters that you must type exactly as they are shown.
<i>italics</i>	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.
{ }	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 <i>ip-address</i>	connect 123.01.22.33
destination [<i>directory</i>]	destination destination c:\temp
compress [yes no]	compress compress yes compress no
answer {yes no}	answer yes answer no
ports [<i>name</i>][...]	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:

```

#####
;;;   COMMAND FILE: command.txt   ;;;
#####
svpip 158.214.135.57           ; IP address of the SVP
login expusr "passwd"         ; Log onto 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 \(on page 121\)](#).

Subcommand list

Subcommand	Function
svpip (on page 90)	Specifies the IP address of SVP to be logged in.
retry (on page 91)	Makes settings on retries of export processing.
login (on page 92)	Logs the specified user into SVP.
show (on page 93)	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 94)	Specifies the type of data that you want to export.
shortrange (on page 113)	Specifies the term of monitoring data to be exported for short-range monitoring data.
longrange (on page 115)	Specifies the term of monitoring data to be exported for long-range monitoring data.
outpath (on page 118)	Specifies the directory in which files should be saved.
option (on page 118)	Specifies whether to save files in ZIP format or in CSV format.
apply (on page 119)	Saves monitoring data in files.
set (on page 120)	Starts or ends monitoring of the storage system, and specifies the sampling interval.
help (on page 121)	Displays the online help for subcommands.
java (on page 122)	Starts Export Tool and writes monitoring data into files.

svpip

Description

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

Syntax

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

Operands

Operand	Description
<i>ip-address</i>	Specifies the IP address of SVP.

Operand	Description
	If SVP is managed with IPv6 (Internet Protocol Version 6), you must specify the <i>IP-address</i> 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.
<i>host-name</i>	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
```

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=<i>m</i>	Specifies the interval between retries in minutes, where <i>m</i> is a value within the range of 1 to 59. If this operand is omitted, the interval between retries is two minutes.
count=<i>n</i>	Specifies the maximum number of retries. If <i>n</i> is 0, the number of retries is unlimited.

Operand	Description
	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.

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

login

Description

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

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

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

Syntax

login *userid password*

Operands

Operand	Description
<i>userid</i>	Specifies the user ID for SVP. Specifies the user ID for . 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 66) .

Operand	Description
<i>password</i>	Specifies the password of the user. Specifies the password of the user. If the password includes any non-alphanumeric character, the password ID must be enclosed by double quotation marks ("").

Example

This example logs the user **expuser** into the SVP whose IP address is 158.214.127.170. The password is **pswd**.

```
svpip 158.214.127.170 login expuser pswd
```

show

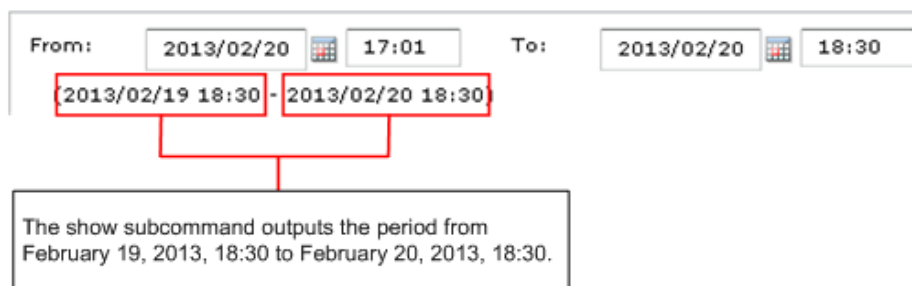
Description

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).

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 \(on page 113\)](#) and [longrange \(on page 115\)](#).

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

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 \(on page 113\)](#) or [longrange \(on page 115\)](#)).

`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 128)

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
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_XXXXX.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	Select Access Path from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about the following: <ul style="list-style-type: none"> ▪ write pending rate ▪ cache ▪ access paths 	PhyCMPK_dat.ZIP ¹	
PhyProcDetail	Select xx from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about MPs for each resource allocated to MP units	PhyProcDetail_dat.ZIP	

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
PhyMPU	Select Access Path from Object list in Performance Objects field in Monitor Performance window.	Usage statistics about the following: <ul style="list-style-type: none"> ▪ access paths ▪ write pending rate ▪ cache 	PhyMPU_dat.ZIP	Resource usage and write-pending rate statistics (on page 128)
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 132)
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 133)
LDEVEachOfCU	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 135)
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 137)

Operand	GUI operation	Monitoring data saved in the file	Saved ZIP file	See
MFPort	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 137)
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 139)
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 139)
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 140)
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 142)

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)). Note that this data cannot be obtained from a mainframe volume.	RCLU_dat.ZIP	Remote copy operations by TC and monitoring data by GAD (for each volume (LU)) (on page 143)
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 143)
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 145)
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 146)

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)). Note that this data cannot be obtained from a mainframe volume.	URLU_dat.ZIP	Remote copy by UR (for each volume (LU)) (on page 147)
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 148)
PhyMPPK	Select MPPK from Object list in Performance Objects field in Monitor Performance window.	MP usage rate of each resource allocated to MP unit	PhyMPPK_dat.ZIP	MP units (on page 141)

Notes:

1. 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

```
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] |
PhyProcDetail |
PhyCMPK [Short|Long] |
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]] [ ...] |
MFFPort [[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
}
```

```
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][[<i>parity-group-id</i>]:[<i>parity-group-id</i>]] [...]	<p>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 <code>PhyPG_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>You can use the <code>Short</code> or <code>Long</code> option to select the storing period of the monitoring data to be exported. If you specify <code>Short</code>, the exported file will contain statistics in a short range for up to 15 days. If you specify <code>Long</code>, the exported file will contain statistics in a long range for up to six months (for example, up to 186 days). If neither <code>Short</code> nor <code>Long</code> is specified, statistics in both the short and long range are exported.</p> <p>When you specify variable <i>parity-group-id</i>, you can narrow the range of parity groups whose monitoring data are to be exported. <i>parity-group-id</i> is a parity group ID. The colon (:) indicates a range. For example, <code>1-1:1-5</code> indicates parity groups from 1-1 to 1-5.</p> <p>Ensure that the <i>parity-group-id</i> value on the left of the colon is smaller than the <i>parity-group-id</i> value on the right of the colon. For example, you can specify <code>PhyPG 1-1:1-5</code>, but you cannot specify <code>PhyPG 1-5:1-1</code>. Also, you can specify <code>PhyPG 1-5:2-1</code>, but you cannot specify <code>PhyPG 2-1:1-5</code>.</p>

Operand	Description
	<p>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.</p> <p>If <i>parity-group-id</i> is not specified, the monitoring data of all parity groups will be exported.</p>
<p>PhyLDEV [Short Long][[<i>parity-group-id</i>]:[<i>parity-group-id</i>]][...]</p>	<p>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 <code>PhyLDEV_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>You can use the <code>Short</code> or <code>Long</code> option to select the storing period of the monitoring data to be exported. If you specify <code>Short</code>, the exported file will contain statistics in short range for up to 15 days. If you specify <code>Long</code>, the exported file will contain statistics in long range for up to six months (for example, up to 186 days). If neither <code>Short</code> nor <code>Long</code> is specified, statistics in both the short and long range are exported.</p> <p>When you specify variable <i>parity-group-id</i>, you can narrow the range of parity groups whose monitoring data are to be exported. <i>parity-group-id</i> is a parity group ID. The colon (:) indicates a range. For example, <code>1-1:1-5</code> indicates parity groups from 1-1 to 1-5.</p> <p>Ensure that the <i>parity-group-id</i> value on the left of the colon is smaller than the <i>parity-group-id</i> value on the right of the colon. For example, you can specify <code>PhyLDEV 1-1:1-5</code>, but you cannot specify <code>PhyLDEV 1-5:1-1</code>. Also, you can specify <code>PhyLDEV 1-5:2-1</code>, but you cannot specify <code>PhyLDEV 2-1:1-5</code>.</p> <p>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.</p> <p>If <i>parity-group-id</i> is not specified, the monitoring data of all volumes will be exported.</p>
<p>PhyExG [[<i>exg-id</i>]:[<i>exg-id</i>]][...]</p>	<p>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 <code>PhyExG_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>When you specify variable <i>exg-id</i>, you can narrow the range of external volume groups whose monitoring data are to be exported. <i>exg-id</i> is an ID of an external volume group. The colon (:) indicates a range. For example, <code>E1-1:E1-5</code> indicates external volume groups from E1-1 to E1-5.</p>

Operand	Description
	<p>Ensure that the <i>exg-id</i> value on the left of the colon is smaller than the <i>exg-id</i> value on the right of the colon. For example, you can specify <code>PhyExG E1-1:E1-5</code>, but you cannot specify <code>PhyExG E1-5:E1-1</code>. Also, you can specify <code>PhyExG E1-5:E2-1</code>, but you cannot specify <code>PhyExG E2-1:E1-5</code>.</p> <p>If <i>exg-id</i> is not specified, the monitoring data of all external volume groups will be exported.</p>
PhyExLDEV [[<i>exg-id</i>]:[<i>exg-id</i>]][...]	<p>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 <code>PhyExLDEV_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>When you specify variable <i>exg-id</i>, you can narrow the range of external volume groups whose monitoring data are to be exported. <i>exg-id</i> is an ID of an external volume group. The colon (:) indicates a range. For example, <code>E1-1:E1-5</code> indicates external volume groups from E1-1 to E1-5.</p> <p>Ensure that the <i>exg-id</i> value on the left of the colon is smaller than the <i>exg-id</i> value on the right of the colon. For example, you can specify <code>PhyExLDEV E1-1:E1-5</code>, but you cannot specify <code>PhyExLDEV E1-5:E1-1</code>. Also, you can specify <code>PhyExLDEV E1-5:E2-1</code>, but you cannot specify <code>PhyExLDEV E2-1:E1-5</code>.</p> <p>If <i>exg-id</i> is not specified, the monitoring data of all external volumes will be exported.</p>
PhyProc [Short Long]	<p>Use this operand when you want to export the following statistics, which are displayed in the Monitor Performance window:</p> <ul style="list-style-type: none"> ▪ Usage rates of MPs ▪ Usage rates of DRRs (data recovery and reconstruction processors) <p>When statistics are exported to a ZIP file, the file name will be <code>PhyProc_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>You can use the <code>Short</code> or <code>Long</code> option to select the storing period of the monitoring data to be exported. If you specify <code>Short</code>, the exported file will contain statistics in short range for up to 15 days. If you specify <code>Long</code>, the exported file will contain statistics in long range for up to six months (for example, up to 186 days). If neither <code>Short</code> nor <code>Long</code> is specified, statistics in both the short and long range are exported.</p>
PhyProcDetail	<p>Use this operand when you want to export the monitoring data of performance information on each MP unit. When statistics are exported to a ZIP file, the file name will be <code>PhyProcDetail_dat.ZIP</code>.</p>

Operand	Description
PhyMPU [Short Long]	<p>Use this operand when you want to export the following statistics, which are displayed in the Monitor Performance window:</p> <ul style="list-style-type: none"> ▪ Usage rates of access paths between HIEs and ISWs ▪ Usage rates of access paths between MP units and HIEs ▪ Usage rates of cache memories ▪ Size of the allocated cache memories ▪ Write pending rates <p>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 128).</p> <p>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.</p>
PhyCMPK [Short Long]	<p>Use this operand when you want to export the following statistics, which are displayed in the Monitor Performance window:</p> <ul style="list-style-type: none"> ▪ 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 units 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 <p>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 128).</p> <p>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.</p>

Operand	Description
<p>PG [[<i>parity-group-id</i> <i>exg-id</i> <i>Migration-Volume-group-id</i>]: [<i>parity-group-id</i> <i>exg-id</i> <i>Migration-Volume-group-id</i>]] [...]</p>	<p>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 <code>PG_dat.ZIP</code>. For details on the statistics exported by this operand, see Resource usage and write-pending rate statistics (on page 128).</p> <p>When you specify variables <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> you can narrow the range of parity groups, external volume groups, or migration volume groups whose monitoring data are to be exported. <i>parity-group-id</i> is a parity group ID. <i>exg-id</i> is an ID of an external volume group. <i>Migration-Volume-group-id</i> 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, <code>1-1:1-5</code> indicates parity groups from 1-1 to 1-5. <code>E1-1:E1-5</code> indicates external volume groups from E1-1 to E1-5. <code>M1-1:M5-1</code> indicates migration volume groups from M1-1 to M5-1.</p> <p>Ensure that the <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> value on the left of the colon is smaller than the <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> value on the right of the colon. For example, you can specify <code>PG 1-1:1-5</code>, but you cannot specify <code>PG 1-5:1-1</code>. Also, you can specify <code>PG 1-5:2-1</code>, but you cannot specify <code>PG 2-1:1-5</code>.</p> <p>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.</p> <p>If none of <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> are specified, the statistics of all parity groups, external volume groups, and migration volume groups will be exported.</p>
<p>LDEV [[[<i>parity-group-id</i> <i>exg-id</i> <i>Migration-Volume-group-id</i>]: [<i>parity-group-id</i> <i>exg-id</i> <i>Migration-Volume-group-id</i>]] [...] internal virtual]]</p>	<p>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 <code>LDEV_</code> will be output. For details on the statistics exported by this operand, see Port statistics (on page 137).</p> <p>When you specify variables <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> you can narrow the range of parity groups, external volume groups, or migration volume groups whose monitoring data are to be exported. <i>parity-group-id</i> is a parity group ID. <i>exg-id</i> is an ID of an external volume group. <i>Migration-volume-group-id</i> 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, <code>1-1:1-5</code> indicates parity groups from 1-1 to 1-5. <code>E1-1:E1-5</code> indicates external volume groups from E1-1 to E1-5. <code>M1-1:M5-1</code> indicates migration volume groups from M1-1 to M5-1.</p>

Operand	Description
	<p>Ensure that the <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> value on the left of the colon is smaller than the <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> value on the right of the colon. For example, you can specify <code>LDEV 1-1:1-5</code>, but you cannot specify <code>LDEV 1-5:1-1</code>. Also, you can specify <code>LDEV 1-5:2-1</code>, but you cannot specify <code>LDEV 2-1:1-5</code>.</p> <p>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.</p> <p>If <code>internal</code> is specified, you can save statistics about volumes in the parity group. If <code>virtual</code> is specified, you can save statistics about volumes in the external volume group or migration volume group.</p> <p>If none of <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> are specified, the statistics of all parity groups, external volume groups, and migration volume groups will be saved to a file.</p> <p>If none of <i>parity-group-id</i>, <i>exg-id</i>, <i>Migration-Volume-group-id</i>, <i>internal</i>, or <i>virtual</i> is specified as the LDEV operand, data that can be saved when <code>internal</code> or <code>virtual</code> is specified is saved.</p> <p>One of the following values can be specified:</p> <ul style="list-style-type: none"> ▪ <i>parity-group-id</i>, <i>exg-id</i>, or <i>Migration-Volume-group-id</i> ▪ <code>internal</code> ▪ <code>virtual</code>
<p>LDEVEachOfCU [[[<i>LDKC-CU-id</i>]: <i>LDKC-CU-id</i>][...] <code>internal</code> <code>virtual</code>]</p>	<p>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 <code>LDEV_</code> 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 135).</p> <p>When you specify variable <i>LDKC-CU-id</i>, you can narrow the range of LDKC:CUs that control the volumes whose monitoring data are to be exported. <i>LDKC-CU-id</i> is an ID of a LDKC:CU. The colon (:) indicates a range. For example, <code>000:105</code> indicates LDKC:CUs from 00:00 to 01:05.</p> <p>Ensure that the <i>LDKC-CU-id</i> value on the left of the colon is smaller than the <i>LDKC-CU-id</i> value on the right of the colon. For example, you can specify <code>LDEVEachOfCU 000:105</code>, but you cannot specify <code>LDEVEachOfCU 105:000</code>.</p> <p>If <code>internal</code> is specified, you can export statistics about volumes in the parity group. If <code>virtual</code> is specified, you can export statistics about volumes in the external volume or V-VOL.</p>

Operand	Description
	If none of <i>LDKC-CU-id</i> , <i>internal</i> , or <i>virtual</i> is specified as the <code>LDEVEachOfCU</code> operand, data that can be saved when <i>internal</i> or <i>virtual</i> is specified is saved.
Port <code>[[port-name]:[port-name]][...]</code>	<p>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 <code>Port_dat.ZIP</code>. For details on the statistics exported by this operand, see Port statistics (on page 137).</p> <p>When you specify variable <i>port-name</i>, you can specify a range of ports for which data is saved using the format <i>port-name:port-name</i>. For example, <code>CL3-a:CL3-c</code> indicates ports from CL3-a to CL3-c.</p> <p>Ensure that the <i>port-name</i> value on the left of the colon is smaller than the <i>port-name</i> value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which value is smaller than which value:</p> $CL1-A < CL1-B < \dots < CL2-A < CL2-B < \dots < CL3-a < CL3-b < \dots < CL4-a < \dots < CL4-r$ <p>For example, you can specify <code>Port CL1-C:CL2-A</code>, but you cannot specify <code>Port CL2-A:CL1-C</code>. Also, you can specify <code>Port CL3-a:CL3-c</code>, but you cannot specify <code>Port CL3-c:CL3-a</code>.</p> <p>If <i>port-name</i> is not specified, the monitoring data of all ports will be exported.</p>
MFPort <code>[[port-name]:[port-name]][...]</code>	<p>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 <code>MF_Port_dat.ZIP</code>. For details on the statistics exported by this operand, see Port statistics (on page 137).</p> <p>When you specify variable <i>port-name</i>, you can narrow a range of ports for which data is saved using the format <i>port-name:port-name</i>. For example, <code>CL1-C.01:CL1-C.03</code> indicates the range from host group #01 of port CL1-C to host group #03 of port CL1-C.</p> <p>Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which <i>port-name</i> value is smaller than which <i>port-name</i> value:</p> $CL1-A < CL1-B < \dots < CL2-A < CL2-B < \dots < CL3-a < CL3-b < \dots < CL4-a < \dots < CL4-r$ <p>For example, you can specify <code>CL1-C:CL2-A</code>, but you cannot specify <code>CL2-A:CL1-C</code>. Also, you can specify <code>CL3-a:CL3-c</code>, but you cannot specify <code>CL3-c:CL3-a</code>. If <i>port-name</i> is not specified, the monitoring data of all volumes is exported.</p>
PortWWN <code>[[port-name]:[port-name]][...]</code>	<p>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 <code>PortWWN_dat.ZIP</code>. For details on the statistics exported by this operand, see Port statistics (on page 137).</p>

Operand	Description
	<p>When you specify variable <i>port-name</i>, you can narrow a range of ports for which data is saved using the format <i>port-name:port-name</i>. For example, CL3-a:CL3-c indicates ports from CL3-a to CL3-c.</p> <p>Ensure that the <i>port-name</i> value on the left of the colon is smaller than the <i>port-name</i> value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which value is smaller than which value:</p> <p>CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r</p> <p>For example, you can specify <code>PortWWN CL1-C:CL2-A</code>, but you cannot specify <code>PortWWN CL2-A:CL1-C</code>. Also, you can specify <code>PortWWN CL3-a:CL3-c</code>, but you cannot specify <code>PortWWN CL3-c:CL3-a</code>.</p> <p>If <i>port-name</i> is not specified, the monitoring data of all host bus adapters will be exported.</p>
<p>LU <code>[[<i>port-name.host-group-id</i>]:[<i>port-name.host-group-id</i>]][...]</code></p>	<p>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 <code>LU_dat.ZIP</code>. For details on the statistics exported by this operand, see Volumes (LU) statistics (on page 139).</p> <p>When you specify variable <i>port-name.host-group-id</i>, you can narrow the range of LU paths whose monitoring data are to be exported. <i>port-name</i> is a port name. <i>host-group-id</i> 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, <code>CL1-C.01:CL1-C.03</code> indicates the range from the host group #01 of the CL1-C port to the host group #03 of the CL1-C port.</p> <p>Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which <i>port-name</i> value is smaller than which <i>port-name</i> value:</p> <p>CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r</p> <p>For example, you can specify <code>LU CL1-C.01:CL2-A.01</code>, but you cannot specify <code>LU CL2-A.01:CL1-C.01</code>. Also, you can specify <code>LU CL1-C.01:CL1-C.03</code>, but you cannot specify <code>LU CL1-C.03:CL1-C.01</code>.</p> <p>If <i>port-name.host-group-id</i> is not specified, the monitoring data of all LU paths will be exported.</p>
<p>PPCGWWN <code>[[<i>monitor-target-name</i>]:[<i>monitor-target-name</i>]][...]</code></p>	<p>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 <code>PPCGWWN_dat.ZIP</code>. For details on the statistics exported by this operand, see All host bus adapters connected to ports (on page 140).</p>

Operand	Description
	<p>When you specify variable <i>monitor-target-name</i>, you can narrow the range of monitoring target groups whose monitoring data are to be exported. <i>monitor-target-name</i> 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.</p> <p>Ensure that the <i>monitor-target-name</i> value on the left of the colon is smaller than the <i>monitor-target-name</i> 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:</p> <ul style="list-style-type: none"> ▪ 0 < 1 < 2 < ... < 9 < a < b < ... < z < A < B < ... < Z ▪ cygnus < raid < Cancer < Pisces < RAID < RAID5 <p>If <i>monitor-target-name</i> is not specified, the monitoring data of all host bus adapters will be exported.</p>
RemoteCopy	<p>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 142).</p>
RCLU [[<i>port-name.host-group-id</i>]:[<i>port-name.host-group-id</i>]] [...]	<p>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. Note that this data cannot be obtained from a mainframe 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 143).</p> <p>When you specify variable <i>port-name.host-group-id</i>, you can narrow the range of LU paths whose monitoring data are to be exported, where <i>port-name</i> is a port name and <i>host-group-id</i> 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.</p> <p>Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which <i>port-name</i> value is smaller than which <i>port-name</i> value:</p> <p>CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r</p>

Operand	Description
	<p>For example, you can specify <code>RCLU CL1-C.01:CL2-A.01</code>, but you cannot specify <code>RCLU CL2-A.01:CL1-C.01</code>. Also, you can specify <code>RCLU CL1-C.01:CL1-C.03</code>, but you cannot specify <code>RCLU CL1-C.03:CL1-C.01</code>.</p> <p>If <i>port-name.host-group-id</i> is not specified, the monitoring data of all volumes (LUs) will be exported.</p>
RCLDEV [[<i>LDKC-CU-id</i>]:[<i>LDKC-CU-id</i>]][...]	<p>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 <code>RCLDEV_</code> 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 143).</p> <p>When you specify variable <i>LDKC-CU-id</i>, you can narrow the range of LDKC:CU that control the volumes whose monitoring data are to be exported. <i>LDKC-CU-id</i> is an ID of an LDKC:CU. The colon (:) indicates a range. For example, <code>000:105</code> indicates LDKC:CU from 00:00 to 01:05.</p> <p>Ensure that the <i>LDKC-CU-id</i> value on the left of the colon is smaller than the <i>LDKC-CU-id</i> value on the right of the colon. For example, you can specify <code>RCLDEV 000:105</code>, but you cannot specify <code>RCLDEV 105:000</code>.</p> <p>If <i>LDKC-CU-id</i> is not specified, the monitoring data of all volumes will be exported.</p>
UniversalReplicator	<p>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 <code>UniversalReplicator.zip</code>. For details on the statistics exported by this operand, see Remote copy by UR and URz (whole volumes) (on page 145).</p>
URJNL [[<i>JNL-group-id</i>]:[<i>JNL-group-id</i>]][...]	<p>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 at each journal. When statistics are exported to a ZIP file, the file name will be <code>URJNL_dat.ZIP</code>. For details on the statistics exported by this operand, see Remote copy by UR and URz (at journals) (on page 146).</p> <p>When you specify variable <i>JNL-group-id</i>, you can narrow the range of journals whose monitoring data are to be exported. <i>JNL-group-id</i> is a journal number. The colon (:) indicates a range. For example, <code>00:05</code> indicates journals from 00 to 05.</p>

Operand	Description
	<p>Ensure that the <i>JNL-group-id</i> value on the left of the colon is smaller than the <i>JNL-group-id</i> value on the right of the colon. For example, you can specify URJNL 00:05, but you cannot specify URJNL 05:00.</p> <p>If <i>JNL-group-id</i> is not specified, the monitoring data of all journal volumes will be exported.</p>
<p>URLU [[<i>port-name.host-group-id</i>]:[<i>port-name.host-group-id</i>]][...]</p>	<p>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. Note that this data cannot be obtained from a mainframe volume. For details on the statistics exported by this operand, see Remote copy by UR (for each volume (LU)) (on page 147).</p> <p>When you specify variable <i>port-name.host-group-id</i>, you can narrow the range of LU paths whose monitoring data are to be exported, where <i>port-name</i> is a port name and <i>host-group-id</i> 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.</p> <p>Ensure that the value on the left of the colon is smaller than the value on the right of the colon. The smallest <i>port-name</i> value is CL1-A and the largest <i>port-name</i> value is CL4-r. The following formula illustrates which <i>port-name</i> value is smaller than which <i>port-name</i> value:</p> <p>CL1-A < CL1-B < ... < CL2-A < CL2-B < ... < CL3-a < CL3-b < ... < CL4-a < ... < CL4-r</p> <p>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.</p> <p>If <i>port-name.host-group-id</i> is not specified, the monitoring data of all volumes (LUs) will be exported.</p>
<p>URLDEV [[<i>LDKC-CU-id</i>]:[<i>LDKC-CU-id</i>]][...]</p>	<p>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 148).</p> <p>When you specify variable <i>LDKC-CU-id</i>, you can narrow the range of LDKC:CU that control the volumes whose monitoring data are to be exported. <i>LDKC-CU-id</i> is an ID of an LDKC:CU. The colon (:) indicates a range. For example, 000:105 indicates LDKC:CU from 00:00 to 01:05.</p> <p>Ensure that the <i>LDKC-CU-id</i> value on the left of the colon is smaller than the <i>LDKC-CU-id</i> value on the right of the colon. For example, you can specify URLDEV 000:105, but you cannot specify URLDEV 105:000.</p>

Operand	Description
	If <i>LDKC-CU-id</i> 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 unit in short range. When statistics are exported to a ZIP file, the filename is <code>PHY_MPPK.ZIP</code> . For details on the statistics exported by this operand, see MP units (on page 141) .

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

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.

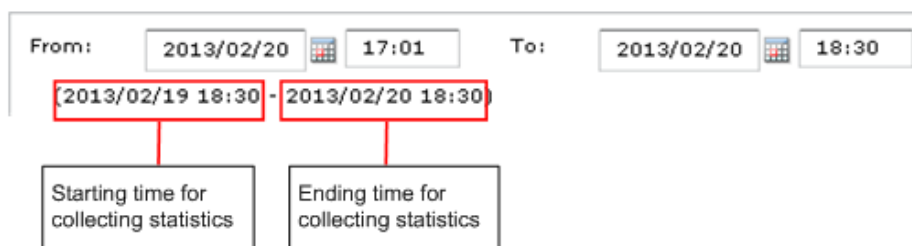
Syntax

```
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
<i>yyyyMMddhhmm</i>	<p><i>yyyyMMdd</i> indicates the year, the month, and the day. <i>hhmm</i> indicates the hour and the minute.</p> <p>If <i>yyyyMMddhhmm</i> is omitted on the left of the colon, the starting time for collecting monitoring data is assumed. If <i>yyyyMMddhhmm</i> is omitted on the right of the colon, the ending time for collecting monitoring data is assumed.</p>

Operand	Description
	To save monitoring data up to the sampling end time, omit <i>yyyyMMddhhmm</i> on the right of the colon. If you specify <i>yyyyMMddhhmm</i> 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.
<i>+hhmm</i>	Adds time (<i>hhmm</i>) to <i>yyyyMMddhhmm</i> if <i>yyyyMMddhhmm</i> is specified. For example, 201306230000+0130 indicates June 23, 2013. 01:30. Adds time to the starting time for collecting monitoring data, if <i>yyyyMMddhhmm</i> is omitted.
<i>-hhmm</i>	Subtracts time (<i>hhmm</i>) from <i>yyyyMMddhhmm</i> if <i>yyyyMMddhhmm</i> is specified. For example, 201306230000-0130 indicates June 22, 2013. 22:30. Subtracts time from the ending time for collecting monitoring data, if <i>yyyyMMddhhmm</i> is omitted. 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: <ul style="list-style-type: none"> ▪ 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

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

Monitoring Data	Operands of the group subcommand
Usage statistics about MPs and data recovery and reconstruction processors	PhyProc Long
Usage statistics about access paths and write pending rate	PhyMPU 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.

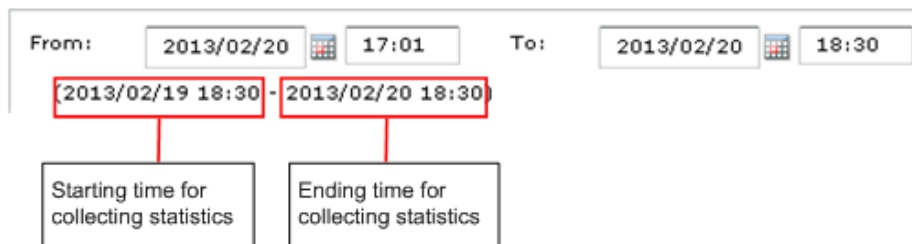
Syntax

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
<i>yyyyMMddhhmm</i>	<i>yyyyMMdd</i> indicates the year, the month, and the day. <i>hhmm</i> indicates the hour and the minute. If <i>yyyyMMddhhmm</i> is omitted on the left of the colon, the starting time for collecting monitoring data is assumed. If <i>yyyyMMddhhmm</i> is omitted on the right of the colon, the ending time for collecting monitoring data is assumed.
<i>+ddhhmm</i>	Adds time (<i>ddhhmm</i>) to <i>yyyyMMddhhmm</i> if <i>yyyyMMddhhmm</i> is specified. For example, 201301120000+010130 indicates Jan. 13, 2013. 01:30.

Operand	Description
	Adds time to the starting time for collecting monitoring data, if <i>yyyyMMddhhmm</i> is omitted.
<i>-ddhhmm</i>	<p>Subtracts time (ddhhmm) from <i>yyyyMMddhhmm</i> if <i>yyyyMMddhhmm</i> is specified. For example, 201301120000-010130 indicates Jan. 10, 2013. 22:30.</p> <p>Subtracts time from the ending time for collecting monitoring data, if <i>yyyyMMddhhmm</i> is omitted.</p> <p>Ensure that <i>mm</i> is 00, 15, 30, or 45. If you do not specify <i>mm</i> 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.</p>

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.

outpath

Description

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

Syntax

outpath [*path*]

Operands

Operand	Description
<i>path</i>	<p>Specifies the directory in which files will be saved.</p> <p>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, \\ .</p> <p>If the specified directory does not exist, this subcommand creates a directory that has the specified name.</p> <p>If this operand is omitted, the current directory is assumed.</p>

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.

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

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 \(on page 92\)](#) to log in 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.
- 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 ={ <i>m</i> off }	<p>To start monitoring, specify the sampling interval (interval of collecting statistics) of monitoring data at <i>m</i>. Specify a value between 1 and 15 in minutes.</p> <p>The sampling interval in long range is fixed to 15 minutes. <i>m</i> is the sampling interval in short range monitoring by Performance Monitor.</p> <p>To end monitoring, specify off.</p> <p>If this operand is omitted, the set subcommand does not make settings for starting or ending monitoring.</p>

Examples

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

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

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

```
svpip 158.214.135.57 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-classpathclass-pathrproperty-parameterssanproject.getexptool.RJElMain`

Operands

Operand	Description
<i>class-path</i>	Specifies the path to the class file of Export Tool. The path must be enclosed in double quotation marks (").

Operand	Description
<p><i>property-parameters</i></p>	<p>You can specify the following parameters. At minimum you must specify <code>-Dmd.command</code>.</p> <ul style="list-style-type: none"> ▪ -Dhttp.proxyHost= <i>host-name-of-proxy-host</i>, or -Dhttp.proxyHost=<i>IP-address-of-proxy-host</i> 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=<i>port-number-of-proxy-host</i> 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=<i>VM-heap-size-when-ExportTool-starts</i> (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=<i>path-to-command-file</i> Specifies the path to the command file ▪ -Dmd.logpath=<i>path-to-log-file</i> 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=<i>name-of-log-file</i> Specifies the name of the log file. If this parameter is omitted, log files are named <code>exportMMddHHmmss.log</code>. MMddHHmmss indicates when Export Tool runs. For example, the log file <code>export0101091010.log</code> contains log information about the Export Tool execution at Jan. 1, 09:10:10.

Operand	Description
	<ul style="list-style-type: none"> <li data-bbox="586 254 1029 285">▪ -Dmd.rmitimeout=<i>timeout(min.)</i> <p data-bbox="623 302 1406 365">Specifies the timeout value for communication between Export Tool and the SVP:</p> <ul style="list-style-type: none"> <li data-bbox="623 390 906 417">• Default: 20 minutes <li data-bbox="623 438 906 466">• Minimum: 1 minute <li data-bbox="623 487 1109 514">• Maximum: 1,440 minutes (24 hours) <p data-bbox="623 539 1414 774">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.</p> <ul style="list-style-type: none"> <li data-bbox="586 800 1109 831">▪ -Del.logpath=<i>log-output-directory-name</i> <p data-bbox="623 848 1414 947">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 <code>log</code>.</p> <ul style="list-style-type: none"> <li data-bbox="586 972 935 1003">▪ -Del logfile=<i>log-file-name</i> <p data-bbox="623 1020 1414 1255">Specify the name of the log file generated when Export Tool was downloaded. By default, <code>loaderMMddHHmmss.log</code> is set. <i>MM</i> is the month, <i>dd</i> is the date, and <i>HH</i> is the hour, <i>mm</i> is minutes, and <i>ss</i> 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.</p>

Operand	Description
	<ul style="list-style-type: none"> <li data-bbox="586 254 1243 285">▪ -Del.mode=<i>startup-mode-of-Export-Tool</i> (all/delete) <p data-bbox="623 302 1378 365">Specify the startup mode of Export Tool. The following shows startup modes and their behavior.</p> <ul style="list-style-type: none"> <li data-bbox="623 390 776 417">• Mode: all <ul style="list-style-type: none"> <li data-bbox="662 438 989 466">Download Export Tool: Yes <li data-bbox="662 487 911 514">Run Export Tool: Yes <li data-bbox="662 535 1305 562">Delete temporary directories in the lib directory: Yes <li data-bbox="623 583 824 611">• Mode: delete <ul style="list-style-type: none"> <li data-bbox="662 636 979 663">Download Export Tool: no <li data-bbox="662 684 902 711">Run Export Tool: no <li data-bbox="662 732 1305 760">Delete temporary directories in the lib directory: Yes <ul style="list-style-type: none"> <li data-bbox="586 785 1192 816">▪ (VSP 5000 series) -Del.security=<i>{ignore verify}</i> <p data-bbox="623 837 1330 900">Specify the settings to disable or enable use of the server verification for the SSL communications.</p> <ul style="list-style-type: none"> <li data-bbox="623 926 1357 953">• ignore: Specifying ignore disables the server verification. <p data-bbox="662 974 1382 1073">The server verification can be performed, however, even if the verification cannot be performed, the Export Tool processing will not be suspended. ignore is set by default.</p> <li data-bbox="623 1094 1330 1121">• verify: Specifying verify enables the server verification. <p data-bbox="662 1142 1386 1276">If this operand is omitted, ignore will be set. If you specify a character string other than ignore and verify, the following message appears and the Export Tool processing will be suspended: Invalid value : "Del.security = nn"</p>

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 :

- The sampling intervals are 1 to 15 minutes and 15 minutes for Short Range and Long Range, respectively.

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 128) Parity group and external volume group statistics (on page 132)
Select Logical Devices (Base) from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 128) Statistics for volumes in parity/external volume groups (on page 133) Volumes in parity groups or external volume groups (at volumes controlled by a particular CU) (on page 135)

GUI operation	Monitoring data
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 143)
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 148)
Select Access Path from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 128)
Select Cache from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 128)
Select Controller from Object list in Performance Objects field in Monitor Performance window.	Resource usage and write-pending rate statistics (on page 128) MP units (on page 141)
Select Fibre Port from Object list in Performance Objects field in Monitor Performance window.	Port statistics (on page 137)
Select iSCSI Port from Object list in Performance Objects field in Monitor Performance window.	Port statistics (on page 137)
Select Mainframe Fibre Port from Object list in Performance Objects field in Monitor Performance window.	Port statistics (on page 137)
Select LUN Base from Object list in Performance Objects field in Monitor Performance window.	Volumes (LU) statistics (on page 139)
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 143)
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 147)
Select WWN from Object list in Performance Objects field in Monitor Performance window.	Host bus adapters connected to ports statistics (on page 139) All host bus adapters connected to ports (on page 140)

GUI operation	Monitoring data
Select Journal from Object list in Performance Objects field in Monitor Performance window.	Remote copy by UR and URz (at journals) (on page 146)
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 142)
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 145)

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	Usage rates for parity groups in long range and short range, respectively (%).
PhyLDEV_dat.ZIP	PHY_Long_LDEV_x-y.csv and PHY_Short_LDEV_x- y.csv	Usage rates for volumes in a parity group in long range and short range, respectively (%).
	PHY_Short_LDEV_SI_x- y.csv	Usage rates for ShadowImage and ShadowImage for Mainframe volumes in a parity group in short range (%).
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 (KB/s).
	PHY_ExG_Read_Response.csv	This file includes the average read response time for the volume groups including external storage volumes (milliseconds).
	PHY_ExG_Write_Response.csv	This file includes the average write response time for the volume groups including external storage volumes (milliseconds).

ZIP file	CSV file	Data saved in the file
	PHY_ExG_Read_Trans.csv	This file includes the amount of read transferred data for volume groups including external storage volumes (KB/s).
	PHY_ExG_Write_Trans.csv	This file includes the amount of write transferred data for volume groups including external storage volumes (KB/s).
PhyExLDEV_dat/ PHY_ExLDEV_Resp onse.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 (KB/s).
PhyExLDEV_dat/ PHY_ExLDEV_Read_ Response.ZIP	PHY_ExLDEV_Read_Respons e_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_Respons e_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 (KB/s).
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 (KB/s).
PhyProc_dat.ZIP	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.
PhyCMPK_dat.ZIP	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.

ZIP file	CSV file	Data saved in the file
	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 units and CM packages in long range.
	PHY_Short_MPPCB_CMPK.csv	Usage rates for access paths between MP units 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 unit.
	PHY_Short_Write_Pending_Rate_z.csv	Write pending rates in short range in each MP unit.
	PHY_Short_Cache_Usage_Rate_z.csv	Usage rates for cache memory in each MP unit.
	PHY_Cache_Allocate_z.csv	The allocated size of the cache memory in each MP unit (MB). 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 unit.
PhyMPU_dat.ZIP (VSP 5000 series)	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.

ZIP file	CSV file	Data saved in the file
	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 unit.
	PHY_Short_Write_Pending_Rate_z.csv	Write pending rates in short range in each MP unit.
	PHY_Short_Cache_Usage_Rate_z.csv	Usage rates for cache memory in each MP unit.
	PHY_Cache_Allocate_z.csv	The allocated size of the cache memory in each MP unit (MB) This value does not correspond to the total capacity of cache because the value is the same as the allocated size of the cache memory that is managed by an MP unit.
	PHY_Long_HIE_ISW.csv	Usage rates of access path between HIEs and ISWs in long range.
	PHY_Long_MPU_HIE.csv	Usage rates of access path between MP units and HIEs in long range.
	PHY_Short_HIE_ISW.csv	Usage rates of access path between HIEs and ISWs in short range.
	PHY_Short_MPU_HIE.csv	Usage rates of access path between MP units and HIEs in short range.
PhyMPU_dat.ZIP (VSP E series) (VSP G130, G/F350, G/F370, G/F700, G/F900)	PHY_Cache_Usage_Rate.csv	Usage rates for cache memory in the entire system.
	PHY_Write_Pending_Rate.csv	Write pending rates in the entire system.
	PHY_Cache_Usage_Rate_z.csv	Usage rates for cache memory in each MP unit.
	PHY_Write_Pending_Rate_z.csv	Write pending rates in each MP unit.
	PHY_Cache_Allocate_z.csv	The allocated size of the cache memory in each MP unit (MB) This value does not correspond to the total capacity of cache because the value is the same as the allocated size of the cache memory that is managed by an MP unit.
<ul style="list-style-type: none"> ▪ 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 unit. 		

ZIP file	CSV file	Data saved in the file
<ul style="list-style-type: none"> Both long range and short range statistics are stored for resource usage and write pending rates. 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 (KB/s)
	PG_Read_TransRate.csv	Size of read data transferred per second (KB/s)
	PG_Write_TransRate.csv	Size of write data transferred per second (KB/s)
	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	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	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	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	

ZIP file	CSV file	Data saved in the file
	PG_CFW_Write_Hit.csv	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
	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 (KB/s)
LDEV_dat/ LDEV_Read_TransRate.ZIP	LDEV_Read_TransRate_x-y.csv	Size of read data transferred per second (KB/s)

ZIP file	CSV file	Data saved in the file
LDEV_dat/ LDEV_Write_TransRate.ZIP	LDEV_Write_TransRate_x-y.csv	Size of write data transferred per second (KB/s)
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
LDEV_dat/ LDEV_CFW_Read_IOPS.ZIP	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	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	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	LDEV_CFW_Write_Hit_x-y.csv	Write hit ratio in "cache-fast-write" mode

ZIP file	CSV file	Data saved in the file
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
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_TransRatexx.csv	The size of read data transferred per second (KB/s)
LDEVEachOfCU_dat/ LDEV_Write_TransRate.ZIP	LDEV_Write_TransRatexx.csv	The size of write data transferred per second (KB/s)

ZIP file	CSV file	Data saved in the file
LDEVEachOfCU_dat/ LDEV_Read_Response.ZIP	LDEV_Read_Responsexx.csv	The average read response time (microseconds) at volumes
LDEVEachOfCU_dat/ LDEV_Write_Response.ZIP	LDEV_Write_Responsexx.csv	The average write response time (microseconds) at volumes
LDEVEachOfCU_dat/ LDEV_IOPS.ZIP	LDEV_IOPSxx.csv	The number of read and write operations per second
LDEVEachOfCU_dat/ LDEV_TransRate.ZIP	LDEV_TransRatexx.csv	The size of data transferred per second (KB/s)
LDEVEachOfCU_dat/ LDEV_Read_IOPS.ZIP	LDEV_Read_IOPSxx.csv	The number of read operations per second
LDEVEachOfCU_dat/ LDEV_Seq_Read_IOPS.ZIP	LDEV_Seq_Read_IOPSxx.csv	The number of sequential read operations per second
LDEVEachOfCU_dat/ LDEV_Rnd_Read_IOPS.ZIP	LDEV_Rnd_Read_IOPSxx.csv	The number of random read operations per second
LDEVEachOfCU_dat/ LDEV_CFW_Read_IOPS.ZIP	LDEV_CFW_Read_IOPSxx.csv	The number of read operations in "cache-fast-write" mode per second
LDEVEachOfCU_dat/ LDEV_Write_IOPS.ZIP	LDEV_Write_IOPSxx.csv	The number of write operations per second
LDEVEachOfCU_dat/ LDEV_Seq_Write_IOPS.ZIP	LDEV_Seq_Write_IOPSxx.csv	The number of sequential write operations per second
LDEVEachOfCU_dat/ LDEV_Rnd_Write_IOPS.ZIP	LDEV_Rnd_Write_IOPSxx.csv	The number of random write operations per second
LDEVEachOfCU_dat/ LDEV_CFW_Write_IOPS.ZIP	LDEV_CFW_Write_IOPSxx.csv	The number of write operations in "cache-fast-write" mode per second
LDEVEachOfCU_dat/ LDEV_Read_Hit.ZIP	LDEV_Read_Hitxx.csv	The read hit ratio
LDEVEachOfCU_dat/ LDEV_Seq_Read_Hit.ZIP	LDEV_Seq_Read_Hitxx.csv	The read hit ratio in sequential access mode
LDEVEachOfCU_dat/ LDEV_Rnd_Read_Hit.ZIP	LDEV_Rnd_Read_Hitxx.csv	The read hit ratio in random access mode
LDEVEachOfCU_dat/ LDEV_CFW_Read_Hit.ZIP	LDEV_CFW_Read_Hitxx.csv	The read hit ratio in "cache-fast-write" mode
LDEVEachOfCU_dat/ LDEV_Write_Hit.ZIP	LDEV_Write_Hitxx.csv	The write hit ratio

ZIP file	CSV file	Data saved in the file
LDEVEachOfCU_dat/ LDEV_Seq_Write_Hit.ZIP	LDEV_Seq_Write_Hitxx.csv	The write hit ratio in sequential access mode
LDEVEachOfCU_dat/ LDEV_Rnd_Write_Hit.ZIP	LDEV_Rnd_Write_Hitxx.csv	The write hit ratio in random access mode
LDEVEachOfCU_dat/ LDEV_CFW_Write_Hit.ZIP	LDEV_CFW_Write_Hitxx.csv	The write hit ratio in "cache-fast-write" mode
LDEVEachOfCU_dat/ LDEV_BackTrans.ZIP	LDEV_BackTransxx.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_Transxx.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_Transxx.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_Transxx.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_Responsexx.csv	The average response time (microseconds) at volumes
<p>Note: The letters "xx" in CSV filenames indicate a CU number. For example, if the filename is <code>LDEV_IOPS_10.csv</code>, the file contains the I/O rate (per second) of the volumes controlled by the CU whose image number is 10.</p>		

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 Target ports
	Port_KBPS.csv	The size of data transferred per second at Target ports (KB/s)
	Port_Response.csv	The average response time (microseconds) at Target ports
	Port_Initiator_IOPS.csv	The number of read and write operations per second at Initiator port
	Port_Initiator_KBPS.csv	The size of data transferred per second at Initiator port (KB/s)
	Port_Initiator_Response.csv	The average response time (microseconds) at Initiator port

Files with statistics about mainframe ports

ZIP file	CSV file	Data saved in the file
MF_Port_data.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 KB/s)
	MF_Port_Read_KBPS.csv	Read data transfer amount per port (in KB/s)
	MF_Port_Write_KBPS.csv	Write data transfer amount per port (in KB/s)
	MF_Port_Avr_CMV.csv	Average CMV processing time (in microseconds)
	MF_Port_Avr_DisconnectTime.csv	Average disconnection time (in microseconds)
	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 (KB/s) 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
<p>Notes:</p> <ul style="list-style-type: none"> ▪ The letters "xx" in CSV filenames indicate a port name. For example, if the filename is <code>PortWWN_1A_IOPS.csv</code>, 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, <code>PortWWN_1A_IOPS-1.csv</code> and <code>PortWWN_1a_IOPS-2.csv</code>). 		

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
	LU_TransRate.csv	The size of data transferred per second (KB/s)
	LU_Read_TransRate.csv	The size of read data transferred per second (KB/s)
	LU_Write_TransRate.csv	The size of write data transferred per second (KB/s)
	LU_Read_Response.csv	The average read response time (microseconds)
	LU_Write_Response.csv	The average write response time (microseconds)

ZIP file	CSV file	Data saved in the file
	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 (KB/s) for HBAs belonging to an SPM group

ZIP file	CSV file	Data saved in the file
	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 (KB/s) 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 units

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
PhyProcDetail_dat. ZIP	PHY_MPU_x.y. csv	<p>The MP usage rate of each resource allocated to MP units in short range is output in the following formats:</p> <ul style="list-style-type: none"> ▪ 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 <p>You can view up to 100 of the most used items in order of use.</p>

ZIP file	CSV file	Data saved in the file
		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	<p>The following data in the whole volumes are saved:</p> <ul style="list-style-type: none"> ▪ 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 ▪ The number of initial copy remote I/Os ▪ The average response time (milliseconds) for initial copy ▪ The average transfer rate (KB/s) for initial copy remote I/Os ▪ The number of update copy remote I/Os ▪ The average transfer rate (KB/s) 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. Note that this data cannot be obtained from a mainframe 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 (KB/s) for initial copy remote I/Os
	RCLU_Initial_Copy_Response.csv	The average response time (milliseconds) for the initial copy of each volume (LU)
	RCLU_Update_Copy_RIO.csv	The number of update copy remote I/Os
	RCLU_Update_Copy_Transfer.csv	The average transfer rate (KB/s) 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
RCLDEV_dat/ RCLDEV_Initial_Copy_Transfer.ZIP	RCLDEV_Initial_Copy_Transfer_xx.csv	The average transfer rate (KB/s) 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 (KB/s) 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

ZIP file	CSV file	Data saved in the file
<p>Note:</p> <ul style="list-style-type: none"> 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	<p>The following data in the whole volumes are saved:</p> <ul style="list-style-type: none"> The number of write I/Os per second The amount of data that are written per second (KB/s) The initial copy hit rate (percent) The average transfer rate (KB/s) 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 (KB/s) 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 (KB/s) 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

ZIP file	CSV file	Data saved in the file
	URJNL_R-JNL_Asynchronous_Copy_Transfer.csv	The average transfer rate* (KB/sec) for journal data received in the secondary storage system
	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. Note that this data cannot be obtained from a mainframe 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_x x.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
<p>Note: The letters "xx" in CSV filenames indicate a CU number. For example, if the filename is <code>URLDEV_Read_Record_10.csv</code>, the file contains the number of read I/Os (per second) of the volumes controlled by the CU whose image number is 10.</p>		

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).	<p>The value (-1) indicates that Performance Monitor failed to obtain monitoring data. Probable reasons are:</p> <ul style="list-style-type: none"> ▪ 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. ▪ There is no volume in a parity group.

Invalid values of monitoring data	Probable causes
	<ul style="list-style-type: none"> ▪ 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 142), Remote copy by UR and URz (whole volumes) (on page 145), and Remote copy by UR and URz (at journals) (on page 146). ▪ If no CU is specified as a monitoring target, the value (-1) is displayed as the monitoring data. ▪ 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). ▪ 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. ▪ 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. ▪ If all CU numbers are not the monitoring target, the value (0) is displayed as the monitoring data. ▪ 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).	<p>The value (-3) indicates that Performance Monitor failed to obtain monitoring data for the following reason:</p> <p>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.</p>
The monitoring data in the CSV file includes (-4).	<p>The value (-4) indicates that Performance Monitor failed to obtain monitoring data for the following reason:</p> <p>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).</p>

Invalid values of monitoring data	Probable causes
<p>The monitoring data in the CSV file includes "-5".</p>	<p>When the CU number is not the monitoring target object, Performance Monitor cannot obtain monitoring data from the CU.</p> <p>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).</p> <p>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.</p>

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 (SPM) 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 on 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.

If you want to use Server Priority Manager to control the I/O priority for iSCSI-attached volumes, you must use CCI to issue SPM commands to the volumes (LDEVs). Also, if you want to use SPM to control the I/O priority for individual FC-attached volumes, you must use CCI to issue SPM commands to the volumes. When you use CCI to issue SPM commands to volumes, you can specify an LDEV and a WWN or iSCSI name of a host adapter.



Caution: Within a single storage system, you can use only one of the following SPM methods to set the I/O priority level:

- Specifying ports (GUI or CLI)
- or
- Specifying LDEVs (CLI only)

For details about using CCI to perform SPM operations, see the *Command Control Interface Command Reference*.

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.

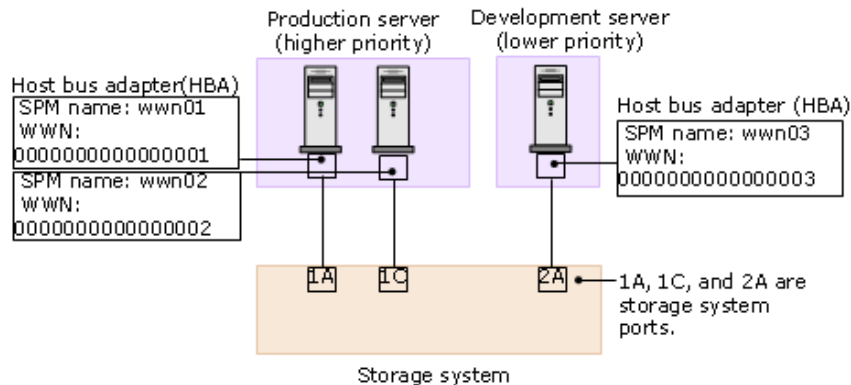
If you also set a threshold of 20 MB per second to the storage system, the upper-limit controls for development servers are disabled when the amount of data transferred between the storage system and the production servers is less than 20 MB per second.

Use cases for Server Priority Manager

There are many 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.



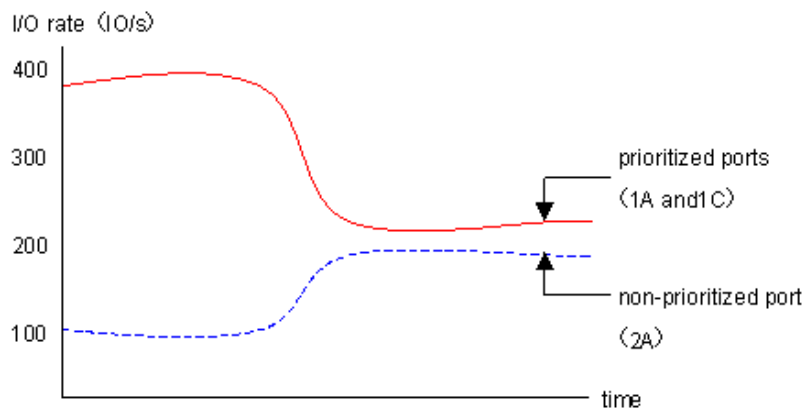
In Network A, ports 1A and 1C are connected to high-priority production servers. Port 2A is connected to a low-priority development server. Therefore, high priority (Prio.) is set to ports 1A and 1C, and low priority (Non-Prio.) is set to port 2A. The following figure shows the priority settings for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

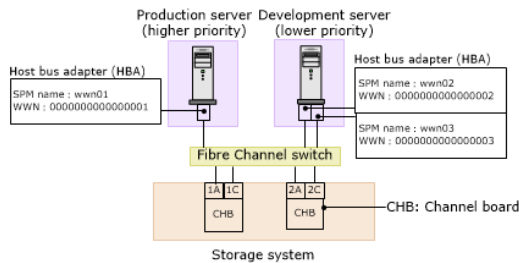
In Network A, if you set a threshold of 500 IO/s to the storage system, the upper limit on the non-prioritized port (2A) is disabled when the sum of the I/O rates for all prioritized ports (1A and 1C) falls below 500 IO/s.

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	<p>When thresholds are set on multiple prioritized ports, depending on the transfer rate, the following controls are executed:</p> <ul style="list-style-type: none"> 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.

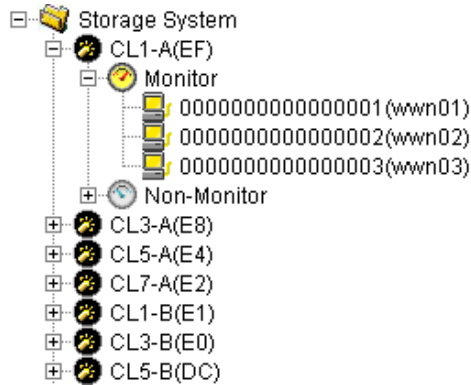


Before using Server Priority Manager, you must find the WWN (Worldwide Name) of each host bus adapter in host servers. WWNs are 16-digit hexadecimal numbers used to identify host bus adapters. For details on how to find WWNs, see the *Provisioning Guide*.

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).

WWN	SPM Name	Group	Per P...				Attribute
			A...	M...	Av...	M...	
0000000000000001	wwn01	group-1	15	20	65	70	Prio.
0000000000000002	wwn02	group-2	16	21	115	120	Non-Prio.
0000000000000003	wwn03	group-3	17	22	165	170	Non-Prio.

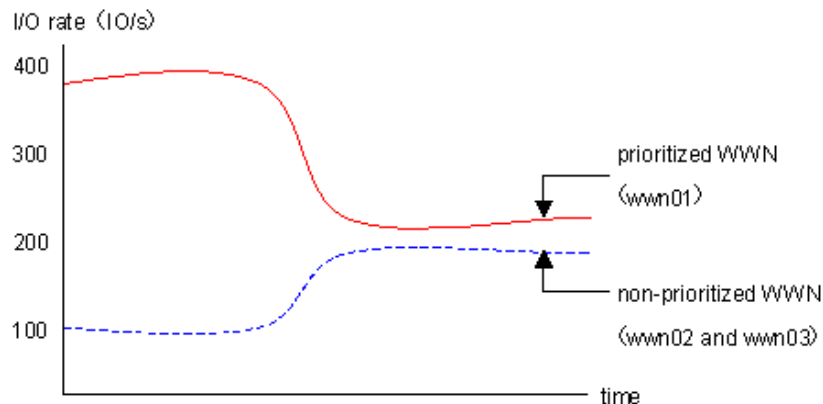
The term prioritized WWN refers to a high-priority host bus adapter (for example, wwn01). The term non-prioritized port refers to a low-priority host bus adapter (for example, wwn02 and wwn03).

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 ($200 \times 4 \times 0.90$). 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.

WWN	SPM Name	Pe...	W...	Attribute	Upper	
					IOPS	MB/s
000000000000000001	wwn01	i...	15206570	Prio.	0	-
000000000000000002	wwn02	j...	1621	Non-Prio.	720	-
000000000000000003	wwn03	...	1722	Non-Prio.	720	-

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	<p>When thresholds are set to prioritized WWNs, depending on the I/O rate or the transfer rate, the following controls are executed.</p> <ul style="list-style-type: none"> ▪ 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

- **Using remote copy functions or global-active device**

The following restrictions apply when using remote copy functions (TrueCopy, TrueCopy for Mainframe, Universal Replicator, Universal Replicator for Mainframe) or global-active device.

Setting Server Priority Manager information for ports

- When you set Server Priority Manager information on the primary storage system, I/O requests issued on the primary storage system are not subject to the upper-limit control, and I/Os are not limited.
- When setting Server Priority Manager information on the secondary storage system, if you specify ports as prioritized ports on the secondary storage system using Server Priority Manager, all I/O requests received by the ports are subject to the threshold control, and its performance data is added.
- When setting Server Priority Manager information on the secondary storage system, even if you specify ports as non-prioritized ports on the secondary storage system using Server Priority Manager, I/O requests received by the ports are not subject to the upper-limit control, and I/Os are not limited.

Setting Server Priority Manager information for WWNs

- When you set Server Priority Manager information on the primary storage system, I/O requests issued on the primary storage system are not subject to the upper-limit control, and I/Os are not limited.
- When setting Server Priority Manager information on the secondary storage system, if you specify WWNs of host bus adapters as prioritized WWNs on the primary storage system using Server Priority Manager, all I/O requests received from the WWNs are subject to the threshold control, and its performance data is added.
- When setting Server Priority Manager information on the secondary storage system, even if you specify WWNs of host bus adapters as non-prioritized WWNs on the primary storage system using Server Priority Manager, I/O requests received from the host bus adapters on the primary storage system are not subject to the upper-limit control, and I/Os are not limited.

- **Using Universal Volume Manager**

The following restrictions apply when using Universal Volume Manager.

- **Setting Server Priority Manager information for ports**

- When you set Server Priority Manager information on the local storage system, I/O requests issued on the local storage system are not subject to the upper-limit control, and I/Os are not limited.
 - When setting Server Priority Manager information on the external storage system, if you specify ports as prioritized ports on the local storage system using Server Priority Manager, all I/O requests received by the ports are subject to the threshold control, and its performance data is added.
 - When setting Server Priority Manager information on the external storage system, even if you specify ports as non-prioritized ports on the local storage system using Server Priority Manager, I/O requests received by the ports on the local storage system are subject to the upper-limit control, and I/Os are limited.

- **Setting Server Priority Manager information for WWNs**

- When you set Server Priority Manager information on the local storage system, I/O requests issued on the local storage system are not subject to the upper-limit control, and I/Os are not limited.
 - When setting Server Priority Manager information on the external storage system, if you specify WWNs of host bus adapters as prioritized WWNs on the local storage system using Server Priority Manager, all I/O requests received from the WWNs are subject to the threshold control, and its performance data is added.
 - When setting Server Priority Manager information on the external storage system, even if you specify WWNs of host bus adapters as non-prioritized WWNs on the local storage system using Server Priority Manager, I/O requests received from the host bus adapters on the local storage system are not subject to the upper-limit control, and I/Os are 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.

- **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.

- **Enabling secondary windows on Device Manager - Storage Navigator**

Secondary windows must be enabled before you use Server Priority Manager. Java and some settings of Device Manager - Storage Navigator are required for the secondary windows.

For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*

- **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
LDEV (FC and iSCSI)	Set Server Priority Manager information	No	Yes	raidcom modify spm_ldev
	Delete Server Priority Manager information	No	Yes	raidcom delete spm_ldev
	Get Server Priority Manager information	No	Yes	raidcom get spm_ldev
* For details, see <i>Command Control Interface User and Reference Guide</i> .				

When you perform one or more of the following operations, the upper limit value control might be disabled for about two minutes:

- Changing the system configuration
- Updating the microcode
- Replacing controllers

- Replacing MP unit
- Adding, replacing, or removing the front-end module
- 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 5000 series) 80 ¹ (VSP E series) 80 ¹ (VSP G130, G/F350, G/F370, G/F700, G/F900)	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	512
	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 ²
	Number of WWNs that can be registered for a storage system	Not supported	2,048 ³
	Number of iSCSI names that can be registered for a storage system	Not supported	2,048 ³
	Number of WWNs that can be registered for an LDEV	Not supported	32 ⁴
	Number of iSCSI names that can be registered for an LDEV	Not supported	32 ⁴

Item	Description	Registration number	
		Device Manager - Storage Navigator	CCI
Notes:			
<ol style="list-style-type: none"> 1. If the number of ports installed in a storage system is less than 192 or 80 , the maximum number of ports that can be registered is the number of ports installed in a storage system. 2. 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. 3. The maximum number of WWNs and iSCSI names for a storage system is 2,048. 4. The maximum total number of WWNs and iSCSI names for an LDEV is 32. <p>Note: This limit of 32 applies only to SPM, not to QoS operations.</p>			

Implementing Server Priority Manager: one-to-one connections

You can implement Server Priority Manager for one-to-one connections. See the following workflows for Server Priority Manager 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 \(on page 182\)](#).
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 \(on page 169\)](#).
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 \(on page 26\)](#).
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 \(on page 169\)](#).

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 \(on page 170\)](#).
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 \(on page 172\)](#).


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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 \(on page 33\)](#).
To export the traffic statistics (as text in CSV format) for analysis in other applications, see [Using Export Tool \(on page 74\)](#).

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 \(on page 153\)](#).

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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 \(on page 153\)](#).


Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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

You can implement Server Priority Manager for many-to-many connections. See the following workflows for Server Priority Manager 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*.
2. If desired, assign names to the WWNs for ease of identification. For details, see [Changing the SPM name of a host bus adapter \(on page 182\)](#).

3. If you want to manage multiple host bus adapters as a single group, create SPM groups. For details, see [Creating an SPM group \(on page 186\)](#).
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 \(on page 174\)](#).
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 \(on page 26\)](#).
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 \(on page 178\)](#).
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 \(on page 179\)](#).
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 \(on page 181\)](#).

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 \(on page 187\)](#).

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 \(on page 175\)](#) 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 \(on page 187\)](#).

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 \(on page 179\)](#).

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 \(on page 25\)](#).


Monitoring all port-HBA traffic: many-to-many connections

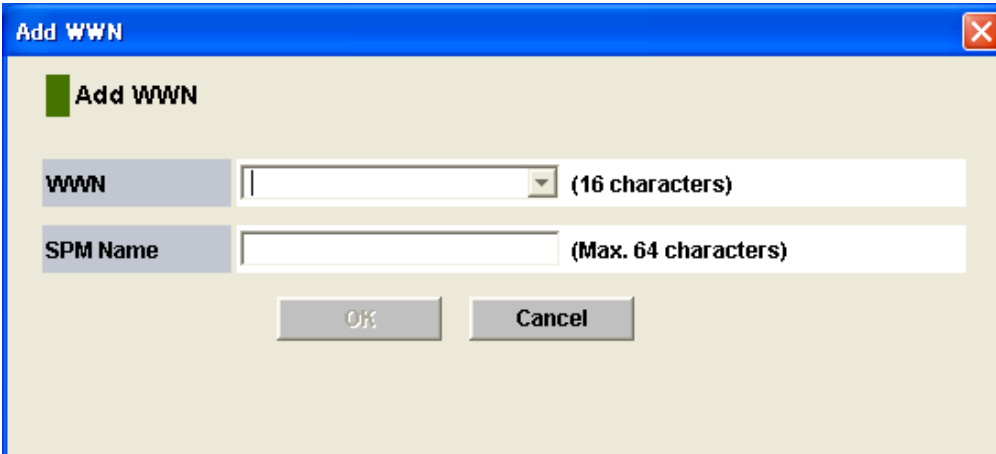
When many-to-many connections are established between HBAs and ports, you must make sure that all traffic between HBAs and ports is monitored.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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*.

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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 \(on page 187\)](#).
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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 [About SPM groups \(on page 185\)](#).
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.

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 [About SPM groups \(on page 185\)](#).



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 \(on page 188\)](#).




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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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.

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 secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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 (HBAs)

Use Server Priority Manager to manage HBAs. You can add, delete, or give an easy-to-manage name to WWNs. You can also group HBAs for setting server priority by groups.

Before starting operations, verify the system requirements in [Requirements for using performance functions \(on page 16\)](#).

In addition, carefully review the system limitations and usage restrictions in [Cautions and restrictions for Server Priority Manager \(on page 161\)](#).

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 \(on page 175\)](#).

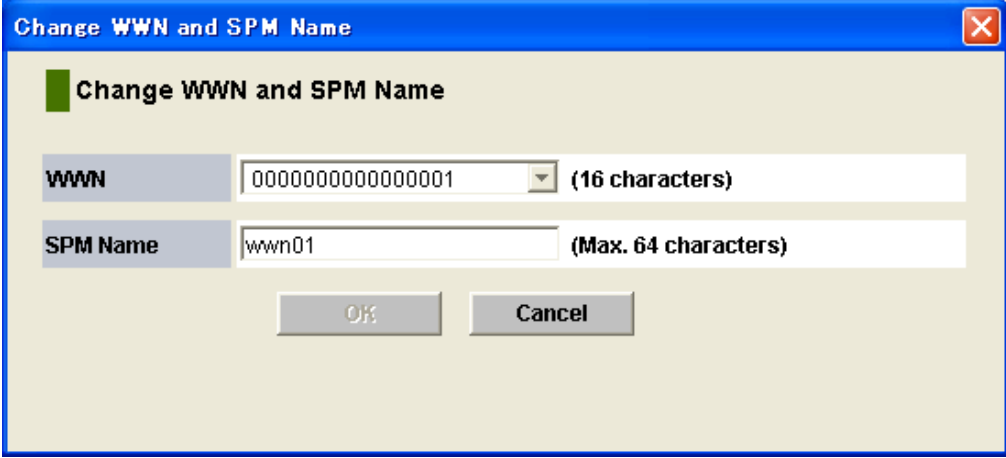
The following procedure describes how to change an SPM name that has been set.

Before you begin

- Required role: Storage Administrator (System Resource Management)
- You must enable the secondary windows on Device Manager - Storage Navigator. For instructions on enabling the secondary windows, see [Enabling the HDvM - SN secondary window \(on page 17\)](#). For details and requirements on using the secondary windows, see the *System Administrator Guide*.

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*. 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.

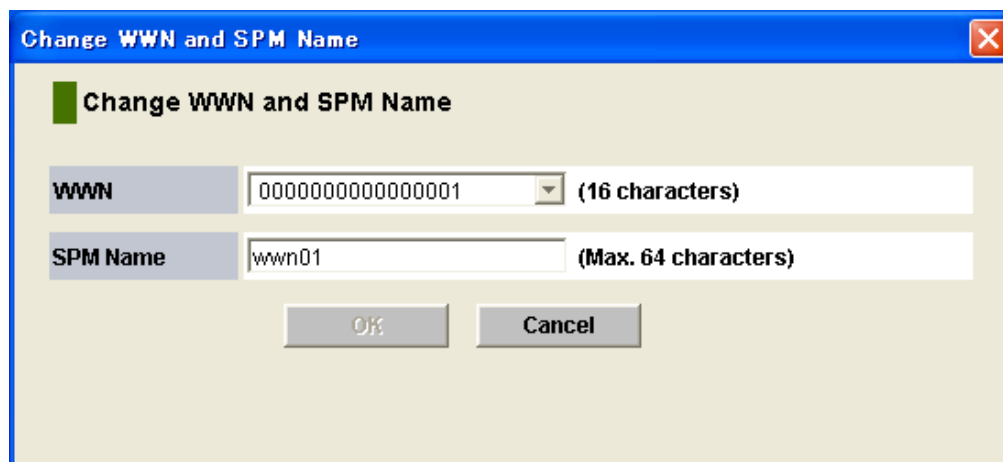
When you add a new host bus adapter rather than replacing one, the WWN of the new host bus adapter is automatically displayed below Non-Monitor for the connected port in the list.

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*.

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*.
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.

About 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 the 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 \(on page 161\)](#).

You can use SPM groups to switch priority of multiple HBAs from prioritized to non-prioritized, or vice versa. You can also use SPM groups 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 that belongs to the SPM group is the upper-limit value set for the SPM group divided by the number of HBAs that 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 ($200 \div 1$) 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 ($200 \div 2$) 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

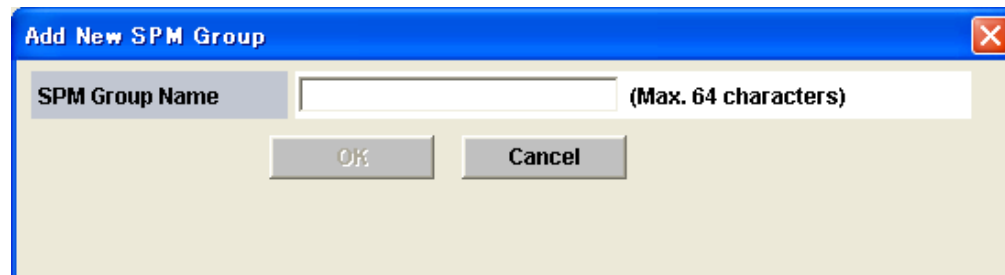
Before you begin


- Required role: Storage Administrator (System Resource Management)
- You must enable the Device Manager - Storage Navigator secondary window. For details, see the *System Administrator Guide*.

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

The following procedure describes how to delete an HBA that has been registered in an SPM group, from the 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*.

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 [About SPM groups \(on page 185\)](#).

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 **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*.


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 ().

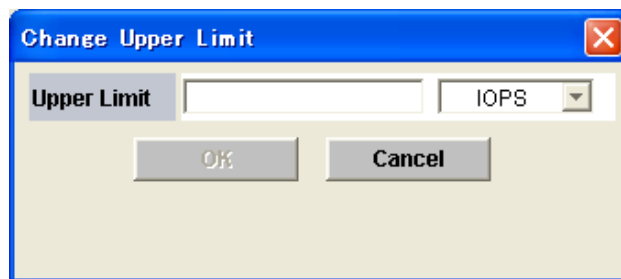
6. If you selected the **Storage System** folder, take the following steps:
 - Select **IOPS** or **MB/s** from the list at the upper-left corner of the list. Select **IOPS** if you want to assign an upper limit to the I/O rate. Select **MB/s** if you want to assign an upper limit to the transfer rate.
 - 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



The following procedure describes how to change an SPM group name that has been set.

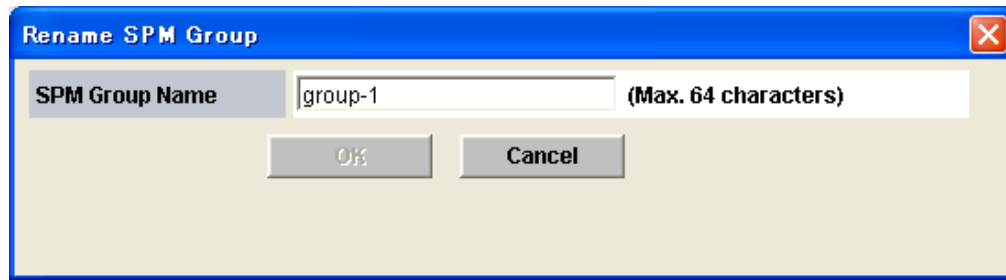
Before you begin

- 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 **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

The following procedure describes how to delete 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*.

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: Quality of Service operations

The Quality of Service (QoS) function enables you to set different performance levels (such as I/O rate and transfer rate) for individual volumes. By using the QoS function to control I/O processing for individual volumes, you can suppress performance interference among applications and provide a certain level of performance and quality.

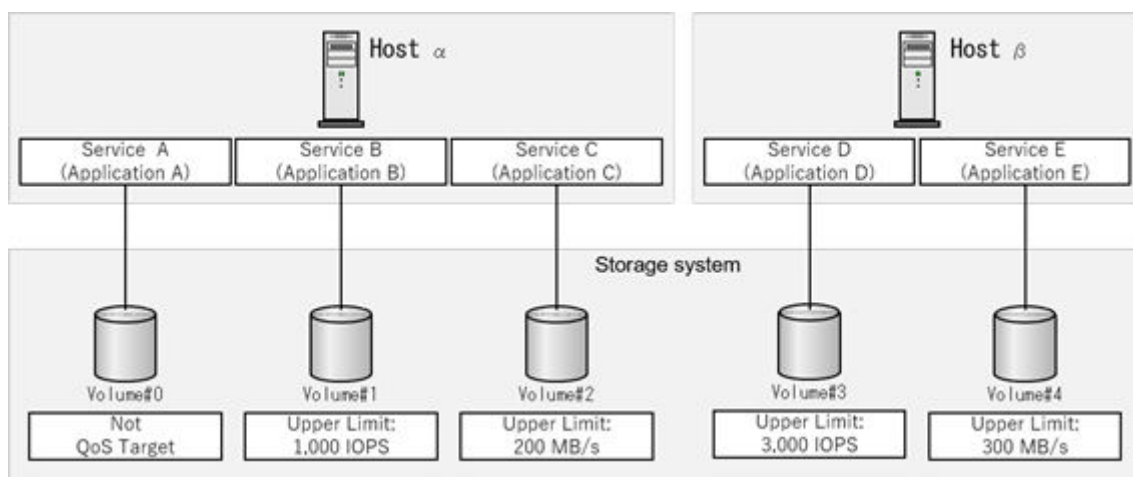
Overview of QoS operations

The QoS function provides the following functions:

- **Upper-limit control:** Controlling the performance upper limit for host I/O requests on the specified volumes
- **QoS monitor:** Displaying the performance information of the volumes subject to the QoS functionality
- **QoS alert:** Monitoring the threshold value for the volumes subject to the QoS functionality

For VSP G130, G/F350, G/F370, G/F700, G/F900, the following functions are also provided:

- **Lower-limit control:** Controlling the performance lower limit for host I/O requests on the specified volumes
- **Priority control:** Controlling the priority of the specified volumes



The QoS function is provided with SVOS RF 9.3 or later on VSP 5000 series (90-03-0x or later) and SVOS RF 9.4 or later on VSP G130, G/F350, G/F370, G/F700, G/F900 (88-06-0x or later). The QoS function is automatically installed on these storage systems, and then starts working on volumes on which the QoS function is enabled (QoS volumes).

You can set the QoS function only for open-system volumes. You cannot specify the QoS settings for command device volumes.

Purposes of QoS control

The following table lists and describes the possible purposes of QoS upper-limit control, lower-limit control, and priority control.

Type of QoS control	Purposes
Upper-limit control	<ul style="list-style-type: none"> ▪ Provides the upper-limit value of the throughput that a public cloud provider can provide to the tenant as one of the service requirements. ▪ When I/O requests are concentrated on certain volumes, the upper limit can be set for the throughput of those volumes. This enables suppressing degradation of the throughput of other volumes.
Lower-limit control	<ul style="list-style-type: none"> ▪ Provides a certain level of performance that a public cloud provider can provide to the tenant as one of the service requirements. ▪ Secures an appropriate throughput for individual volumes. ▪ The throughput can be suppressed for volumes for which the lower-limit value is exceeded, and the throughput can be prioritized for volumes for which the lower-limit value is not reached. This enables maintaining appropriate throughput for individual volumes.
Priority control	<ul style="list-style-type: none"> ▪ Provides a variation to service performances that a public cloud provider can provide to the tenant. ▪ Provides the priority for I/O processing on individual volumes.

QoS upper-limit control

QoS provides upper-limit control for individual volumes. When an I/O request is issued to a volume for which an upper-limit value is set, the storage system checks the average throughput of the volume for the last 1 second. If the throughput reached (or exceeded) the upper-limit value, the storage system stops I/O processing for the volume, although it continues to accept I/O requests from services. When the throughput falls below the upper-limit value, the storage system resumes I/O processing for the volume.

The QoS upper-limit control can be applied to the I/O rate, the transfer rate, or both. If the upper-limit control is applied to both the I/O rate and the transfer rate, I/O processing is suppressed when either the I/O rate or the transfer rate reaches the upper-limit value. You can set the following values for upper-limit control of volumes:

- I/O rate (IOPS): 100 to 2,147,483,647
- Transfer rate (MB/s): 1 to 2,097,151

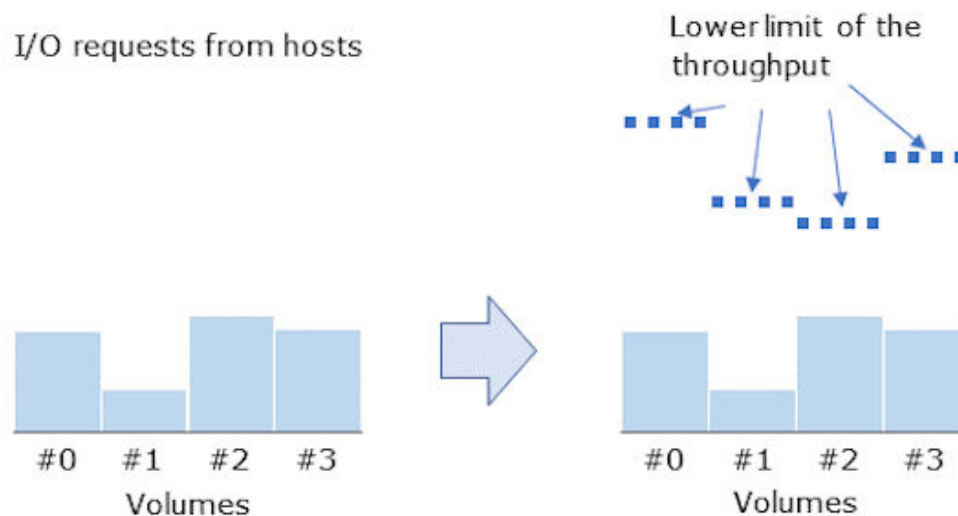
Caution: If you set a low upper-limit value compared to the actual I/O frequency, the I/O performance is degraded. Use the QoS monitor function to recognize the actual I/O frequency, and then change the upper-limit value to an appropriate value.

Note: The QoS function controls the upper limit only for the I/Os between hosts and the target volume. When the volume is an external volume or a pair volume for remote copy operations, the upper limit for the I/Os between the storage systems is not controlled.

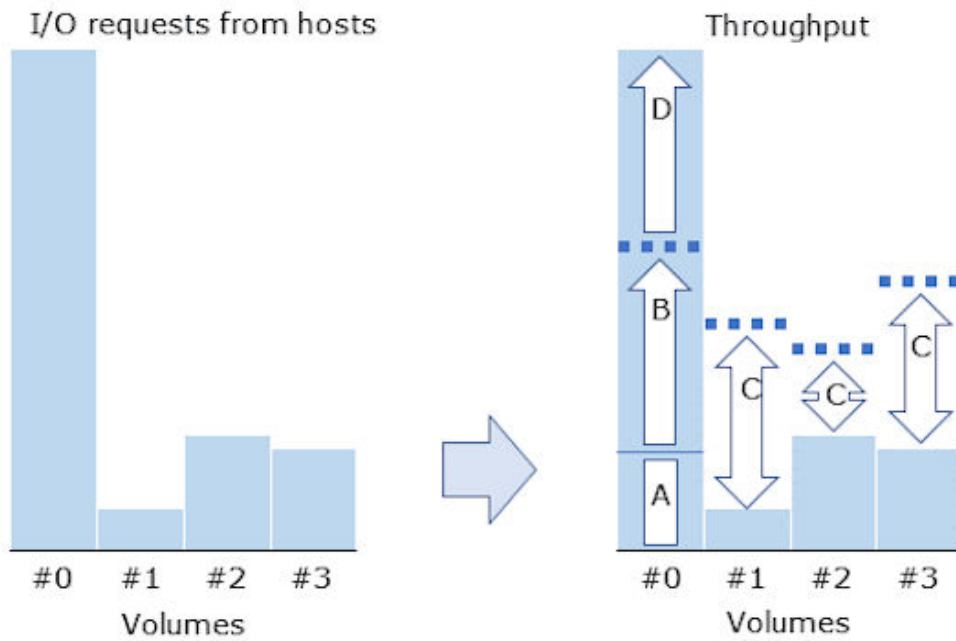
QoS lower-limit control (for VSP G130, G/F350, G/F370, G/F700, G/F900)

QoS provides lower-limit control for individual volumes to secure a certain level of performance (specified as the lower-limit value) for services that request I/Os. Set the lower-limit value for all volumes, where the value for each volume must be determined depending on the amount of I/Os.

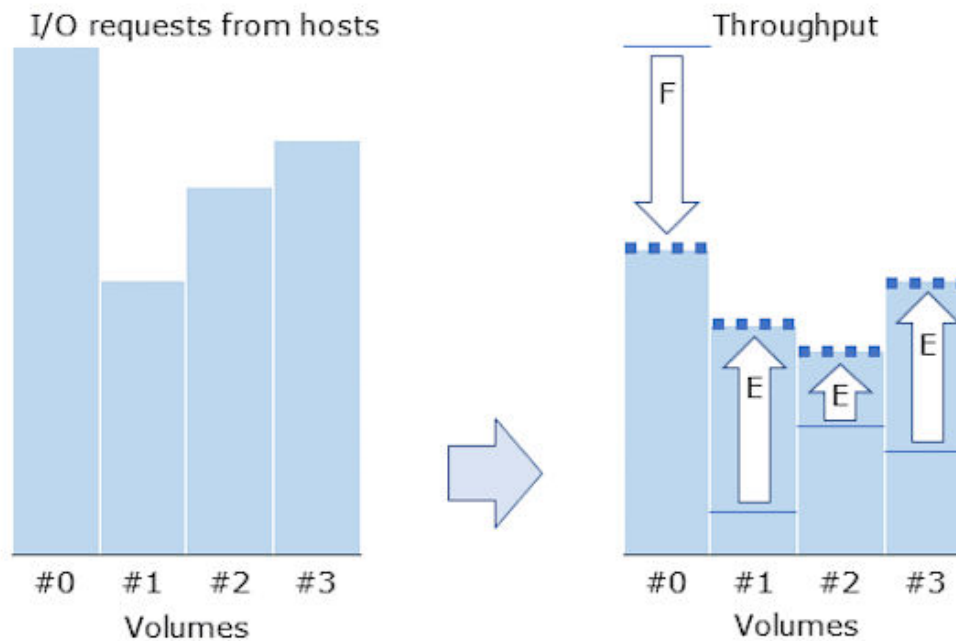
When there are few I/O requests from hosts on individual volumes (#0 to #3) as in the following figure, the lower limit control function does not work because it is not necessary.



In this condition, if I/O requests from hosts on a specific volume (for example, take the specific volume as volume #0 in the figure) increase and require the throughput no less than the lower limit value set for volume #0, the throughput is in the state of not satisfying the lower limit (as shown by A in the following figure). Therefore, this function controls assignment of the order of I/O processing so that I/O processing on volume #0 takes priority and the throughput of volume #0 satisfies the lower limit (as shown by B in the following figure). Furthermore, if there is enough room for the entire I/O processing (for example, there are few I/O requests from hosts on volumes #1 to #3, and the throughput of volumes #1 to #3 does not need to satisfy each lower limit (as shown by C in the following figure)), this function allows I/O processing on volume #0 even if the throughput becomes larger than the lower limit (as shown by D in the following figure).



In this condition, if I/O requests from hosts on volumes #1 to #3 also increase, this function controls assignment of the order of I/O processing so that I/O processing on volumes #1 to #3 takes priority and the throughput of volumes #1 to #3 satisfies each lower limit (as shown by E in the following figure). Because the throughput of volume #0 already exceeds the lower limit, assignment of the order of I/O processing is adjusted so that I/O processing on volumes #1 to #3 takes priority over I/O processing on volume #0. Then, the throughput of volume #0 is decreased to around the lower limit value (as shown by F in the following figure).



This approximates the throughput of individual volumes to the lower-limit value.

The lower-limit control can be applied to the I/O rate, transfer rate, or both. If the lower-limit control is applied to both the I/O rate and the transfer rate, the I/O rate and the transfer rate are monitored on individual volumes. Then, when an I/O occurs, the volumes for which either of the I/O rate or the transfer rate does not reach the lower-limit value take priority for I/O processing.

You can set the following values for lower-limit control of volumes:

- I/O rate (IOPS): 10 to 2,147,483,647
- Transfer rate (MB/s): 1 to 2,097,151

**Caution:**

- Specify the lower-limit values for all volumes for which the LUN path is set. If there are volumes for which the lower-limit values are not set, the volumes take priority over the other volumes and you cannot obtain expected results.
- If you specify the lower-limit value that exceeds the performance capacity of the storage system, you cannot obtain expected results. Specify an appropriate value considering the performance capacity of the storage system.



Note: The QoS function controls the lower limit only for the I/Os between hosts and the target volume. When the volume is an external volume or a pair volume for remote copy operations, the lower limit for the I/Os between the storage systems is not controlled.

QoS priority control (for VSP G130, G/F350, G/F370, G/F700, G/F900)

QoS provides priority control for individual volumes, prioritizing the I/O requests from services to the storage system.

Priority has three levels as described in the following table. When the storage system receives I/O requests for volumes for which priority is set, I/O processing is controlled so that the I/O processing for the volumes with higher priority takes priority and the I/O processing for the volumes with lower priority is delayed. The target response time is defined for each priority level. The storage system controls I/Os so that the target response time is satisfied.

Priority level	I/O rate (IOPS)
3 (High)	1 ms
2 (Middle)	5 ms
1 (Low)	10 ms



Caution: Specify the priority for all volumes for which the LUN path is set. If there are volumes for which the priority is not set, the volumes take priority over the other volumes and you cannot obtain expected results.



Note:

- The QoS function controls priority only for the I/Os between hosts and the target volume. When the volume is an external volume or a pair volume for remote copy operations, the priority for the I/Os between the storage systems is not controlled.
- The priority control defines the priority of response and does not secure the target response time. The target response time might not be satisfied if a heavy load is placed on the storage system.
- The target response time has a fixed value and cannot be changed.

QoS monitor function

The QoS monitor function collects performance information for the QoS volumes so you can check the average performance of the volumes for the last 1 second. The following table lists and describes the performance information collected by the QoS monitor.



Note: The QoS monitor function monitors only the commands subject to QoS control. It does not monitor the control commands between storage systems.

Item	Description
Number of received commands	Number of commands that the monitored volume received
Amount of transferred commands	Amount of transferred commands (KB/s) that the monitored volume received
Throughput	Throughput of the monitored volume (IOPS)

Item	Description
Amount of transferred data	Amount of transferred data on the monitored volume (KB/s)
Response	Average response time of the monitored volume (μ s)
Monitoring time	Time when the performance information was collected



Note: If any of the following maintenance operations is in process on the storage system during monitoring, the maintenance operation might affect the performance information:

- Changing system configuration
- Replacing the microcode
- Replacing a controller

QoS alert function

The QoS alert function issues a SIM to notify to the user that the status of a QoS volume is out of the setting range. After you set the QoS alert function for a QoS volume, the alert conditions are periodically checked in the storage system. The QoS alert function provides the following functions.

Upper-limit alert: An upper-limit alert (SIM ee0000) is output when the upper-limit value set for a QoS volume is continuously reached for the time period specified as the threshold period. Since I/O processing is suppressed when the upper-limit value is reached, you can use this alert function to monitor whether and how often the I/O processing is suppressed.

The upper-limit alert function is disabled by default. You can set the threshold period for the upper-limit alert from 1 second to 600 seconds (10 minutes). The storage system outputs a SIM for alert notification once per 24 hours. If one volume reaches its upper limit more than once, or if another volume also reaches its upper-limit within 24 hours, the second and subsequent alerts are not reported. If the storage system is VSP 5000 series, the SIM is automatically completed within about 10 minutes after the alert is reported.



Caution:

- If you change the threshold period for alert notification, an alert might be output even if the new threshold period is not reached, depending on when you changed the setting and the time at which the threshold period is judged.
- (For VSP 5000 series) If any problem (such as a failure or malfunction) occurs in a storage system or network, a SIM for alert notification might not be completed. After the storage system or network returns to the normal state, whether the SIM has been completed is checked (once per day). If the SIM has not been completed, the processing necessary for completion is performed again.

Lower-limit alert (for VSP G130, G/F350, G/F370, G/F700, G/F900): A lower-limit alert (SIM ee1000) is output when the state in which the lower-limit value set for a QoS volume is not reached continues for the time period specified as the threshold period. You can use this alert function to monitor the status of lower-limit control of throughput.

The lower-limit alert function is disabled by default. You can set the threshold period for the lower-limit alert from 1 second to 600 seconds (10 minutes). The storage system outputs a SIM for alert notification once per 24 hours. If one volume does not reach its lower limit more than once, or if another volume also does not reach its lower limit within 24 hours, the second and subsequent alerts are not reported.



Note: A lower-limit alert is output when lower-limit control is not available, in which the storage system receives many I/O commands from hosts but cannot increase the throughput to the lower-limit value. For I/O commands from hosts, the number of received I/O commands and the amount of received I/O commands are monitored. If the number of received I/O commands or the amount of received I/O commands does not reach the specified value for 1 second, this alert is not output. This is because the storage system recognizes that the number (or amount) of I/O commands from hosts becomes fewer (or lower) and determines that there is no problem even if the throughput is lower than the lower-limit value.

Response delay alert (for VSP G130, G/F350, G/F370, G/F700, G/F900): A response delay alert (SIM ee2000) is output when the state, in which the target response time corresponding to the priority set for a QoS volume is exceeded, continues for the time period specified as the threshold period. You can use this alert function to monitor the status of delay for the target response time.

The response delay alert is disabled by default. You can set the threshold period for the response delay alert from 1 second to 600 seconds (10 minutes). The storage system outputs a SIM for alert notification once per 24 hours. If one volume exceeds the target response time more than once, or if another volume exceeds the target response time within 24 hours, the second and subsequent alerts are not reported.



Note:

- If you change the threshold period for alert notification, an alert might be output even if the new threshold period is not reached, depending on when you changed the setting and the time at which the threshold period is judged.
- If the target response time is exceeded, the timer starts counting. If the state in which there is no I/O continues for 1 second or more, the count of the timer is reset.

CCI commands for QoS operations

Use the following CCI commands to specify the QoS settings and to obtain QoS monitor information. For details, see the *Command Control Interface Command Reference*.

Function	Command	Setting item	Command option
Specifying the settings	raidcom modify ldev	Upper limit	-upper_throughput_io -upper_data_trans_mb
		Lower limit (for VSP G130, G/F350, G/F370, G/F700, G/F900)	-lower_throughput_io -lower_data_trans_mb
		Priority (for VSP G130, G/F350, G/F370, G/F700, G/F900)	-response_priority
		Threshold period for alert notification	-upper_alert_time -lower_alert_time (for VSP G130, G/F350, G/F370, G/F700, G/F900) -response_alert_time (for VSP G130, G/F350, G/F370, G/F700, G/F900)
Viewing the settings	raidcom get ldev	Setting status of the above items	-key qos
QoS monitor	raidcom get ldev	Performance information	key qos_monitor

You can use CCI to check the last time an alert was issued for the monitored volume. If you receive an alert notification, check for every monitored volume the last time the volume exceeded the upper-limit value.

Command example for VSP 5000 series:

```
C:\HORCM\etc>raidcom get ldev -ldev_list defined -fx -key qos
LDEV#  UPPER_THROUGHPUT (IOps)  UPPER_DATA_TRANS (MBps)  UPPER_ALERT (s)  UPPER_ALERT_NOTICE
1000  555                          5555                    5                2019-12-23T09:29:38
```

Command example for VSP G130, G/F350, G/F370, G/F700, G/F900:

```
CC:\HORCM\etc>raidcom get ldev -ldev_list defined -fx -key qos
LDEV#  UPPER_THROUGHPUT (IOps)  UPPER_DATA_TRANS (MBps)  UPPER_ALERT (s)
UPPER_ALERT_NOTICE  LOWER_THROUGHPUT (IOps)  LOWER_DATA_TRANS (MBps)
LOWER_ALERT (s)  LOWER_ALERT_NOTICE  PRIORITY  RESPON_TARGET (ms)
RESPONSE_ALERT (s)  RESPONSE_ALERT_NOTICE
a000                100                1                1
2020-03-10T15:17:28 100
1                    1 2020-03-10T15:17:28    1
10                   1 -
```

**Note:**

- UPPER_ALERT_NOTICE indicates the time the volume reached the upper limit even if the time is before the alert notification.
- UPPER_ALERT_NOTICE does not indicate the time if the volume has never reached the upper limit.
- The time that reached an alert condition is recorded based on the system date and time (date, time, and time zone) of the storage system.

Therefore, if you change the system date and time of the storage system, the time which previously reached the alert condition becomes incorrect after the change.

(For VSP G130, G/F350, G/F370, G/F700, G/F900):

- LOWER_ALERT_NOTICE indicates the time the volume is determined not to reach the lower limit even if the time is before the alert notification.
- LOWER_ALERT_NOTICE does not indicate the time if the volume has never reached the lower limit.
- RESPONSE_ALERT_NOTICE indicates the time the volume exceeds the target response time even if the time is before the alert notification.
- RESPONSE_ALERT_NOTICE does not indicate the time if the volume has never exceeded the target response time.

Implementing QoS controls

Use the following workflow to configure QoS settings to set performance levels for individual volumes.

1. Make sure your storage system firmware and CCI version meet the requirements for QoS:
 - The VSP 5000 series firmware must be 90-03-0x or later.
 - The VSP G130, G/F350, G/F370, G/F700, G/F900 firmware version must be 88-06-0x or later.
 - The CCI version must be 01-55-03/03 or later.
2. Identify the volumes for which you want to implement QoS controls. The QoS function can be set only for OPEN-V volumes.
3. Specify the desired QoS settings to the volumes (see [Overview of QoS operations \(on page 191\)](#)).
4. Specify the desired QoS alert settings (see [Overview of QoS operations \(on page 191\)](#)).
5. Monitor the performance information by using the QoS monitor function (see [Overview of QoS operations \(on page 191\)](#)).
6. Revise the QoS volume settings as needed.

See [QoS use cases \(on page 201\)](#) to determine the appropriate setting values.

QoS use cases

The QoS function can control the performance for processing storage devices based on the upper limit, lower limit, and priority for the services that issued I/O requests. The following table lists and describes the use cases, and the suitable control methods and guidelines for individual use cases.

Use case	Control method	See
<ul style="list-style-type: none"> ▪ Restricting performance for I/O processing for a specific service to a certain level or lower. ▪ Suppressing influence on other services when unexpected massive I/O requests are issued by a specific service. 	Upper-limit control	Preparing for unexpected massive I/O requests (on page 202)
(For VSP G130, G/F350, G/F370, G/F700, G/F900) Securing a certain level of performance for I/O processing for a specific service.	Lower-limit control	Securing a certain level of I/O processing performance (on page 203)
(For VSP G130, G/F350, G/F370, G/F700, G/F900) Setting relative priority levels for individual services.	Priority control	Setting priority for individual services (on page 203)

Combining upper-limit control, lower-limit control, and priority control

(VSP G130, G/F350, G/F370, G/F700, G/F900) You can use a combination of upper-limit, lower-limit, and priority controls for the same volume.



Caution:

The lower-limit value is a specific numerical value for the throughput that the storage system administrator ensures for the storage system users. You can specify any numerical value. The lower-limit control controls I/O commands and I/O processing for data on the volume.

The priority is an option used to specify the time since the storage system receives an I/O command until it finishes necessary processing and returns the response (target response time). The priority is specified in three levels (high, medium, and low).

The target response time is a specific numerical value, but you cannot specify a value you want. The priority control controls the I/O processing order. When the priority is set for individual volumes, the storage system changes the I/O processing order, if necessary, so that the response time for each I/O command is within the target response time. For example, if the storage system receives I/O commands for volumes with lower priority level and then receives I/O commands for volumes with higher priority level, the I/O commands for volumes with higher priority level are processed first.

As described above, the lower-limit control and the priority control may have different purposes for their control. Therefore, they can be used in combination with each other with the following considerations.

The QoS function monitors the throughput to check the influences of the lower-limit values and priority levels that are set for volumes. Then, the lower-limit values and priority levels are revised, if necessary, based on the monitoring results. If both the lower-limit control and priority control are set, it is difficult to determine whether the influences are caused by the lower-limit control or by the priority control. For example, if a volume with high priority level receives an I/O command and then a volume with medium priority level receives an I/O command, the I/O processing order necessary for responding the I/O command is normally not changed. However, the order of response might be changed by the lower-limit control.

Preparing for unexpected massive I/O requests

The upper-limit control is a suitable solution if you want to suppress influences on other services when unexpected massive I/O requests are issued by a specific service.

Upper-limit value setting

If you set an upper-limit value that is lower than the actual throughput, the application might be drastically slowed down. For the initial upper-limit value, specify the value with a margin, based on the amount of throughput during your business cycle (for example, one day to one week). For details about the amount of throughput, see the server's throughput data or the performance values in Performance Monitor.

When an upper-limit alert is issued

If an upper-limit alert is issued or the monitor information is abnormal during operations, an unexpectedly large amount of I/O requests might be issued. Use the QoS monitor function to check the amount of throughput, and revise the upper-limit value, if necessary.

Securing a certain level of I/O processing performance

(VSP G130, G/F350, G/F370, G/F700, G/F900) The lower-limit control is a suitable solution if you want to secure a certain level of I/O processing performance for a specific service.



Caution: Set the lower-limit values for all volumes for which the LUN path is set.

Lower-limit value setting

For the initial lower-limit value, specify the minimum value in the available setting range. After you start operations, gradually increase the lower-limit value while checking the application behavior and the amount of throughput during the business cycle (for example, for one day to one week). For details about the amount of throughput, see the performance values in the QoS monitor function.

Note the following when you increase the lower-limit value:

- The sum of the lower-limit values for all volumes must be the same as or lower than the I/O processing capacity of the storage system.
- Set the lower-limit values for volumes that have a certain level of throughput. When you specify the lower-limit values for volumes on which I/Os occur intermittently, specify the minimum value in the available setting range.
- Even when you set the higher lower-limit value, if there are a few I/O requests from servers to the volume, the throughput does not increase.

When a lower-limit alert is issued

Consider the following causes when a lower-limit alert is issued or the monitor information is abnormal during operations:

- The sum of the lower-limit values for all volumes exceeds the I/O processing capacity of the storage system.
- A hardware failure (such as a drive failure) might occur. (In this case, a SIM indicating hardware failure is reported.)

In other causes, the lower-limit control might not work satisfactory. In that case, consider releasing the lower-limit setting.

Setting priority for individual services

(VSP G130, G/F350, G/F370, G/F700, G/F900) The priority control is a suitable solution if you want to set relative priority levels for individual services.



Caution: Set priority levels for all volumes for which the LUN path is set.

Priority settings

There are three priority levels. The I/O processing for volumes with higher priority takes priority, and the I/O processing for volumes with lower priority is delayed. If the setting is not balanced (for example, only the high-level priority is specified), the arrangement of the processing order is not performed. Specify the high priority level for about 10% of the volumes, the medium priority level for about 30% of the volumes, and the low priority level for about 60% of the volumes. If individual services have almost the same priority level, the priority control is not a suitable solution.

When a response delay alert is issued

Consider the following causes when a response delay alert is issued or the monitor information is abnormal during operations:

- A hardware failure (such as a drive failure) might occur. (In this case, a SIM indicating hardware failure is reported.)
- The number (or amount) of issued I/O requests might exceed the processing capacity of the storage system.

In other causes, the priority control might not be satisfactory. Consider releasing the priority setting.

Chapter 7: 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

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.

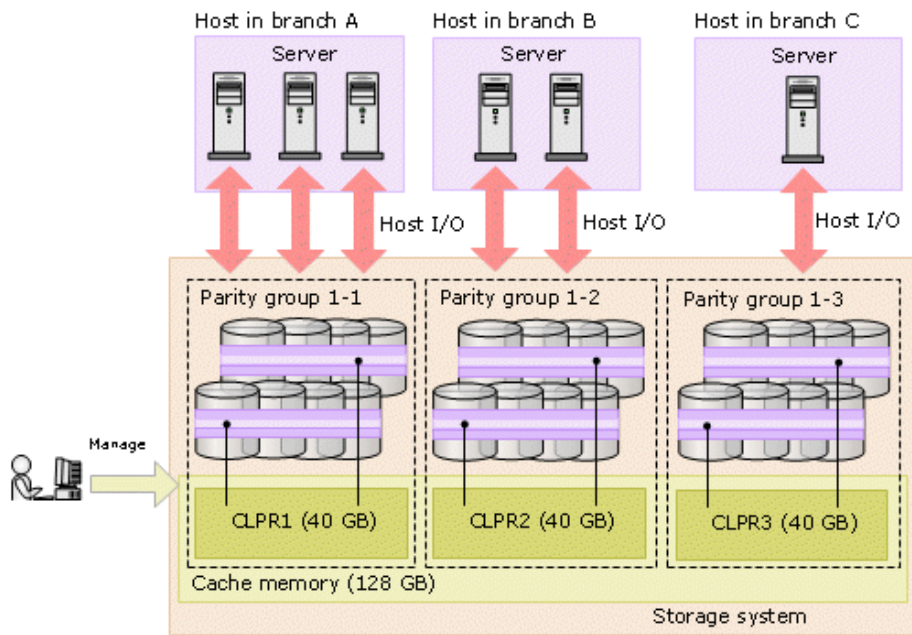


Note: You can create a maximum of 32 CLPRs including CLPR0, which is created by default.

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 \(on page 217\)](#) and [Migrating resources to and from a CLPR \(on page 218\)](#).
5. Manage the CLPRs as needed.
 - After a CLPR has been created, you can change the CLPR name, CLPR cache capacity. For details, see [Editing an existing CLPR \(on page 219\)](#).

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 CLPRO satisfy the following formulas on all MP unit:

- For CLPR with decreased cache capacity

$$\frac{\text{Write pending rate} \times \text{cache capacity before operation}}{\text{cache capacity after operation}} < 30\%$$

$$\frac{\text{Sidefile occupancy rate} \times \text{cache capacity before operation}}{\text{cache capacity after operation}} < \text{sleep wait threshold} \times 50\%$$

- For CLPR with increased cache capacity

$$\text{Sidefile occupancy rate} < \text{sleep wait threshold} \times 50\%$$

- When you move resources in CLPRs, make sure that the writing pending rates of the MP 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 unit become less than 50 percent.
- (VSP E series or VSP G/F350, G/F370, G/F700, G/F900) When you perform the following CLPR operations successively, you must wait for the current CLPR operation to complete before starting the next one:
 - Creating a CLPR
 - Deleting a CLPR
 - Moving resources within a CLPR
 - Editing CLPR settings (changing cache capacities)

As an exception, you can move resources in a CLPR while resources are being moved in another CLPR.

- **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.
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 unit
- RAID level
- Number of installed drives
- Use of the following specialized applications:
 - Dynamic Provisioning
 - Dynamic Tiering
 - active flash
 - Universal Volume Manager
 - Dynamic Provisioning for Mainframe
 - Dynamic Tiering for Mainframe
 - active flash for mainframe

Cache capacity without Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, active flash for mainframe

The following products require more cache capacity to run:

- Dynamic Provisioning
- Dynamic Tiering
- active flash
- Universal Volume Manager
- Dynamic Provisioning for Mainframe
- Dynamic Tiering for Mainframe
- active flash for mainframe

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.

Table 1 VSP 5000 series

Internal/external VOL for a CLPR (total capacity)	Number of MP units	Recommended cache capacity for a CLPR
Less than 4 TB	2	8 GB
	4	12 GB
	8	28 GB
	12	44 GB
4 TB or more	2	16 GB
	4	16 GB
	8	28 GB
	12	44 GB
16 TB or more	2	24 GB
	4	24 GB
	8	28 GB
	12	44 GB
48 TB or more	2	32 GB
	4	32 GB

Internal/external VOL for a CLPR (total capacity)	Number of MP units	Recommended cache capacity for a CLPR
	8	32 GB
	12	44 GB
96 TB or more	2	40 GB
	4	40 GB
	8	40 GB
	12	44 GB
160 TB or more	2	48 GB
	4	48 GB
	8	48 GB
	12	48 GB
240 TB or more	2	56 GB
	4	56 GB
	8	56 GB
	12	56 GB
360 TB or more	2	64 GB
	4	64 GB
	8	64 GB
	12	64 GB
600 TB or more	2	72 GB
	4	72 GB
	8	72 GB
	12	72 GB

Table 2 VSP E series and VSP G/F350, G/F370, G/F700, G/F900 models

Internal/external VOL for a CLPR (total capacity) ¹	Recommended cache capacity for a CLPR ²
Less than 4 TB	12 GB

Internal/external VOL for a CLPR (total capacity) ¹	Recommended cache capacity for a CLPR ²
4 TB or more	16 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
240 TB or more	56 GB
360 TB or more	64 GB
600 TB or more	72 GB
<p>Notes:</p> <ol style="list-style-type: none"> If you are calculating the total capacity of internal/external volumes, note the following for each volume capacity: <ul style="list-style-type: none"> 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. If the recommended cache capacity exceeds the maximum capacity, install the maximum capacity. 	

Formula to size VOL capacity of internal storage

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

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

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
- Dynamic Provisioning for Mainframe
- Dynamic Tiering for Mainframe
- 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 \(on page 212\)](#).

Table 3 VSP 5000 series

Internal/external VOL for a CLPR (Total capacity)	Number of MP units	Recommended cache capacity for a CLPR
Less than 4 TB	2	12 GB
	4	20 GB
	8	36 GB
	12	52 GB
4 TB or more	2	16 GB
	4	20 GB
	8	36 GB
	12	52 GB
16 TB or more	2	24 GB
	4	24 GB
	8	36 GB

Internal/external VOL for a CLPR (Total capacity)	Number of MP units	Recommended cache capacity for a CLPR
	12	52 GB
48 TB or more	2	32 GB
	4	32 GB
	8	36 GB
	12	52 GB
96 TB or more	2	40 GB
	4	40 GB
	8	40 GB
	12	52 GB
160 TB or more	2	48 GB
	4	48 GB
	8	48 GB
	12	52 GB
240 TB or more	2	56 GB
	4	56 GB
	8	56 GB
	12	56 GB
360 TB or more	2	64 GB
	4	64 GB
	8	64 GB
	12	64 GB
600 TB or more	2	72 GB
	4	72 GB
	8	72 GB
	12	72 GB

Table 4 VSP E series and VSP G/F350, G/F370, G/F700, G/F900 models

Internal/external VOL for a CLPR (Total capacity) ¹	Recommended cache capacity for a CLPR ²
Less than 16 TB	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
240 TB or more	56 GB
360 TB or more	64 GB
600 TB or more	72 GB
<p>Notes:</p> <ol style="list-style-type: none"> If you are calculating the total capacity of internal/external/virtual volumes, note the following for each volume capacity: <ul style="list-style-type: none"> 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. Virtual volume: Add the total capacity of LDEV. Check virtual volume LDEV capacity in the Logical Device window. For details on the Logical Device window, see <i>Provisioning Guide</i> of your storage system. If the recommended cache capacity exceeds the maximum capacity, install the maximum capacity. 	

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.

For VSP E series and VSP G/F350, G/F370, G/F700, G/F900, we recommend installing at least the following capacity (whichever is larger):

- Recommended capacity calculated using the capacity in [Cache capacity with Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, or active flash for mainframe \(on page 213\)](#) or [Cache capacity without Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Dynamic Tiering for Mainframe, active flash, active flash for mainframe \(on page 210\)](#).
- <total capacity of capacity saving-enabled V-VOLs> x 0.2%

The following table lists recommended cache capacity when all volumes in a storage system are capacity saving-enabled V-VOLs.

Table 5 For VSP 5000 series

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.

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.

Total capacity of external volume of CLPR with UVM	Number of MP units	Recommended cache capacity for each CLPR
Less than 128 TB	4 or 8	8 GB
	12	12 GB
128 TB or more	4	8 GB
	8	16 GB
	12	24 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:

- Maximum of 31 CLPRs (CLPR1 to CLPR31) for VSP 5000 series.
- Maximum of 31 CLPRs (CLPR1 to CLPR31) for VSP E990.
- Maximum of 21 CLPRs (CLPR1 to CLPR21) for VSP G350 and VSP F350, and 31 CLPRs (CLPR1 to CLPR31) for VSP G370, VSP G700, VSP G900, VSP F370, VSP F700, VSP F900.

When you create a CLPR, you assign the necessary capacity from CLPR0 to the new CLPR. The default cache capacity is listed below

- 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. In **Cache Size**, select the cache capacity. If no CLPR ID is available, a blank is displayed.

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.

5. 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.

6. 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.

7. Click **Finish**.

8. 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 \(on page 218\)](#).

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.

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

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. In **Cache Size**, select the CLPR cache capacity as needed. The minimum cache size is 8 GB (VSP 5000 series) or 4 GB (VSP E series or VSP G130, G/F350, G/F370, G/F700, G/F900), and the size can be changed in increments of 4 GB (VSP 5000 series) or 2 GB (VSP E series or VSP G130, G/F350, G/F370, G/F700, G/F900). 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.
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 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*.

For troubleshooting information on Device Manager - Storage Navigator, see the *System Administrator Guide*.

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 149)
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 175) .

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
<p>(VSP 5000 series)</p> <p>You cannot run the security setting command, or the following message is issued:</p> <p>""keytool' is not recognized as an internal or external command, operable program or batch file."</p>	<ul style="list-style-type: none"> ▪ The path to keytool (<code>keytool.exe</code>) might not be defined. Add the path to <code>keytool.exe</code> in the PATH environment variable. For more information about how to add a path in the PATH environment variable, see the documentation for your operating system. ▪ The version of the installed Java Runtime Environment (JRE) might not be correct. To check the JRE version, run the following command on the Windows command prompt or the UNIX console window: If the version is not correct, install the correct JRE version. <pre style="background-color: #f0f0f0; padding: 5px;">java -version</pre>
<p>You cannot run the batch file.</p>	<p>The path to the Java Virtual Machine (<code>Java.exe</code>) 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.</p> <p>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:</p> <pre>Java -version</pre> <p>If the version is incorrect, install the correct version of JRE.</p>
<p>Export Tool stops and the processing does not continue.</p>	<ul style="list-style-type: none"> ▪ 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 (00014011). ▪ 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.

Possible problems	Probable causes and recommended action
<p>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.</p>	
<p>An error occurs and the processing stops.</p>	<p>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 122). If the error persists, contact the customer support.</p> <p>If the error message ID is (0002 5510), probable error causes and solutions are:</p> <ul style="list-style-type: none"> ▪ 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. <p>If the error message ID is none of the above, see Messages issued by Export Tool (on page 226).</p>
<p>The monitoring data in the CSV file includes (-1).</p>	<p>For details on invalid monitoring data, see Causes of invalid monitoring data (on page 149).</p>

Possible problems	Probable causes and recommended action
<ul style="list-style-type: none"> ▪ 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. 	<p>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.</p>
<p>Export Tool terminated abnormally. NoSuchObjectException is shown in the log file.</p>	<p>The computer workload might be high. Perform potential fixes to lower the workload as shown below. Then execute Export Tool again.</p> <ul style="list-style-type: none"> ▪ Reduce the number of Export Tool applications running concurrently. ▪ Execute Export Tool while virus scan is not being performed by anti-virus software.
<p>When a CSV file is opened, the parity group ID and volume ID appear as follows:</p> <ul style="list-style-type: none"> ▪ The parity group IDs appear as dates. ▪ The volume IDs appear with a decimal point. 	<p>To display a CSV file correctly, you need to perform the following operations:</p> <ol style="list-style-type: none"> 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
<p>When you run Export Tool with many volumes specified, Export Tool terminated abnormally while collecting monitoring data.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>"404 Not found." or other errors appear when you run Export Tool.</p>	<p>This error occurred because the Export Tool execution has failed. Possible causes are as follows:</p> <ul style="list-style-type: none"> ▪ The <code>svpip</code> value is wrong. ▪ The SVP version you are using is old.
<p>(VSP 5000 series) A root certificate or a self-signed certificate of the SVP cannot be registered in Export Tool.</p>	<ul style="list-style-type: none"> ▪ Perform the operations as a user with administrator permissions. ▪ Verify the path to the certificate. ▪ The specified certificate must be in X.509 PEM or X.509 DER format.
<p>(VSP 5000 series) The communications to the SVP cannot be established.</p>	<p>Verify that the connection destination is correct or that the SVP is working correctly. If the connection destination is correct, the server verification during the SSL communications might have not been performed.</p> <p>If the communications could not be established, the following message is issued: "The SSL communication to the server cannot be established." or "Login failed." Take the recommended actions for the message. For details about the issued messages, see Messages issued by Export Tool (on page 226).</p>

Possible problems	Probable causes and recommended action
<p>(VSP 5000 series) When you run the delete command and the list command of the security setting command, the following message is issued:</p> <p>"keytool error: java.lang.Exception: the keystore file does not exist: ExportTool.dat".</p>	<p>Keystore has not been created because the import command of the security setting command has not been run. Run the import command, and then rerun the delete and list command.</p>

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
<p>Connection to the server has not been established.</p>	<p>Connection to the server has not been established.</p>	<p>Use the <code>login</code> subcommand.</p>

Export Tool messages	Description	Recommended action
(VSP 5000 series) Error: The command is not running with administrator permissions.	<p>The following operations were performed by a user who does not have administrator permissions for the PC running Export Tool:</p> <ul style="list-style-type: none"> ▪ Register certificate in Export Tool (Windows) ▪ View certificate registered in Export Tool (Windows) ▪ Delete certificate from Export Tool (Windows) ▪ Get help in Export Tool (Windows) ▪ Register certificate in Export Tool (UNIX) ▪ View certificate registered in Export Tool (UNIX) ▪ Delete certificate from Export Tool (UNIX) ▪ Get help in Export Tool (UNIX) 	Perform the operations as a user with administrator permissions for the PC running Export Tool.
Execution stops.	Processing was stopped.	Remove errors.
Illegal character: <i>character</i>	An illegal character is used.	Use legal characters.
Invalid length: <i>token</i>	The length is invalid.	Specify a value that has a correct length.
Invalid Mode: <i>startup-mode</i>	Operation has failed due to invalid mode.	Specify a correct mode.
Invalid range: <i>range</i>	The specified range is invalid.	Specify the correct range.
Invalid URL: <i>URL</i>	The specified URL is invalid.	Check the URL.
Invalid value: <i>value</i>	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:	For 1 and 2, specify the correct operand.

Export Tool messages	Description	Recommended action
	<p>1. An incorrect operand is used for the following subcommand:</p> <ul style="list-style-type: none"> ▪ (VSP 5000 series) svpip <p>2. An incorrect operand is used for the login subcommand.</p> <p>3. The specified user ID is used by another user, and the user is logging in to the storage system or SVP.</p> <p>4. Another user is using the Server Priority Manager window.</p> <p>5. Another user is running Export Tool.</p> <p>6. (VSP 5000 series) The combination of DKCMAIN/SVP and Export Tool is invalid.</p> <p>7. You have not selected the cipher suites corresponding to the key type of the certificate on the TLS Security Settings dialog box.</p> <p>If the error is not caused by the conditions listed above, see Troubleshooting Export Tool for Performance Monitor (on page 222).</p>	<p>For 3, determine the user logging in with same user ID and ask the user to log off.</p> <p>For 4 and 5, take one of the following actions:</p> <ul style="list-style-type: none"> ▪ 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. <p>(VSP 5000 series) For 6, use the correct combination of versions for DKCMAIN/SVP and Export Tool.</p> <p>For 7,</p> <ol style="list-style-type: none"> 1. Connect to the Tool Panel dialog box via an HTTP connection, and enable all cipher suites. 2. Make sure you can log in to Device Manager - Storage Navigator. 3. Verify the settings of the cipher suites. <p>For details, see the <i>System Administrator Guide</i>.</p>
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.

Export Tool messages	Description	Recommended action
Missing svpip (VSP 5000 series)	The svpip subcommand is not used.	Use the svpip command.
Missing time range	The time range is not specified.	Specify the time range.
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: <i>range</i>	The value is outside the range.	<p>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 (on page 115).</p> <p>If the set subcommand is used with the switch operand, specify a value within the range of 1 to 15.</p>
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 (<i>part-code, error-number</i>)	An error occurs at the RMI server.	See the <i>Hitachi Device Manager - Storage Navigator Messages</i> .
Same log path: <i>path</i>	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.
Unable to execute ExportTool.	Failed to run Export Tool.	Run Export Tool again. If the problem occurs again, contact customer support.

Export Tool messages	Description	Recommended action
	The downloaded file is damaged or an error might have occurred while running Export Tool.	
Unable to get ExportTool from the server : URL= <i>URL</i> [, <i>code=error-code</i>]	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: <i>file</i>	Export Tool cannot read the command file.	Specify the name of the command file correctly.
Unknown host: <i>host-name</i>	Export Tool cannot resolve the host name.	Specify the correct host name.
Unsupported command: <i>command</i>	Export Tool does not support the specified command.	Specify a correct command.
Unsupported operand: <i>operand</i>	The specified operand is not supported.	Correct the specified operand.
Unsupported option: <i>option</i>	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. When you press a key, a message appears and asks whether to perform the specified action.

Export Tool messages	Description	Recommended action
		<p>To perform the specified action, press the <y> key.</p> <p>To cancel the specified action, press the <n> key.</p>
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: <i>line</i>	A syntax error is detected in a command line in your command file.	<p>Check the command line for the syntax error and then correct the script.</p> <p>Some operands must be enclosed by double quotation marks ("). Check the command line to find whether double quotation marks are missing.</p>
(VSP 5000 series) The batch command cannot be run. See the manual or run the help command to check the arguments for this operation.	<p>The options specified for the following operations are not correct:</p> <ul style="list-style-type: none"> ▪ Register certificate in Export Tool (Windows) ▪ View certificate registered in Export Tool (Windows) ▪ Delete certificate from Export Tool (Windows) ▪ Get help in Export Tool (Windows) ▪ Register certificate in Export Tool (UNIX) ▪ View certificate registered in Export Tool (UNIX) ▪ Delete certificate from Export Tool (UNIX) ▪ Get help in Export Tool (UNIX) 	Verify the specified options.

Export Tool messages	Description	Recommended action
(VSP 5000 series) The SSL communication to the server cannot be established : host= <i>host-name</i> , port= <i>port-number</i>	The SSL communications to the SVP cannot be established due to one of the following reasons:	Take the following actions:
	a. The server certificate of the SVP has not been updated and remains in the initial state, however the server verification is enabled.	Update the server certificate of the SVP by following the System Administrator Guide.
	b. The entered host name or IP address is not correct.	Enter the correct host name or IP address, and then retry the operation.
	c. The certificate of the SVP has been updated, however a root certificate or a self-signed certificate of the SVP is not registered in Export Tool.	Register the root certificate or the self-signed certificate of the SVP in Export Tool.
	d. The host name or the IP address of the SVP entered in the <code>svpip</code> subcommand in the command file is not the same as that in subjectAltName (SAN) or CommonName (CN) of a server certificate of the SVP.	Contact the certificate issuer to obtain a valid certificate, and then update the certificate of the SVP.
	e. The server certificate of the SVP has expired.	Contact the certificate issuer to obtain a valid certificate, and then update the certificate of the SVP.
	f. The server certificate of the SVP has been revoked.	Contact the certificate issuer to obtain a valid certificate, and then update the certificate of the SVP. Verify that the CRL repository or the OCSP responder can be accessed from Export Tool in the network environment.

Export Tool messages	Description	Recommended action
	g. The certificate of the SVP was signed by an intermediate CA. However, only the server certificate has been registered on the SVP.	If the certificate of the SVP has been signed by an intermediate CA, register all of the intermediate certificates including the server certificate on the SVP.
	h. The cipher suites corresponding to the key type of the certificate are not selected on the TLS Security Setting.	Take the recommended actions by following the login error (20121-107097) in the System Administrator Guide.
Unable to connect to the server : <i>host:port</i>	Failed to access the server.	Check the hostname and port number.
Unable to create temporary directory: <i>tmp</i>	Failed to create a temporary directory.	Check the access permission to the directory, and make sure if there are any files.

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 175) .

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.	<p>If you cannot migrate a parity group in the CLPR to another CLPR, perform the following:</p> <ul style="list-style-type: none"> ▪ Make sure to click Apply when creating a new CLPR.

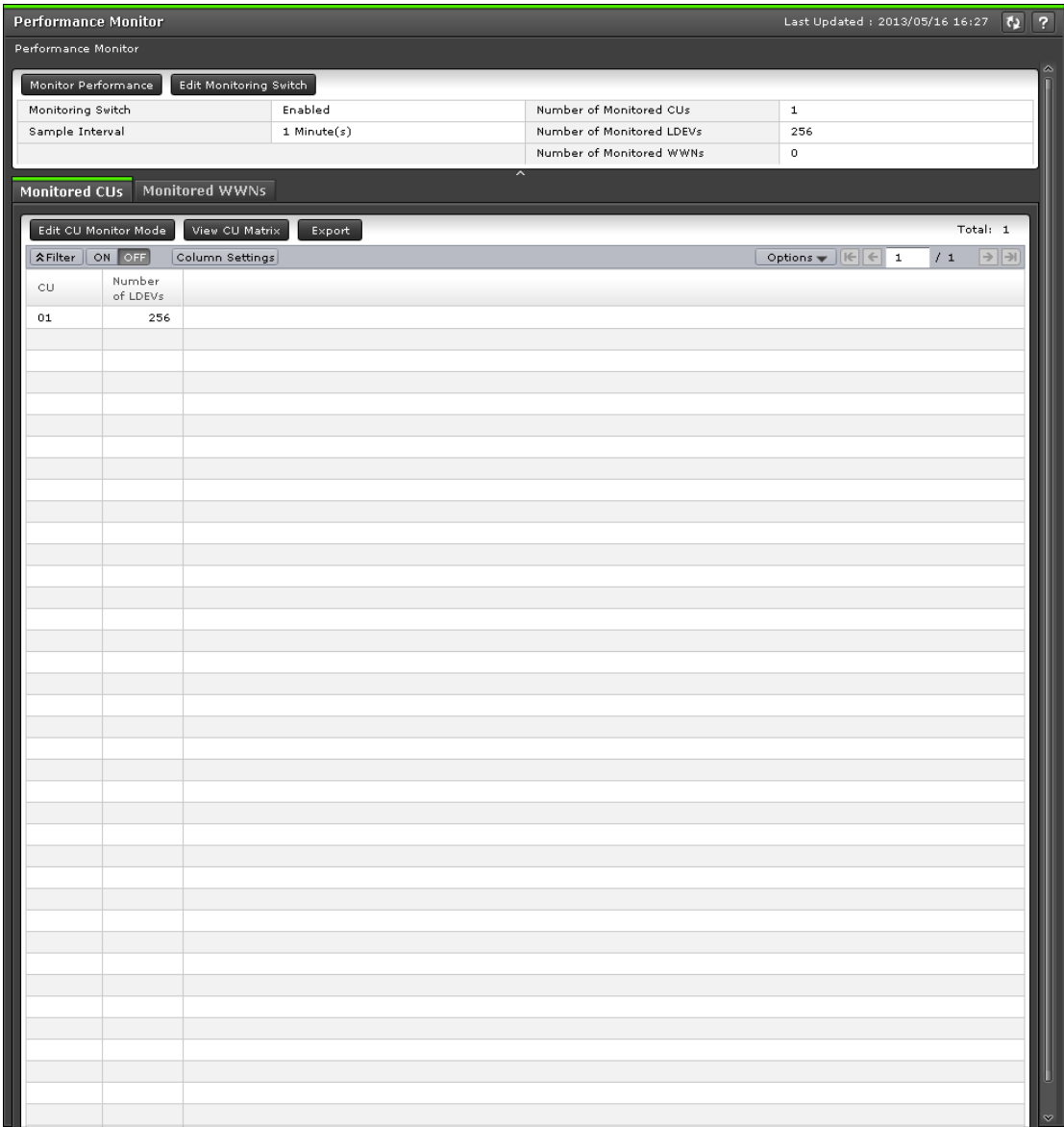
Appendix A: Performance Monitor GUI reference

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

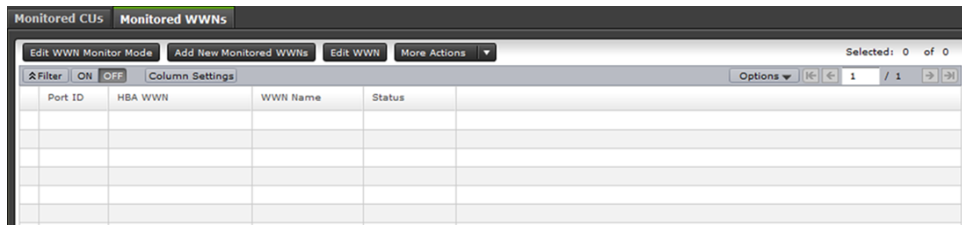
Item	Description
Monitoring Switch	Current monitoring status: Enabled: Performance Monitor is monitoring the storage system. Disabled: The storage system is not being monitored.
Sample Interval	Current sampling interval, from 1 to 15 minutes, for which statistics are collected during short-range monitoring. This value is available when Enabled is selected in the Monitoring Switch field. If Disabled is selected, a hyphen appears.
Number of Monitored CUs	Numbers of CU currently being monitored: <ul style="list-style-type: none"> ▪ VSP 5000 series: 0 to 255 ▪ VSP E990: 0 to 255 ▪ VSP G350, VSP F350: 0 to 64 ▪ VSP G370, VSP F370: 0 to 128 ▪ VSP G700, VSP F700: 0 to 192 ▪ VSP G900, VSP F900: 0 to 255
Number of Monitored LDEVs	Numbers of LDEV currently being monitored: <ul style="list-style-type: none"> ▪ VSP 5000 series: 0 to 65,280 ▪ VSP E990: 0 to 65,280 ▪ VSP G350, VSP F350: 0 to 16,384 ▪ VSP G370, VSP F370: 0 to 32,768 ▪ VSP G700, VSP F700: 0 to 49,152 ▪ VSP G900, VSP F900: 0 to 65,280
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.

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. <ul style="list-style-type: none"> 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.

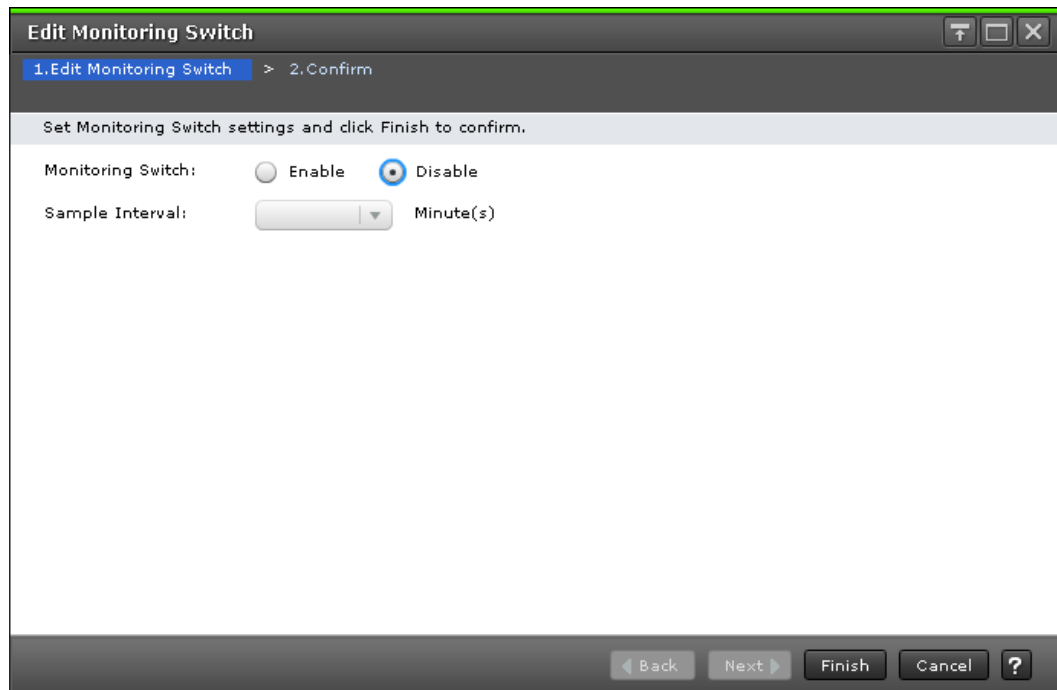
Item	Description
Port ID	Name of the port of the monitored WWN.
HBA WWN	Host bus adapter ID of the monitored WWN.
WWN Name	A WWN name is up to 64 alphanumeric characters and some signs.
Status	Following statuses of the port connected with WWN. <ul style="list-style-type: none">  Normal: All WWNs connected with the port are monitoring target objects.  Non-Integrity: The WWN is not monitored for the corresponding port, but monitored for other ports.

Item	Description
Edit WWN Monitor Mode	Click to open the Edit WWN Monitor Mode window.
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.

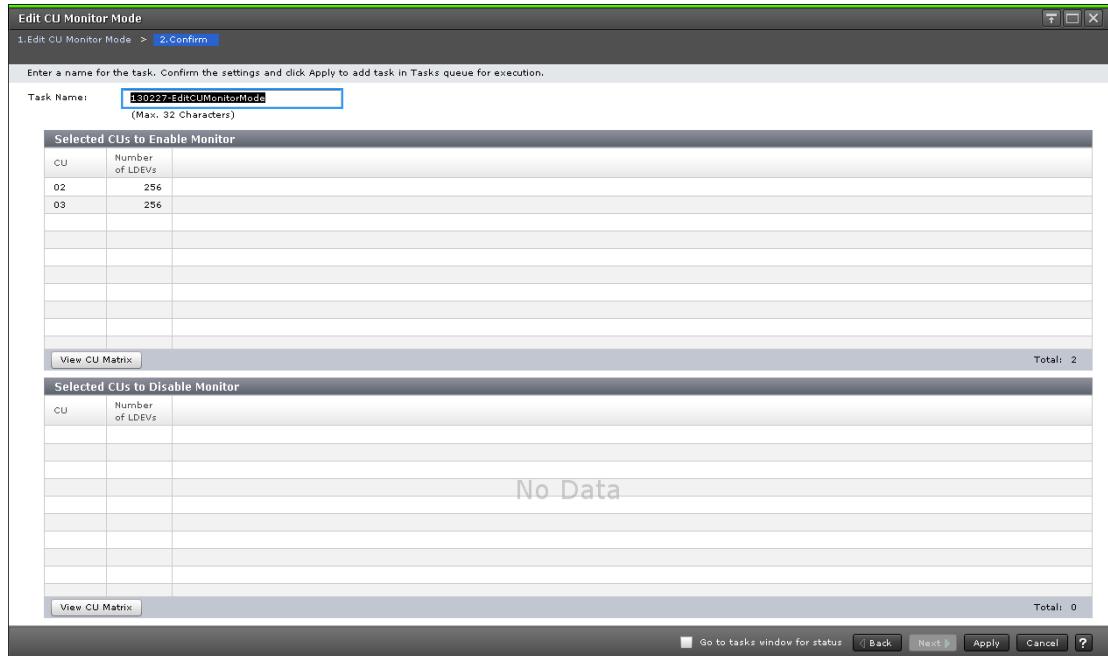


Setting fields

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. <ul style="list-style-type: none"> If the number of CUs to be monitored is 32 (for VSP G350, G370, G700, G900) or 64 (for VSP 5000 series) or fewer and short range is selected, you can specify from 1 to 15 minutes at intervals of 1 minute. If more than 32 (for VSP G350, G370, G700, G900) or 64 (for VSP 5000 series) CUs are monitored and short range is selected, you can specify 5, 10, or 15 minutes. You cannot select long range.

Edit Monitoring Switch confirmation window

Use this window to confirm the specified monitoring information and to assign a task name to the editing task.



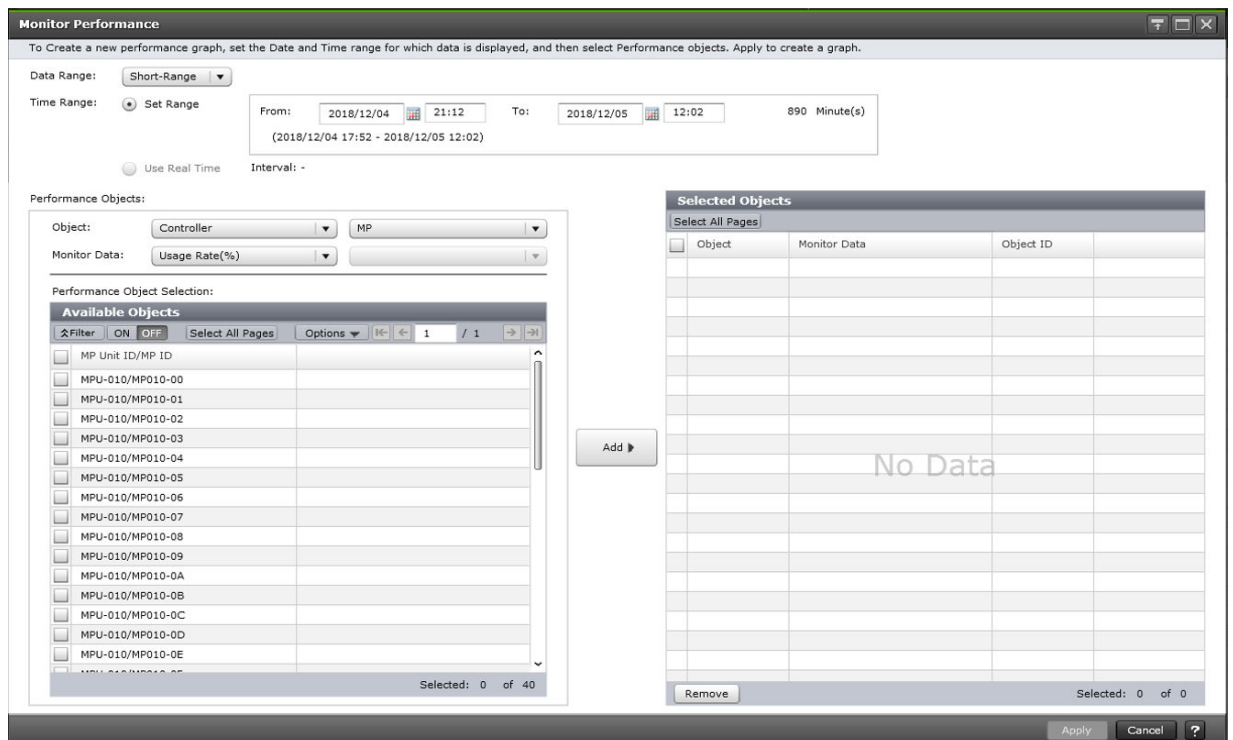
Monitoring Switch Setting table

Confirm the monitoring switch information to be changed.

Item	Description
Monitoring Switch	<p>Following monitoring statuses of the storage system are given below.</p> <p>Enabled: Performance Monitor is monitoring the storage system.</p> <p>Disabled: Performance Monitor is not monitoring the storage system.</p>
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

The Data range is set to Short-Range (not displayed on this window).

Data Range:

Time Range: Set Range Use Real Time

From: To: 89 Minute(s)
 (2013/02/19 18:30 - 2013/02/20 18:30)

Interval: -

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.

- Short-Range: Graphs are displayed according to the value specified in the Sample Interval field in the **Edit Monitoring Switch** window. You can specify the sampling interval from 1 to 15 minutes. The interval for measuring or storing the information depends on the number of CUs to be monitored.
- Long-Range: Graphs are displayed 0, 15, 30, or 45 minutes on every hour.

(VSP E series or VSP G/F350, G/F370, G/F700, G/F900) The Data Range field is not provided. Graphs are displayed according to the value specified in the Sample Interval field in the **Edit Monitoring Switch** window. You can specify the sampling interval from 1 to 15 minutes. The interval for measuring or storing the information depends on the number of CUs to be monitored.

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

Performance Objects:

Object:

Monitor Data:

Performance Object Selection:

Available Objects

Filter: ON OFF Select All Pages Options 1 / 1

<input type="checkbox"/>	MP Unit ID/MP ID
<input type="checkbox"/>	MPU-010/MP010-00
<input type="checkbox"/>	MPU-010/MP010-01
<input type="checkbox"/>	MPU-010/MP010-02
<input type="checkbox"/>	MPU-010/MP010-03
<input type="checkbox"/>	MPU-010/MP010-04
<input type="checkbox"/>	MPU-010/MP010-05
<input type="checkbox"/>	MPU-010/MP010-06
<input type="checkbox"/>	MPU-010/MP010-07
<input type="checkbox"/>	MPU-010/MP010-08
<input type="checkbox"/>	MPU-010/MP010-09
<input type="checkbox"/>	MPU-010/MP010-0A
<input type="checkbox"/>	MPU-010/MP010-0B
<input type="checkbox"/>	MPU-010/MP010-0C
<input type="checkbox"/>	MPU-010/MP010-0D
<input type="checkbox"/>	MPU-010/MP010-0E
<input type="checkbox"/>	MPU-010/MP010-0F

Selected: 0 of 40

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.
Performance Object Selection	Objects that can be displayed in graphs.

Add

Adds objects to display the graph.

Selected Objects table

Object	Monitor Data	Object ID
No Data		

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	Usage Rate	%

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data

- 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	%

- 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
HIE-ISW	Usage Rate	%
MP unit-HIE	Usage Rate	%

- 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
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- 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

- 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
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Initiator	Throughput
	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

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	Write (CFW)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
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:		
<ol style="list-style-type: none"> 1. Only information about internal volumes is displayed. Information about external volumes and FICON DM volumes is not displayed. 2. 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	

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
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	
	Random	
	CFW	
Read 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	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	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	%

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
<p>* Only information about internal volumes is displayed. Information about the following is not displayed:</p> <ul style="list-style-type: none"> ▪ external volumes ▪ 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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	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/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
	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

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 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	
		Write	
* 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/Target and Fibre Port/Initiator	Port ID	Name of the port. Only the ports assigned to the user are displayed.
Mainframe Fibre Port	Port ID	Name of the port. Only the ports assigned to the user are displayed.
iSCSI Port/Target and iSCSI Port/Initiator	Port ID	Name of the port. Only the ports assigned to the user are displayed.
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.

Monitoring object	Item	Description
	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.
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 <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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.

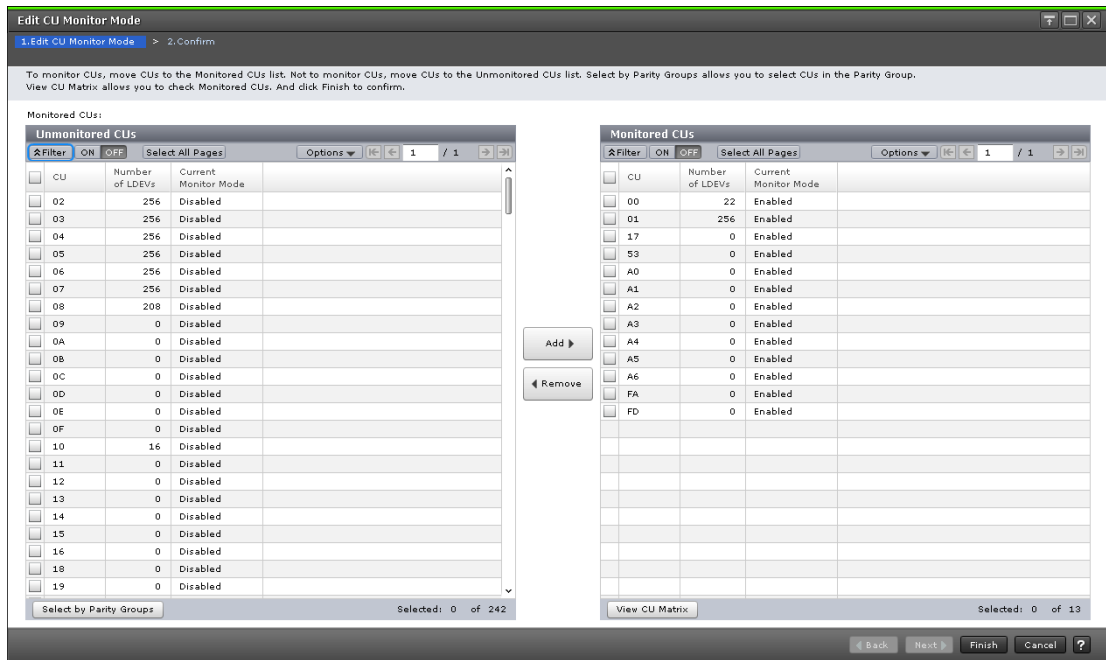
Monitoring object	Item	Description
LUN/TC/GAD	Port ID <ul style="list-style-type: none"> Item: Type Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> Item: iSCSI target name Description: Name of the iSCSI target 	Name of the host group 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/UR	Port ID <ul style="list-style-type: none"> Item: Type Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> 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.

Monitoring object	Item	Description
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 unit ID/MP ID	ID of an MP unit and processor.
Controller/DRR	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP unit ID	ID of an MP unit.
	Cache	Name of the cache.
Access Path/HIE-ISW	Access Path	Name of the access path.
Access Path/MP unit-HIE	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.



Unmonitored CUs table

CU	Number of LDEVs	Current Monitor Mode
02	256	Disabled
03	256	Disabled
04	256	Disabled
05	256	Disabled
06	256	Disabled
07	256	Disabled
08	208	Disabled
09	0	Disabled
0A	0	Disabled
0B	0	Disabled
0C	0	Disabled
0D	0	Disabled
0E	0	Disabled
0F	0	Disabled
10	16	Disabled
11	0	Disabled
12	0	Disabled
13	0	Disabled
14	0	Disabled
15	0	Disabled
16	0	Disabled
18	0	Disabled
19	0	Disabled

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.

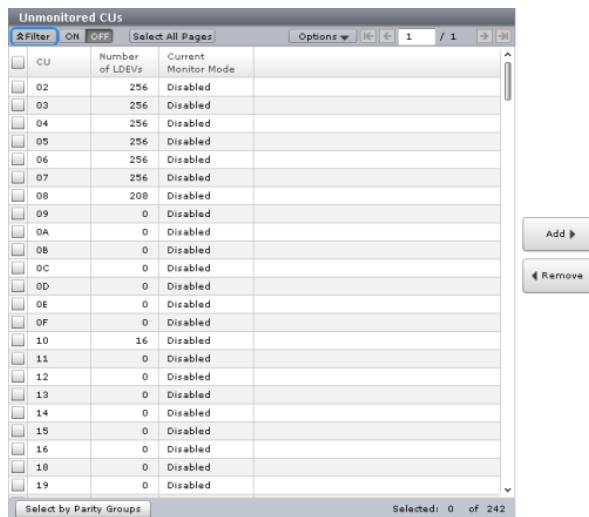
Add

Click to add CUs to Monitored CUs table.

Remove

Click to remove CUs from Monitored CUs table.

Monitored CUs table

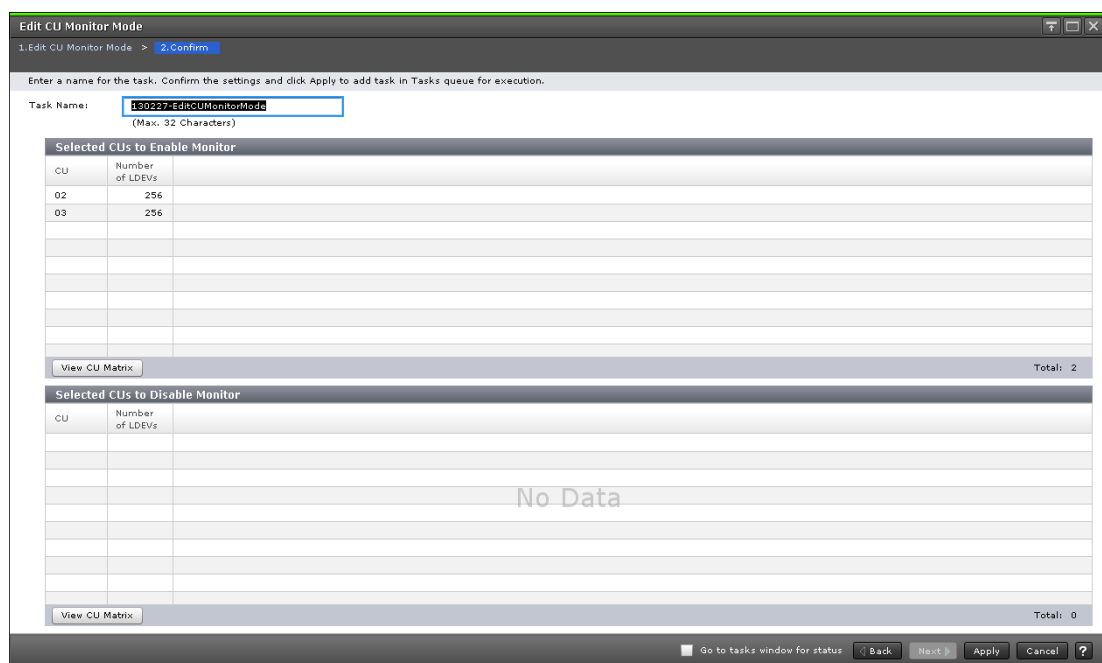


A table of the CUs that are going to be monitored.

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. <ul style="list-style-type: none"> ▪ 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.



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. <ul style="list-style-type: none"> 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

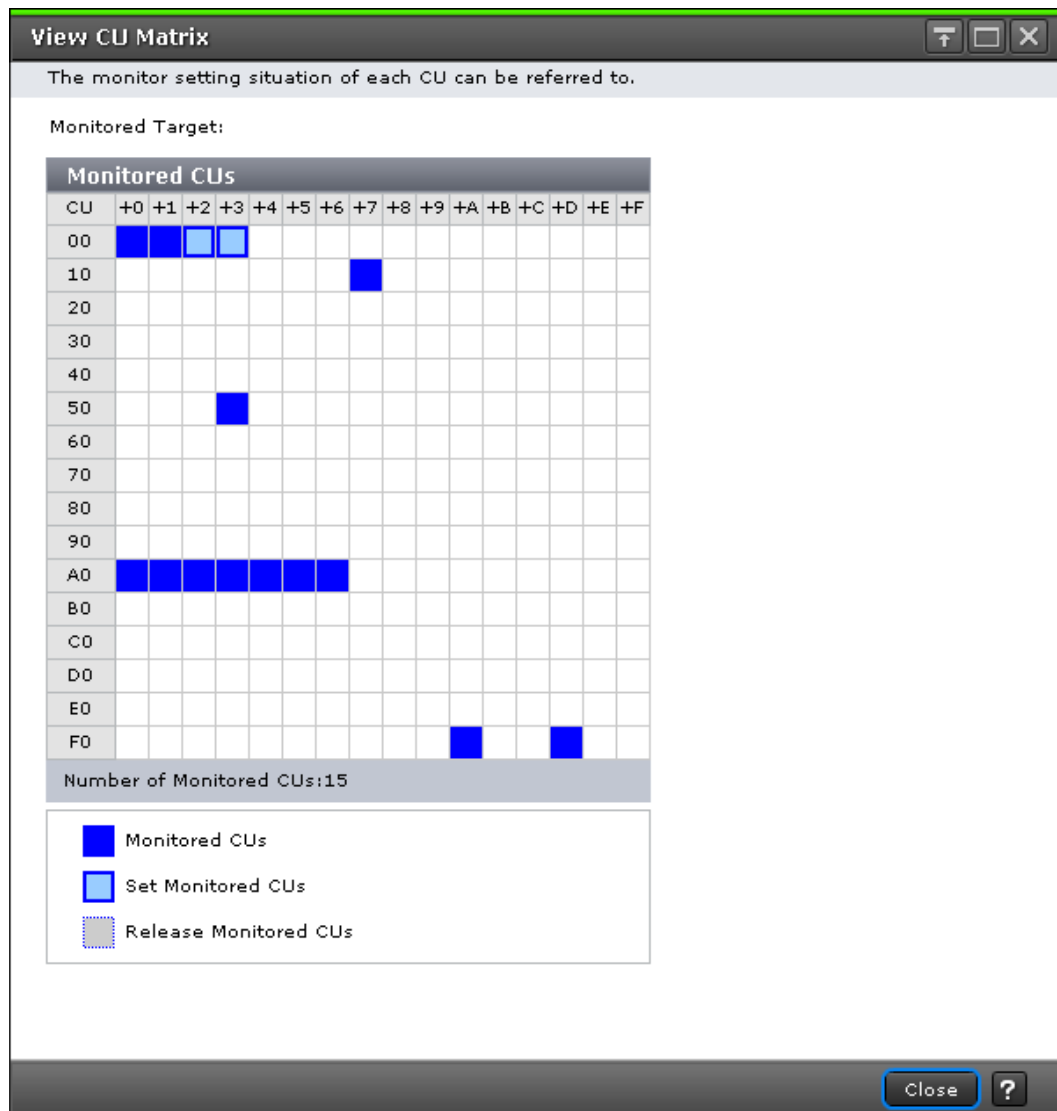
Information about the CUs not to be monitored.

Item	Description
CU	CUs not to be monitored.

Item	Description
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. <ul style="list-style-type: none"><li data-bbox="695 407 1089 436">▪ CU which is being monitored<li data-bbox="695 457 1219 487">▪ CU which is scheduled to be monitored<li data-bbox="695 508 1409 537">▪ 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.



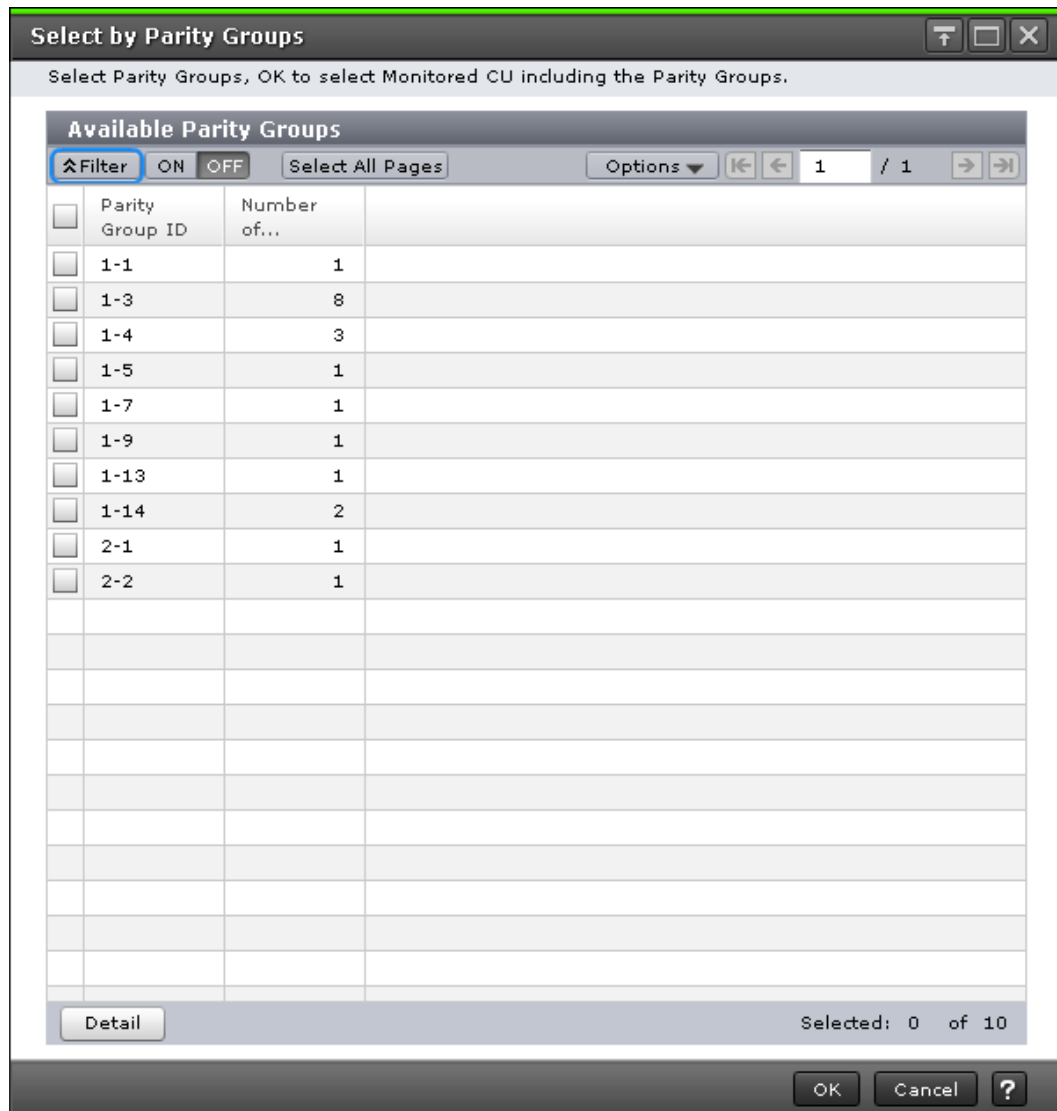
Monitored CUs table

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
<input type="checkbox"/> Set Monitored CUs	Cell marker indicating that the CU is scheduled to be monitored.
<input type="checkbox"/> 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.

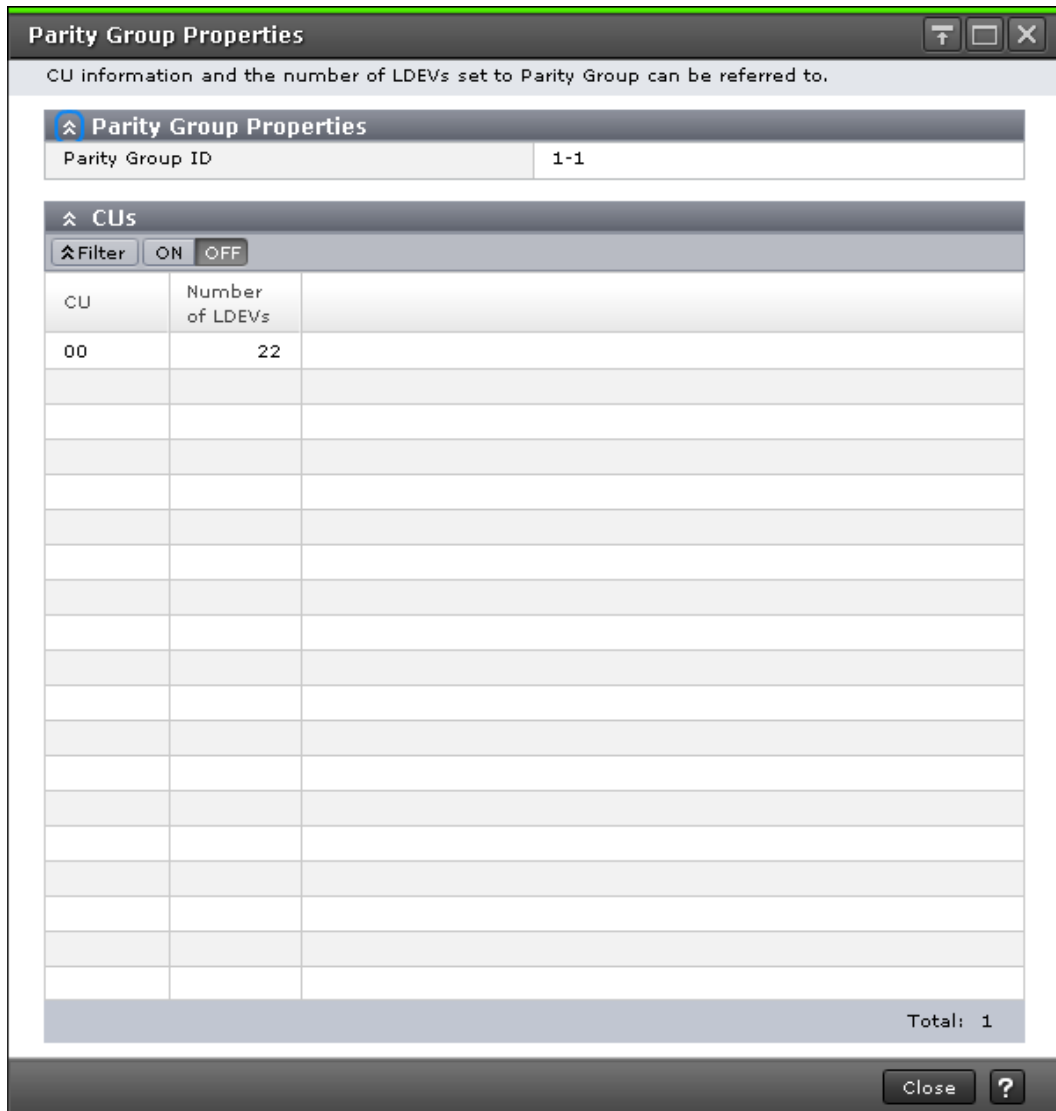


Available Parity Groups table

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.



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

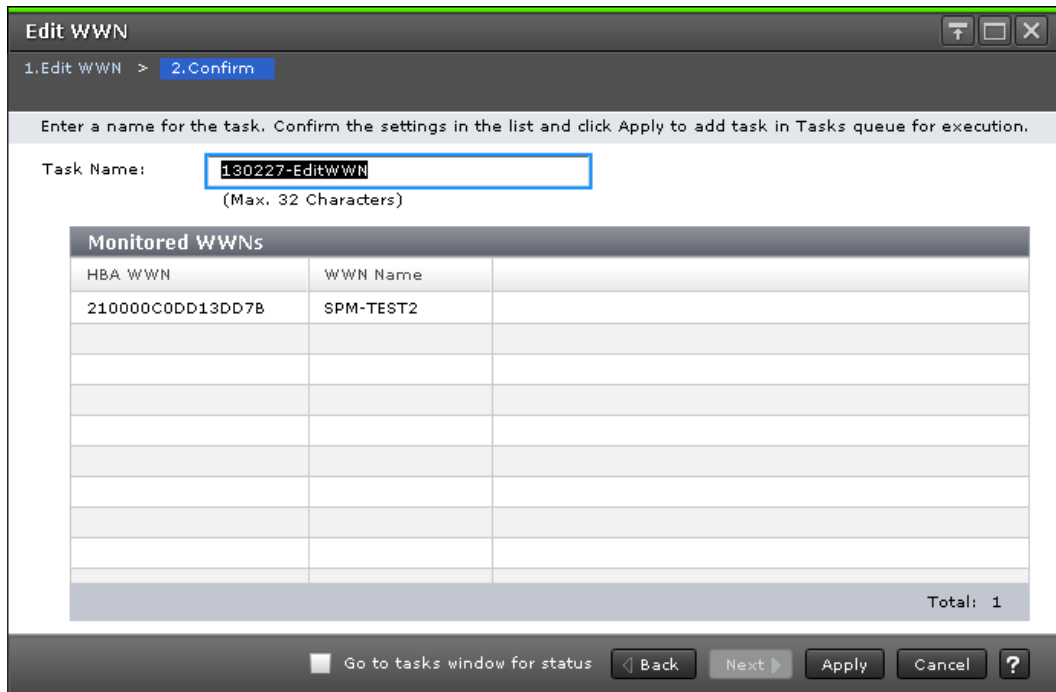
Use this window to edit the HBA WWN and WWN name of the WWN to be monitored.

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

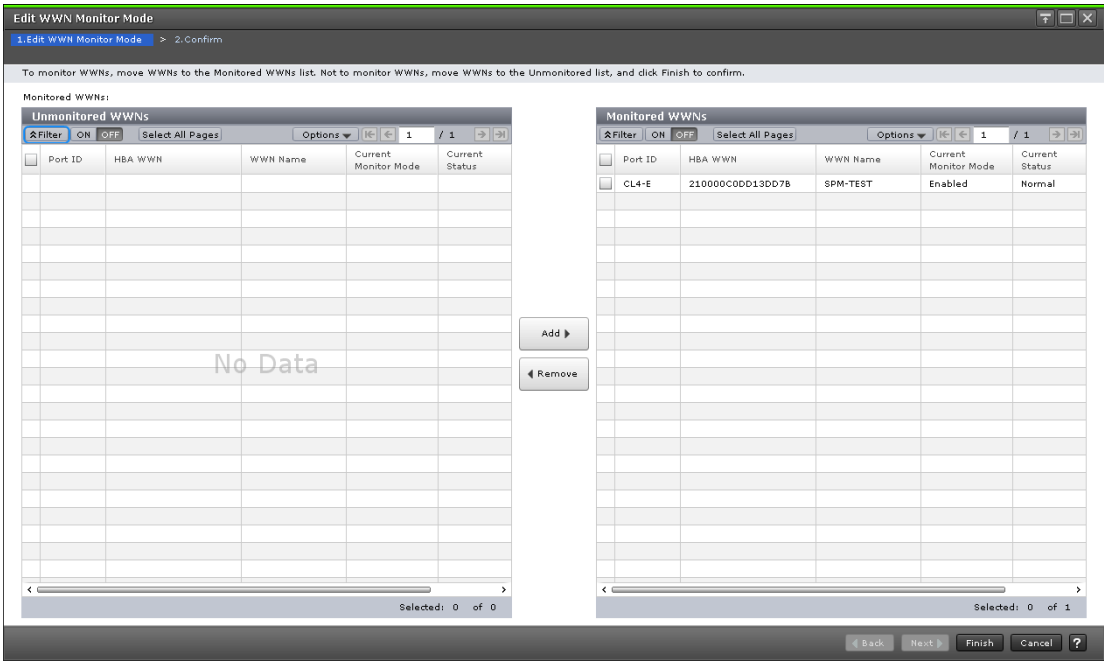
Confirm the information about the WWNs to be monitored.

Item	Description
HBA WWN	HBA WWNs to be applied.
WWN Name	WWN Names to be applied.

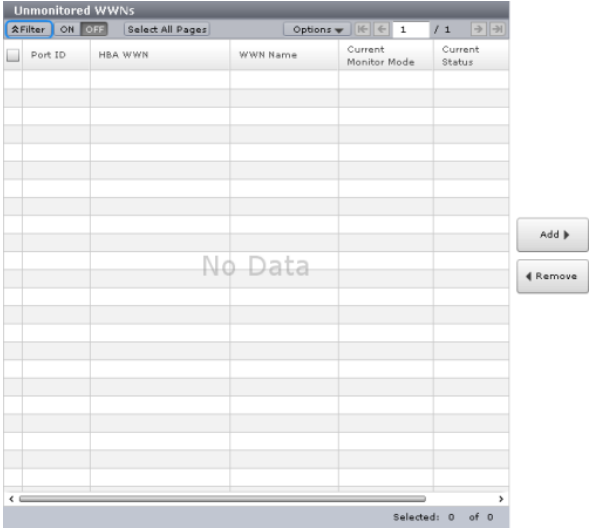
Edit WWN Monitor Mode wizard

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
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.

Enter a name for the task. Confirm the settings and click Apply to add task in Tasks queue for execution.

Task Name: (Max: 32 Characters)

Selected WWNs to Enable Monitor			
Port ID	HBA WWN	WWN Name	Status
No Data			
Total: 0			

Selected WWNs to Disable Monitor			
Port ID	HBA WWN	WWN Name	Status
CL4-E	210000C0DD13DD7B	SPM-TEST	Normal
Total: 1			

Go to tasks window for status

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.

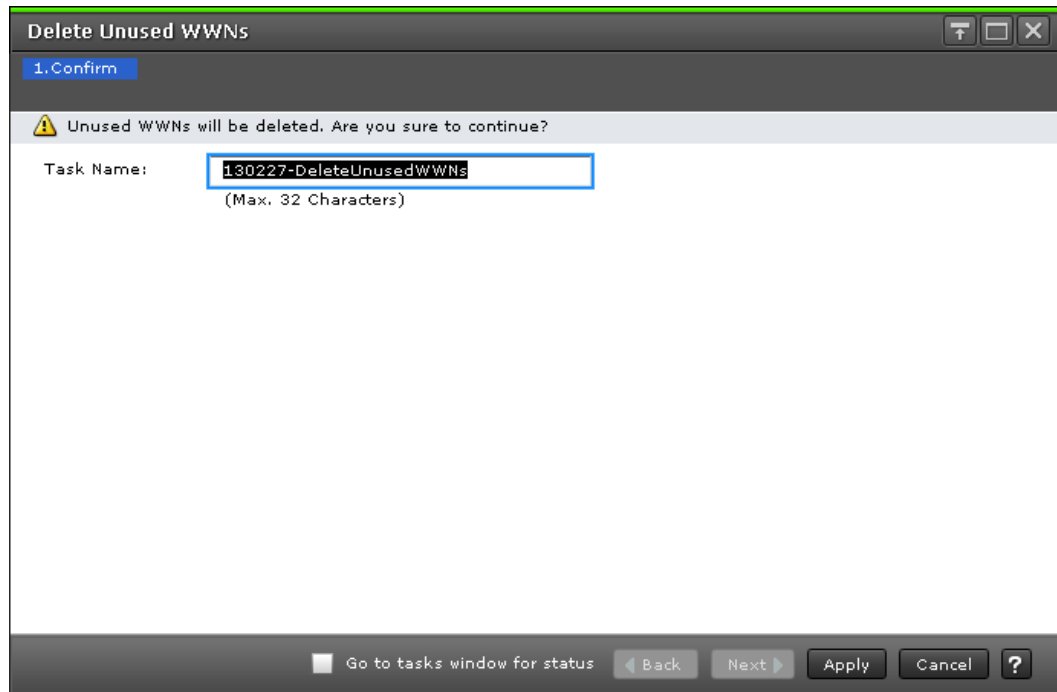
Selected WWNs to Disable Monitor table

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.

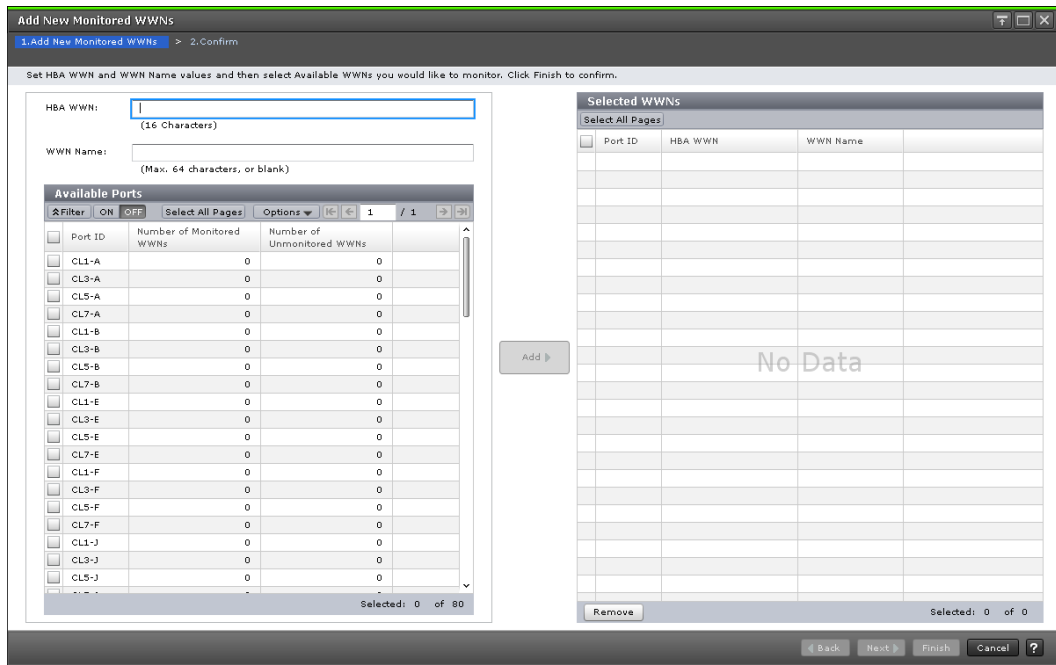


Item	Description
Task Name	Specify the task name. You can enter up to 32 alphanumeric characters and symbols in all, except for \ / : , ; * ? " < > . The characters are case-sensitive. "date-window name" is entered as a default.

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.

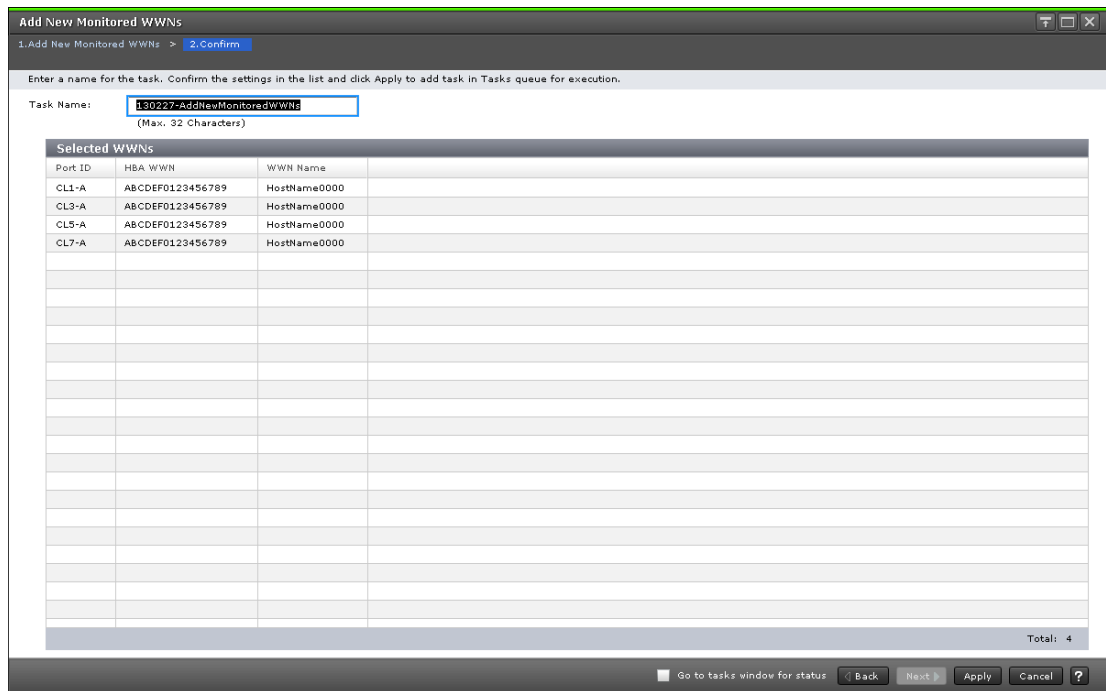
Available Ports table



Item	Description
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

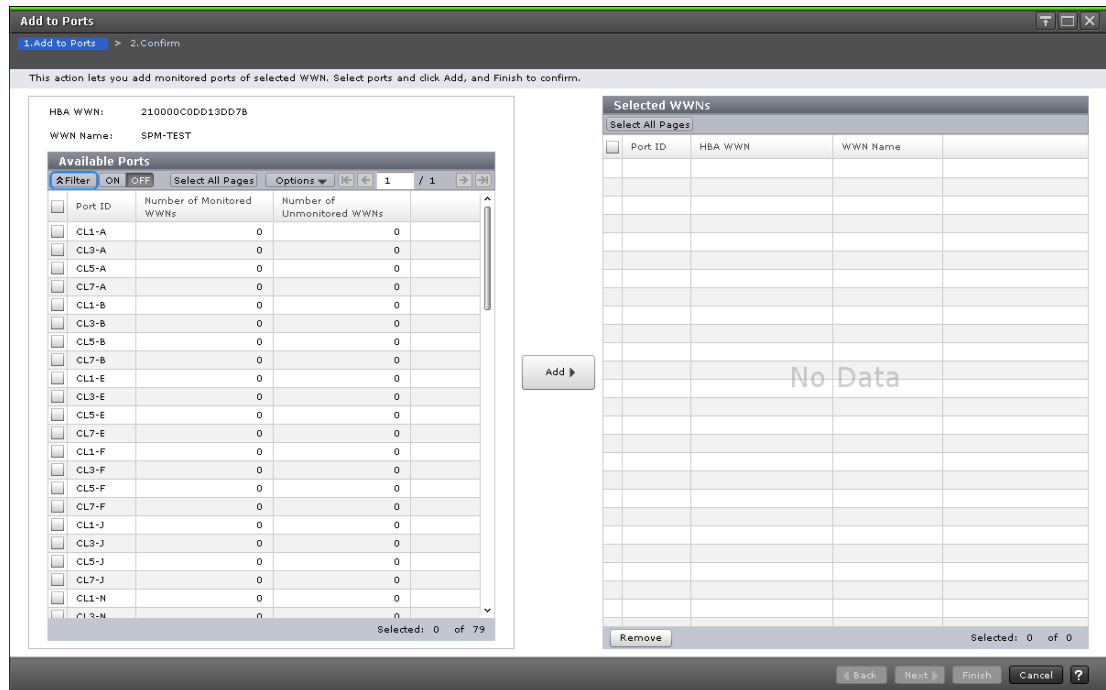
Confirm the list of combinations of ports and WWNs added as monitoring target objects.

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

HBA WWN: 210000C0DD13DD7B
 WWN Name: SPM-TEST

Available Ports

Filter ON OFF Select All Pages Options 1 / 1

<input type="checkbox"/>	Port ID	Number of Monitored WWNs	Number of Unmonitored WWNs
<input type="checkbox"/>	CL1-A	0	0
<input type="checkbox"/>	CL3-A	0	0
<input type="checkbox"/>	CL5-A	0	0
<input type="checkbox"/>	CL7-A	0	0
<input type="checkbox"/>	CL1-B	0	0
<input type="checkbox"/>	CL3-B	0	0
<input type="checkbox"/>	CL5-B	0	0
<input type="checkbox"/>	CL7-B	0	0
<input type="checkbox"/>	CL1-E	0	0
<input type="checkbox"/>	CL3-E	0	0
<input type="checkbox"/>	CL5-E	0	0
<input type="checkbox"/>	CL7-E	0	0
<input type="checkbox"/>	CL1-F	0	0
<input type="checkbox"/>	CL3-F	0	0
<input type="checkbox"/>	CL5-F	0	0
<input type="checkbox"/>	CL7-F	0	0
<input type="checkbox"/>	CL1-J	0	0
<input type="checkbox"/>	CL3-J	0	0
<input type="checkbox"/>	CL5-J	0	0
<input type="checkbox"/>	CL7-J	0	0
<input type="checkbox"/>	CL1-N	0	0
<input type="checkbox"/>	CL3-N	0	0

Selected: 0 of 79

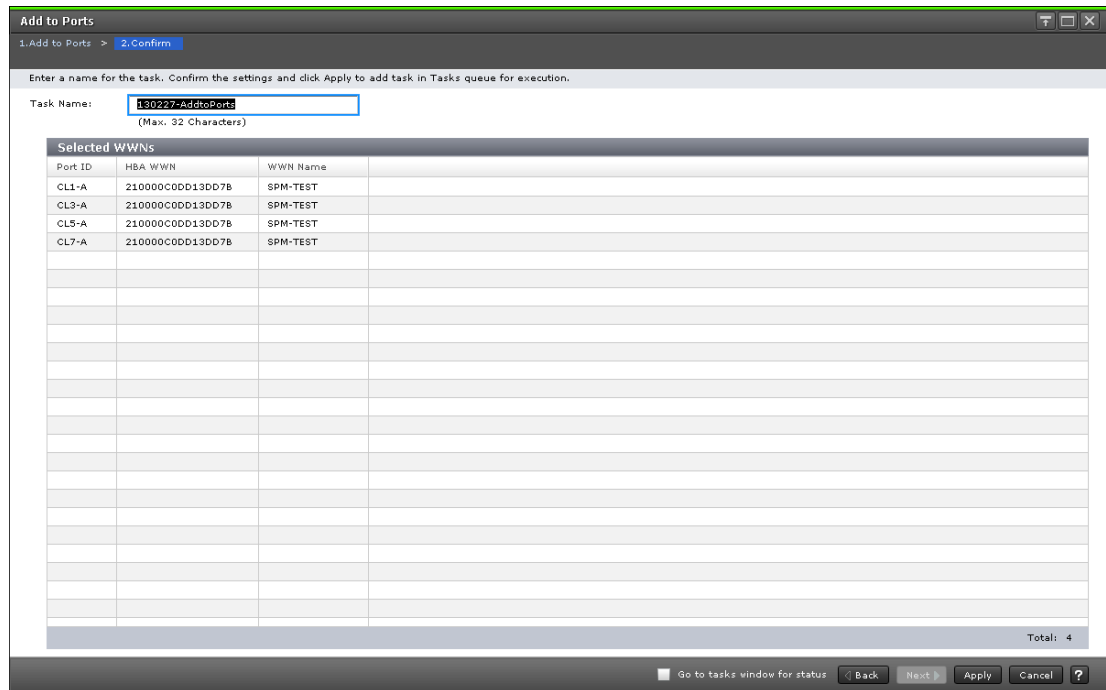
Add ▶

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.



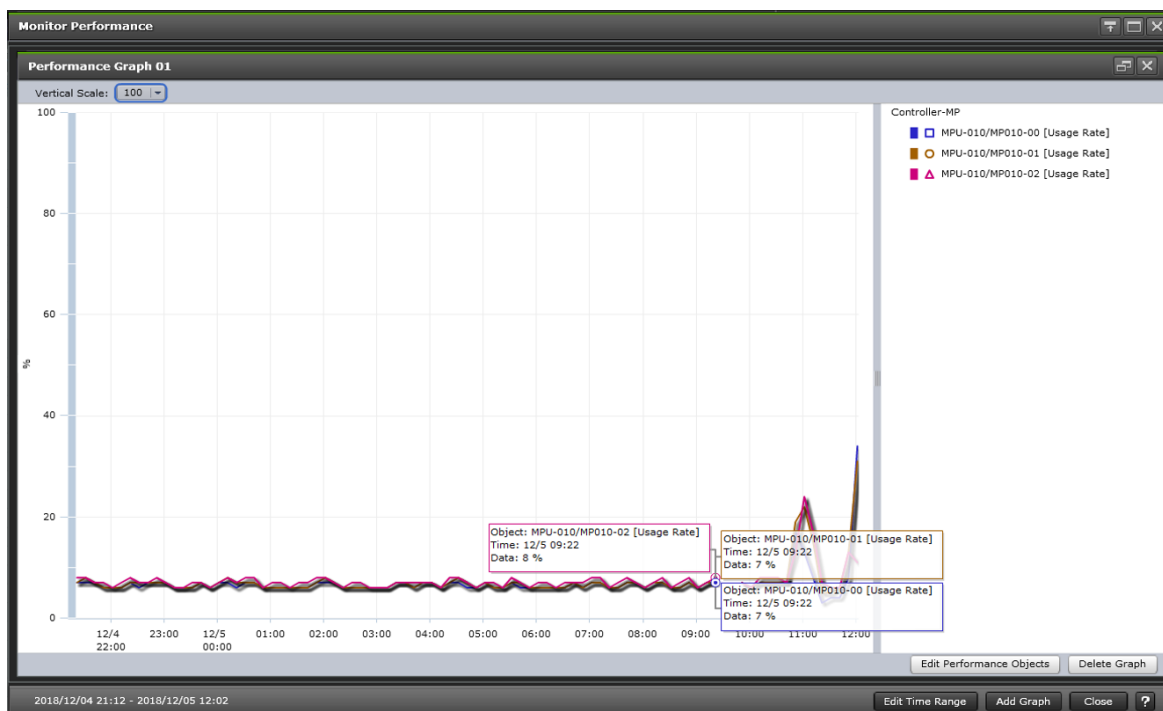
Selected WWNs table

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	<p>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.</p> <ul style="list-style-type: none"> ▪ 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.

Item	Description
	<ul style="list-style-type: none"> You can view up to 16 graphs across a total of four panels. When Time Range is Use Real Time, and an MP unit is displayed in the legend to the right of the graph panel, the name of the MP unit is displayed as a link. If you click the link, a maximum of top 20 resource usage rates associated with the MP unit are displayed. For details, see MP Properties window (on page 284).
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.

Item	Description
	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

Use this window to display the resources assigned to an MP unit of top 20 in usage rates.

MP Properties

MPU-010/MP010-00

Filter ON OFF

No.	Resource Type	Resource ID	Resource Name	Use	Usage Rate (%)
1	LDEV	00:01:2D		Open Ta...	1
2	LDEV	00:06:00		Open Ta...	1
3	LDEV	00:06:01		Open Ta...	1
4	LDEV	00:10:00		Open Ta...	1
5	LDEV	00:10:3E		Open Ta...	1
6	LDEV	00:F1:00		Open Ta...	1
7	LDEV	00:00:64		Open Ext...	1
8	LDEV	00:00:65		Open Ext...	1
9	External ...	E5-1	-	Open Ext...	1
10	External ...	E1-1	-	Open Ext...	1
11	LDEV	00:01:2D		Back-end	1
12	LDEV	00:03:E8		Back-end	1
13	LDEV	00:06:00		Back-end	1
14	LDEV	00:06:01		Back-end	1
15	LDEV	00:10:00		Back-end	1
16	LDEV	00:20:00		Back-end	1
17	LDEV	00:F1:00		Back-end	1
18	LDEV	00:F2:00		Back-end	1
19	LDEV	00:00:64		System	1
20	LDEV	00:00:65		System	1

2018/12/25 12:25 - 2018/12/25 12:26

Close ?

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.

Item	Description
Resource Name	<p>Shows the name of the following resources:</p> <p>LDEV: An LDEV name is displayed.</p> <p>External Volume: A hyphen (-) is displayed because an external volume has no name.</p> <p>Journal: A hyphen (-) is displayed because a journal has no name.</p>
Use	<p>Shows a kernel type of a resource as follows:</p> <p>Open Target: Indicates that this resource is used on the front end for the open system.</p> <p>Open External: Indicates that this resource is used by the external storage system for the open system.</p> <p>Open Initiator: Indicates that this resource is used by the initiator for the open system.</p> <p>Mainframe Target: Indicates that this resource is used on the front end for the mainframe.</p> <p>Mainframe External: Indicates that this resource is used by the external storage system for the mainframe.</p> <p>Back-end: Indicates that this resource is used on the back end.</p> <p>System: Indicates that this resource is used by the maintenance and other functions.</p>
Usage Rate (%)	<p>Shows a usage rate of a resource.</p> <p>The rate (%) of a resource processed in the latest monitoring period is displayed.</p>

Edit Time Range window

Use this window to select a date and time range for displaying monitoring data in a performance graph.

Edit Time Range

Modify the Date and Time range for which data is displayed in the performance graph.

Time Range: From: 2013/02/20 17:01

To: 2013/02/20 18:30

89 Minute(s)

(2013/02/19 18:30 - 2013/02/20 18:30)

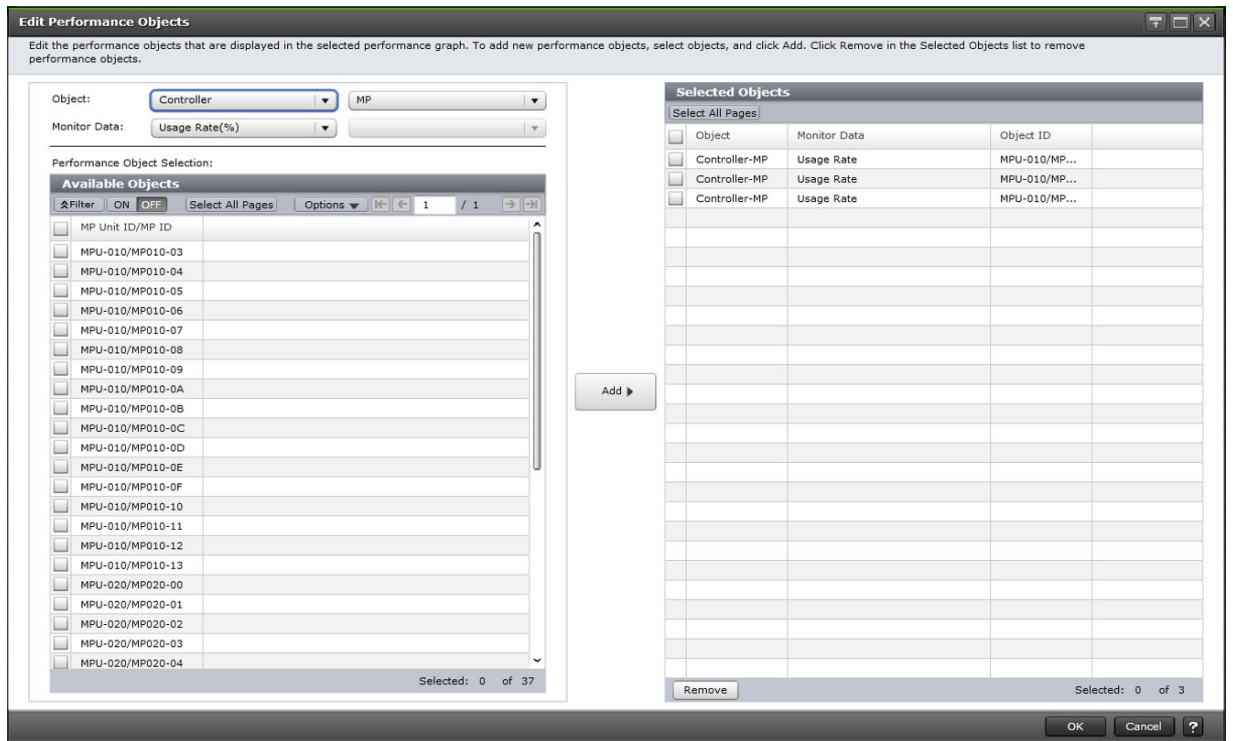
OK Cancel ?

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

Edit Performance Objects

Edit the performance objects that are displayed in the selected performance graph. To add new performance objects, select performance objects.

Object:

Monitor Data:

Performance Object Selection:

Available Objects

Filter ON OFF Select All Pages Options 1 / 1

<input type="checkbox"/>	MP Unit ID/MP ID
<input type="checkbox"/>	MPU-010/MP010-03
<input type="checkbox"/>	MPU-010/MP010-04
<input type="checkbox"/>	MPU-010/MP010-05
<input type="checkbox"/>	MPU-010/MP010-06
<input type="checkbox"/>	MPU-010/MP010-07
<input type="checkbox"/>	MPU-010/MP010-08
<input type="checkbox"/>	MPU-010/MP010-09
<input type="checkbox"/>	MPU-010/MP010-0A
<input type="checkbox"/>	MPU-010/MP010-0B
<input type="checkbox"/>	MPU-010/MP010-0C
<input type="checkbox"/>	MPU-010/MP010-0D
<input type="checkbox"/>	MPU-010/MP010-0E
<input type="checkbox"/>	MPU-010/MP010-0F
<input type="checkbox"/>	MPU-010/MP010-10
<input type="checkbox"/>	MPU-010/MP010-11
<input type="checkbox"/>	MPU-010/MP010-12
<input type="checkbox"/>	MPU-010/MP010-13
<input type="checkbox"/>	MPU-020/MP020-00
<input type="checkbox"/>	MPU-020/MP020-01
<input type="checkbox"/>	MPU-020/MP020-02
<input type="checkbox"/>	MPU-020/MP020-03
<input type="checkbox"/>	MPU-020/MP020-04

Add

Selected: 0 of 37

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.

Performance Object Selection

Objects that can be displayed in graphs.

Available Objects table

The columns depend on the object selected. For details, see [Monitor Performance window \(on page 241\)](#).

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	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	%

- 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
HIE-ISW	Usage Rate	%
MP unit-HIE	Usage Rate	%

- 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
Target	Throughput	IOPS
	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
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- 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

- 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

- 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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Sequential)	
	Write (Random)	
	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	%
<p>1. Only information about internal volumes is displayed. Information about the following is not displayed:</p> <ul style="list-style-type: none"> ▪ external volumes ▪ FICON DM volumes <p>2. Information for ShadowImage for Mainframe is included.</p>		

- 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
	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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	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)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Drive To Cache (Random)	
Drive Usage Rate*	None	%
<p>* Only information about internal volumes is displayed. Information about the following is not displayed:</p> <ul style="list-style-type: none"> ▪ external volumes ▪ 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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	Write (Sequential)	
	Write (Random)	
	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

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	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	%
	Meta Data Usage Rate	%
Restore Journal	Throughput	IOPS
	Journal	count/sec
	Data Trans.	MB/s

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
	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	%

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
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	
		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
* 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	Port ID	Name of the port. Only the ports assigned to the user are displayed.
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.

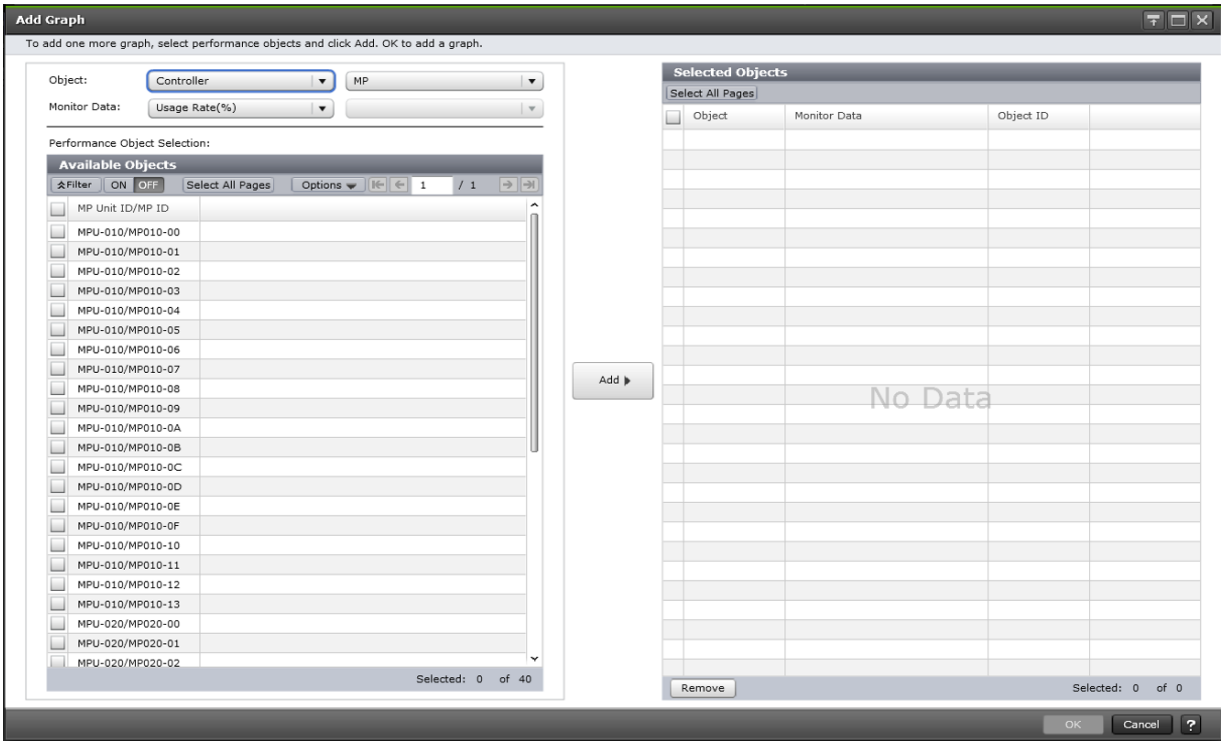
Monitoring object	Item	Description
	HBA WWN	WWN of the host bus adapter. A WWN is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter.
	WWN Name	Nickname of the host bus adapter. A WWN name is up to 64 alphanumeric characters and some signs.
Logical Device/Base	LDEV ID	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.
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 <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.

Monitoring object	Item	Description
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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/UR	Port ID <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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.
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 unit ID/MP ID	ID of an MP unit and processor.
Controller/DRR	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP unit ID	ID of an MP unit.
	Cache	Name of the cache.
Access Path/HIE-ISW	Access Path	Name of the access path.
Access Path/MP unit-HIE	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

The screenshot shows the 'Add Graph' window with the following configuration:

- Object:** Controller (dropdown), MP (dropdown)
- Monitor Data:** Usage Rate(%) (dropdown)
- Performance Object Selection:**
 - Available Objects:** A list of 40 objects with checkboxes. The list includes:
 - MP Unit ID/MP ID
 - MPU-010/MP010-00 through MPU-010/MP010-13
 - MPU-020/MP020-00 through MPU-020/MP020-02
 - Selected:** 0 of 40
 - Add:** A button with a right-pointing arrow.

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 \(on page 308\)](#).

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 \(on page 319\)](#).

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
DRR	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	%

- 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
HIE-ISW	Usage Rate	%
MP unit-HIE	Usage Rate	%

- 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
Target	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms
Initiator	Throughput	IOPS
	Data Trans.	MB/s
	Response Time	ms

- 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

- 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

- 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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	Write (CFW)	
Data Trans.	Total	MB/s
	Read	
	Write	
Response Time	Total	ms
	Read	
	Write	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
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 (VSP 5000 series)	Read (Sequential)	%
	Read (Random)	
	Write (Sequential)	
	Write (Random)	
Drive Access Rate ¹ (VSP E series) (VSP G/F350, G/F370, G/F700, G/F900)	None	%
ShadowImage ^{1,2}	None	%
Notes: <ol style="list-style-type: none"> Only information about internal volumes is displayed. Information about the following is not displayed: <ul style="list-style-type: none"> external volumes FICON DM volumes 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	%

Item on right side of Object field	Item on left side of Monitor Data field	Unit of monitoring data
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
	Sequential	
	Random	
	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	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	
	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	%

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
<p>* Only information about internal volumes is displayed. Information about the following is not displayed:</p> <ul style="list-style-type: none"> ▪ external volumes ▪ 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	
	CFW	
Read Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Write Throughput	Total	IOPS
	Sequential	
	Random	
	CFW	
Cache Hit	Read (Total)	%
	Read (Sequential)	
	Read (Random)	
	Read (CFW)	
	Write (Total)	
	Write (Sequential)	
	Write (Random)	

Item on left side of Monitor Data field	Item on right side of Monitor Data field	Unit of monitoring data
	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	%
	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
	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

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 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	
		Write	
* 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.
Mainframe 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.
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.

Monitoring object	Item	Description
	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.
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 <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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.

Monitoring object	Item	Description
LUN/TC/GAD	Port ID <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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/UR	Port ID <ul style="list-style-type: none"> ▪ Item: Type ▪ Description: Type of port 	Name of the port.
	Host Group Name/iSCSI Target Alias <ul style="list-style-type: none"> ▪ 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.

Monitoring object	Item	Description
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 unit ID/MP ID	ID of an MP unit and processor.
Controller/DRR	DRR ID	ID of a data recovery and reconstruction processor.
Cache	MP unit ID	ID of an MP unit.
	Cache	Name of the cache.
Access Path/HIE-ISW	Access Path	Name of the access path.
Access Path/MP unit-HIE	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	<ul style="list-style-type: none">▪ 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.

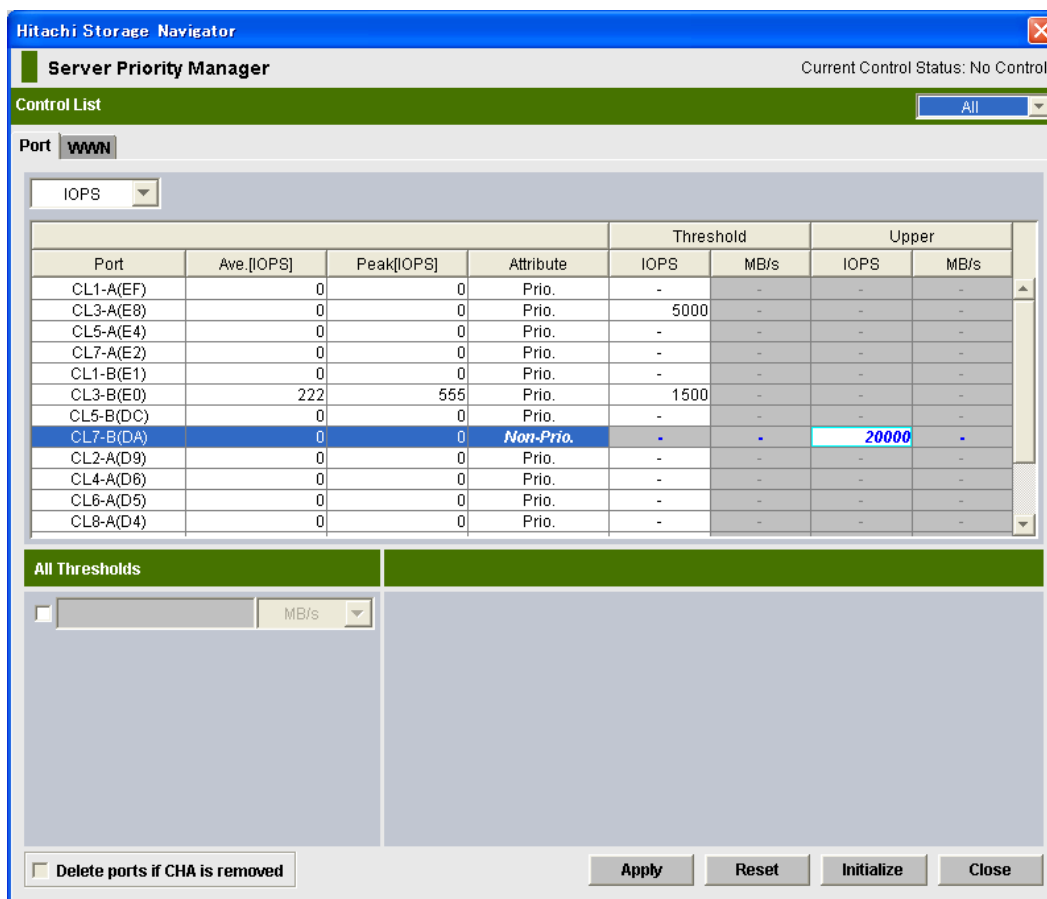
The screenshot shows the Server Priority Manager GUI. At the top, the title bar reads "Server Priority Manager". Below it, the main content area is titled "Server Priority Manager". There are three main sections: 1. "Monitoring Switch" with a toggle set to "Enable" and a "1 min." indicator. 2. "Monitoring Term" with "From" and "To" date/time pickers. The "From" date is 2013/01/16 06:43 and the "To" date is 2013/01/16 08:13. Below these are sliders for adjusting the time range, with a "90 min." indicator and an "Apply" button. 3. "Open SPM Dialog" with a button labeled "Server Priority Manager".

Item	Description
Monitoring Switch	Enable: Performance Monitor is monitoring the storage system Disable: The storage system is not being monitored.

Item	Description
Monitoring Term	<p>Specify a period in which to collect monitoring data and display in Server Priority Manager main window. A day is set by default.</p> <p>To set a date and time in the From and To fields, do either of the following:</p> <ul style="list-style-type: none"> ▪ 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. <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
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
<p>Current Control Status</p>	<p>Shows the current control status of the system.</p> <ul style="list-style-type: none"> ▪ 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. <p>Tip: If WWN Control is displayed when the Port tab is active, click Apply to switch control so that Port Control is displayed.</p> <p>Tip: To return the control status to No Control, specify Prio. for attributes of all ports and then click Apply.</p>
<p>Control List</p>	<p>Allows you to narrow ports appearing in the list:</p> <ul style="list-style-type: none"> ▪ 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.

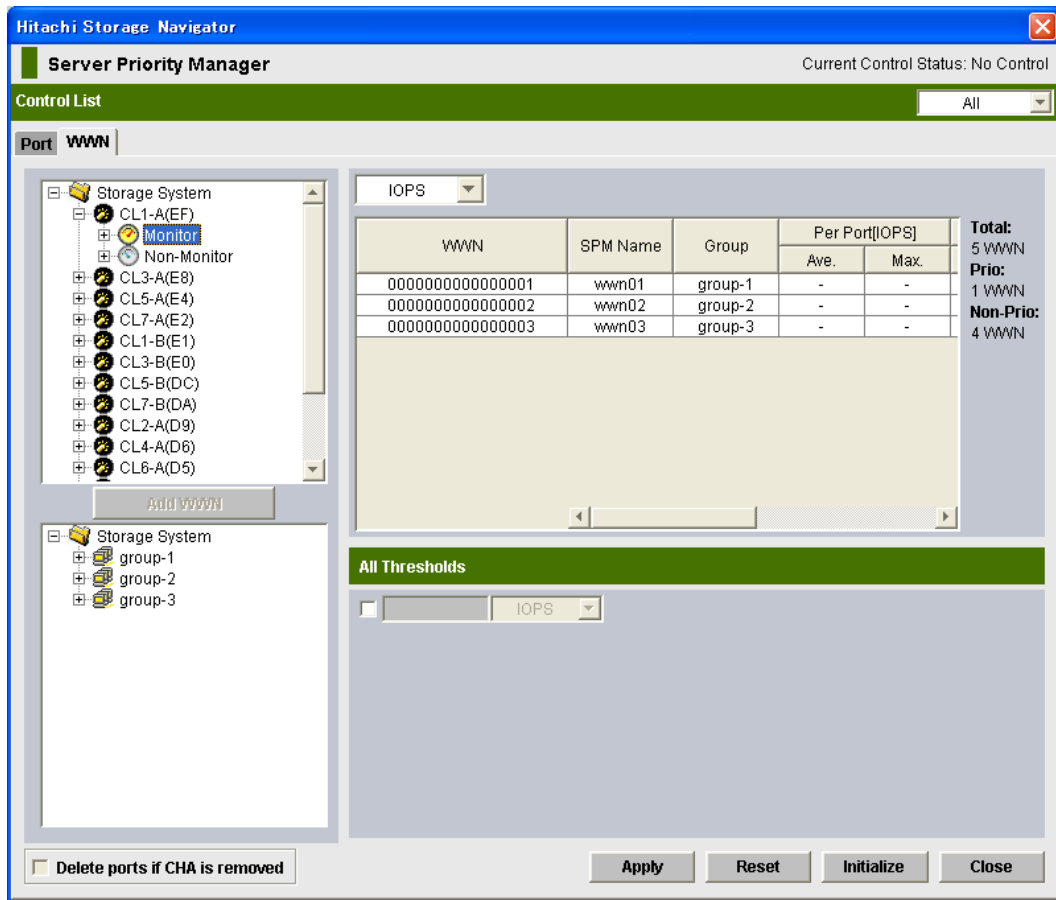
Item	Description
	If you change settings of a port, that port remains in the list regardless of the selection in the list.
Statistic type list	<p>Allows you to change the type of performance statistics to be displayed in the list.</p> <ul style="list-style-type: none"> ▪ If IOPS (I/Os per second) is 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	<p>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.</p> <p>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.</p> <p>The table contains these columns:</p> <ul style="list-style-type: none"> ▪ 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. ▪ Attribute indicates the priority of each port. Prio indicates a prioritized port. Non-Prio indicates a non-prioritized port.

Item	Description
	<ul style="list-style-type: none"> <li data-bbox="553 254 1425 384"> <p>▪ 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.</p> <p>Use the IOPS column to specify the threshold for I/O rates. Use the MB/s column to specify the threshold for transfer rates.</p> <p>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.</p> <p>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.</p> <li data-bbox="553 764 1425 894"> <p>▪ 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.</p> <p>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.</p> <p>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.</p>
All Thresholds	<p>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.</p> <p>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.</p> <p>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.</p>
Delete ports if CHB is removed	<p>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.</p> <p>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.</p>






Item	Description
	<p>The Delete ports if CHB is removed check box is available only when the following Server Priority Manager settings on ports in a removed channel adapter remains on SVP:</p> <ul style="list-style-type: none"> ▪ 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	<p>Changes the settings in this window as explained below, and then applies the resulting settings to the storage system:</p> <ul style="list-style-type: none"> ▪ 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	<p>The current system control.</p> <ul style="list-style-type: none"> ▪ 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. <p>Tip: If Port Control appears when the WWN tab is active, click Apply to switch control so that WWN Control is displayed.</p> <p>Tip: To return the control status to No Control, specify Prio. for attributes of all host bus adapters and then click Apply.</p>
Control List	<p>Allows you to narrow WWNs in the list:</p> <ul style="list-style-type: none"> ▪ 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	<p>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 .</p> <p>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.</p> <ul style="list-style-type: none"> ▪ 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. <p>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.</p> <p>Only the WWN is displayed on the right of the host bus adapter icon () below Non-Monitor.</p> <p>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 175).</p> <p>The list on the right of the tree changes depending on the item you select in the tree as follows.</p> <ul style="list-style-type: none"> ▪ 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	<p>SPM groups and host bus adapters (WWNs) in each SPM group:</p> <ul style="list-style-type: none"> ▪ SPM groups (), which contain one or more WWNs, appear below the Storage System folder. For details on SPM groups, see About SPM groups (on page 185). ▪ 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 (). <p>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 175).</p> <p>The list on the right of the tree changes depending on the item you selected in the tree as follows:</p> <ul style="list-style-type: none"> ▪ 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	<p>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.</p> <p>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 WWN button is unavailable.</p>
Statistic type	<p>Allows you to change the type of performance statistics to be displayed in the WWN list.</p> <ul style="list-style-type: none"> ▪ 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	<p>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.</p> <p>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.</p> <p>On the right side of the list appear total number of WWNs, the number of prioritized WWNs, and the number of non-prioritized WWNs.</p> <p>The list contains the following columns (use the slide bar to view all of the columns):</p> <ul style="list-style-type: none"> ▪ 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.

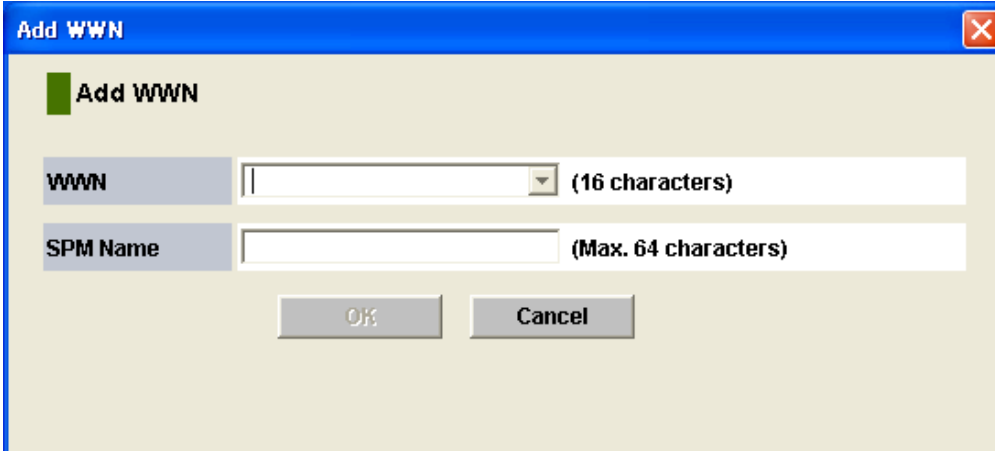
Item	Description
	<ul style="list-style-type: none"> <li data-bbox="553 254 1409 386"> <p>▪ Per Port [IOPS]: The traffic (I/O rate or transfer rate) between the host bus adapter and the port selected in the upper-left tree. This item is displayed only when you select an icon in the upper-left tree. The Per Port column contains the following:</p> <p style="margin-left: 20px;">Ave.: Average I/O rate or the average transfer rate for the specified period.</p> <p style="margin-left: 20px;">Max.: Maximum I/O rate or the maximum transfer rate for the specified period.</p> <li data-bbox="553 575 1409 779"> <p>▪ 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.</p> <li data-bbox="553 800 1409 1346"> <p>▪ The WWN Port column contains the following:</p> <p style="margin-left: 20px;">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.</p> <p style="margin-left: 20px;">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.</p> <li data-bbox="553 1367 1409 1684"> <p>▪ 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 174).</p> <p style="margin-left: 20px;">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.</p>

Item	Description
	<ul style="list-style-type: none"> ▪ 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. <p>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.</p> <p>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.</p> <p>Notes:</p> <ul style="list-style-type: none"> ▪ 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 188). ▪ The Upper columns will not appear if an SPM group () or a host bus adapter () is selected in the lower-left tree.
All Thresholds	<p>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.</p> <p>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.</p> <p>On the WWN tab, you cannot specify individual thresholds for each host bus adapter.</p>
Delete ports if CHB is removed	<p>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.</p>

Item	Description
	<p>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.</p> <p>This check box is available only when the following Server Priority Manager settings on ports in a removed channel adapter remain on the SVP:</p> <ul style="list-style-type: none"> ▪ 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	<p>Changes the settings in this window, as explained below, and then applies the resulting settings to the storage system:</p> <ul style="list-style-type: none"> ▪ 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.



The screenshot shows a dialog box titled "Add WWN". It features a blue title bar with a close button (X) in the top right corner. The main content area is light beige and contains a green square icon followed by the text "Add WWN". Below this, there are two input fields: "WWN" with a dropdown arrow and "(16 characters)" to its right, and "SPM Name" with "(Max. 64 characters)" to its right. At the bottom of the dialog are "OK" and "Cancel" buttons.

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).

Summary

Item	Description
Number of CLPRs	Displays the number of CLPRs in the storage system.
Cache Size	Displays the cache capacities in the storage system:
Number of Resources	Displays the number of resources already assigned to CLPRs: <ul style="list-style-type: none"> Parity Group: Number of parity groups Virtual Volume: Number of virtual volumes Total: Number of resources already assigned to CLPRs

Cache Partitions tab

CLPR Name	Cache Size			Number of Resources			Number of Resident Extents
	General	Resident	Total	Parity Group	Virtual Volume	Total	
CLPR0	493.25 GB	0.00 GB	493.25 GB	6	0	6	16384
CLPR1	8.00 GB	0.00 GB	8.00 GB	0	0	0	0

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:
Number of Resources	Displays the number of resources already assigned to CLPRs: <ul style="list-style-type: none"> Parity Group: Number of parity groups Virtual Volume: Number of virtual volumes Total: Number of resources already assigned to CLPRs
Create CLPRs	Opens the Create CLPRs wizard.
Migrate CLPR Resources	Opens the Migrate CLPR Resources wizard.
Edit CLPR	Opens the Edit CLPR wizard.

Item	Description
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

The screenshot displays the '0:CLPR0' window in the Virtual Partition Manager GUI. The window title is '0:CLPR0' and it shows 'Last Updated : 2018/11/05 08:57'. The breadcrumb path is 'Cache Partitions > 0:CLPR0'.

The summary section shows the following details for CLPR 0:CLPR0:

CLPR	0:CLPR0	
Cache Size	130.00 GB	
Number of Resources	Parity Group	1
	Virtual Volume	10
	Total	11

The 'Parity Groups' tab is active, showing a table with the following columns: Parity Group ID, RAID Level, Base Emulation Type, and Capacity. The table contains one entry:

Parity Group ID	RAID Level	Base Emulation Type	Capacity
1-1	5(3D+1P)	OPEN-V	805.26 GB

At the top of the Parity Groups section, there are buttons for 'Migrate CLPR Resources' and 'Export'. The table has a 'Filter' set to 'ON' and 'OFF', and 'Column Settings' are visible. The table shows 'Total: 1' and 'Options' with navigation icons.

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.
Base Emulation Type	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

LDEV ID	LDEV Name	RAID Level	Emulation Type	Capacity	Provisioning Type
No Data					

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	Displays the emulation type of the virtual volume.
Capacity	Displays the capacity.
Provisioning Type	Displays the LDEV type.

Item	Description
Virtual Storage Machine*	<p>Displays information about the virtual storage machine:</p> <ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> • virtual emulation type • virtual LUSE volume number • virtual CVS attribute <p>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.</p> ▪ 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.
<p>* These items are not shown in the table by default. To display these items, use the Column Settings window. For details, see the <i>System Administrator Guide</i> of your storage system.</p>	

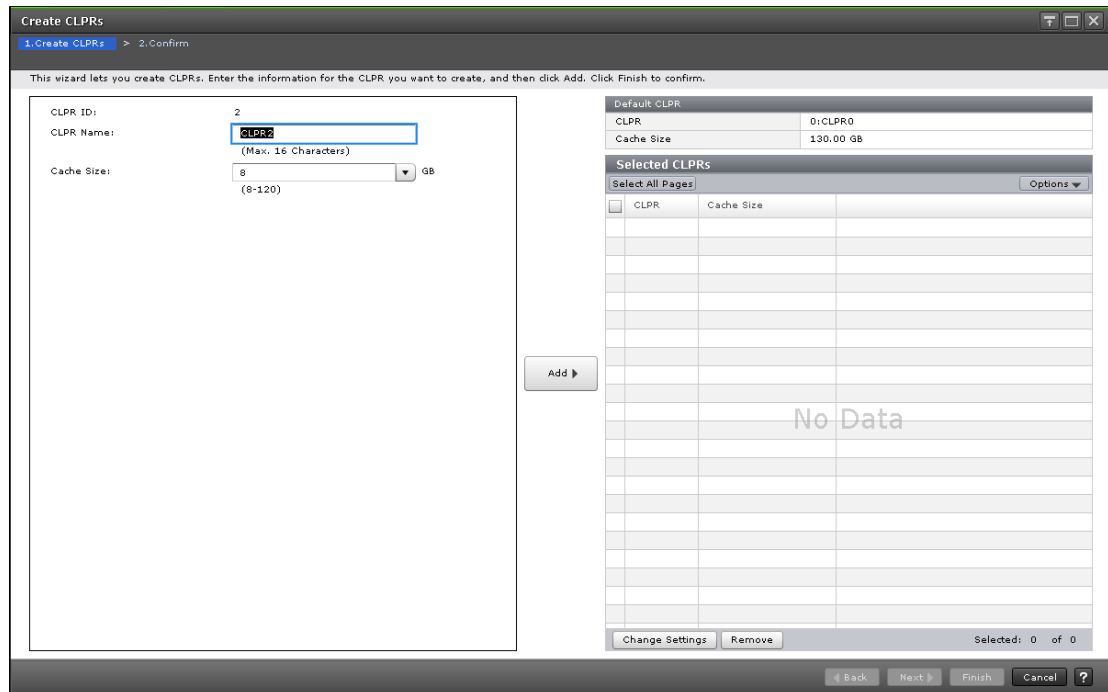
Create CLPRs wizard

The Create CLPRs wizard includes the following windows:

- [Create CLPRs window \(on page 345\)](#)
- [Create CLPRs confirmation window \(on page 347\)](#)

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) .
Total Cache Size (VSP 5000 series)	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. The default is 8 GB, and the desired value can be selected in increments of 4 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. The remaining capacity (subtract the resident cache size from the total cache size) must be 8 GB or more.
Total Cache Size (VSP E series)	Enables you to select the cache capacity of CLPR. A blank is displayed if no CLPR ID is available.

Item	Description
(VSP G130, G/F350, G/F370, G/F700, G/F900)	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.
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.

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.

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.

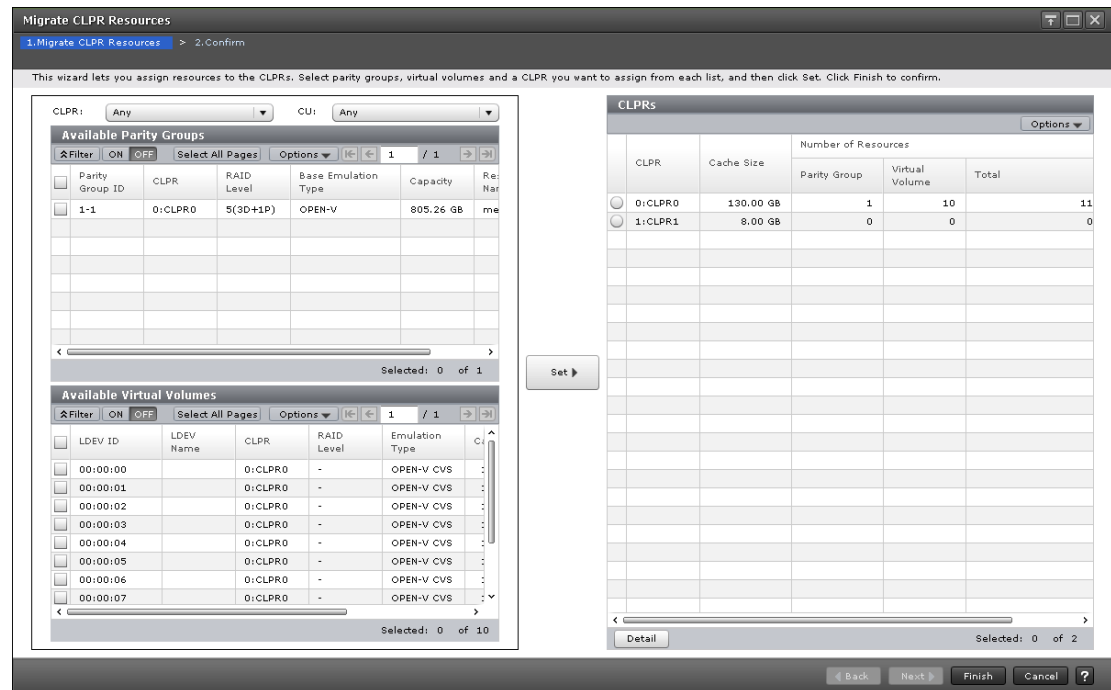
Migrate CLPR Resources wizard

The Migrate CLPR Resources wizard includes the following windows:

- [Migrate CLPR Resources window \(on page 349\)](#)
- [Migrate CLPR Resources confirmation window \(on page 351\)](#)

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	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	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.

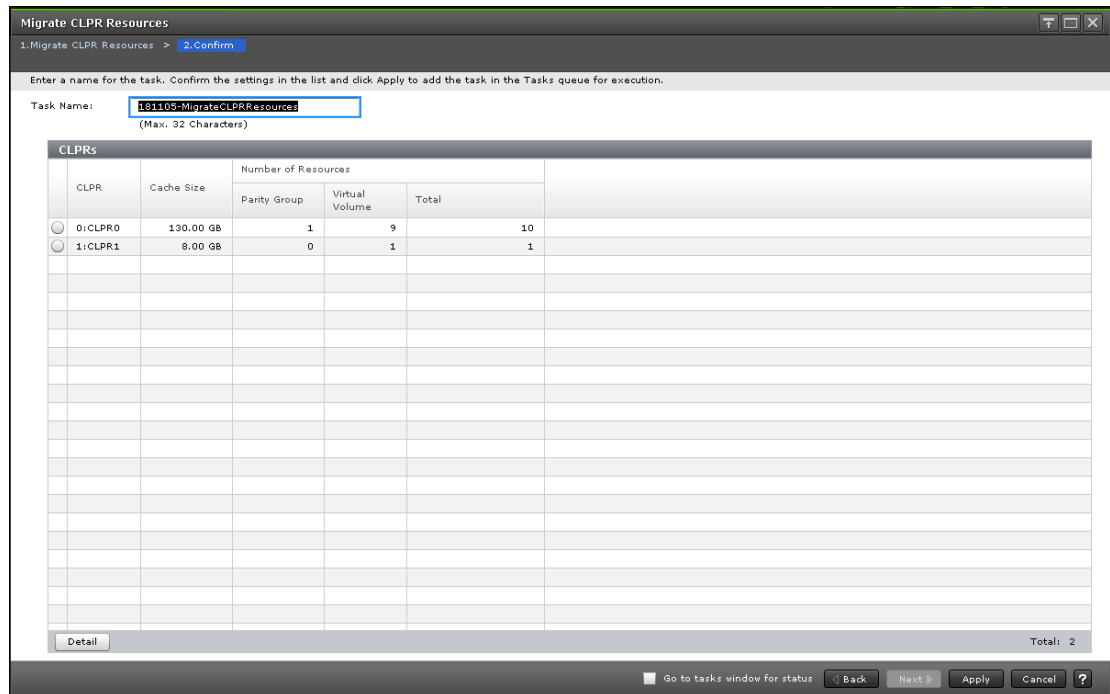
CLPRs table

Displays the information about the resources to assign to CLPRs.

Item	Description
CLPR	Displays the CLPR IDs and CLPR names.
Cache Size	Displays the total cache capacities.
Number of Resources	Displays the number of resources assigned to CLPRs. The value changes depending on the resources. <ul style="list-style-type: none"> ▪ 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.

Item	Description
Cache Size	Displays the total cache capacities of the CLPRs.
Number of Resources	Displays the number of resources assigned to CLPRs. <ul style="list-style-type: none"> ▪ 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 \(on page 352\)](#)
- [Edit CLPR confirmation window \(on page 354\)](#)

Edit CLPR window

This window appears when you click Edit CLPR on the **Cache Partition** window.

Edit CLPR

1. Edit CLPR > 2. Confirm

This wizard lets you edit one or more properties.
Check the box in front of the property you want to edit, and then enter the new value.

CLPR ID: 1

CLPR Name: CLPR1
(Max. 16 Characters)

Cache Size: 8 GB
(8-128)

◀ Back Next ▶ Finish Cancel ?

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) .
Cache Size	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.

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.

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:

Change Settings window

This window appears when you click Change Settings on the **Create CLPRs** window.

Change Settings

Enter the CLPR name and click OK.

CLPR Name: Prefix Initial Number

CLPR2

(Max.16 Characters total including max.9-digit number)

OK Cancel ?

CLPR Name field

Item	Description
CLPR Name	<p>Displays the CLPR name set at the time of the CLPR creation, and enables you to edit the name.</p> <ul style="list-style-type: none"> ▪ 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. <p>The maximum number of characters for CLPR name is 16, including both Prefix and Initial number, not 25 (16+9).</p>

CLPR Properties window

This window appears when you click Detail on the **Migrate CLPR Resources** window.

Parity Groups table

Item	Description
Parity Group ID	Displays the parity Group IDs.
Migrated	Indicates whether there is a change by CLPR allocation: <ul style="list-style-type: none"> ▪ 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	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: <ul style="list-style-type: none"> ▪ 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	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.

Item	Description
Number of Resources	Displays the number of resources already assigned to the CLPR. <ul style="list-style-type: none"> ▪ Parity Group: Number of parity groups ▪ Virtual Volume: Number of virtual volumes ▪ Total: Number of resources assigned to CLPRs

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:

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