This manual describes NEC Storage PerformanceMonitor (performance monitoring function) and NEC Storage PerformanceOptimizer (performance optimization function).

The performance monitoring function is for monitoring the performance of the Disk Array Subsystem (hereinafter may be referred to as disk array), collecting performance information, and displaying the performance in real-time.

The performance optimization function is for optimizing the performance of the disk array by moving a logical disk in the disk array, displaying the Busy Ratio, and estimating the Busy Ratio after it has been moved.

Refer to the “NEC Storage Manager Manual Guide” (IS901) for the overview of NEC Storage Manager and the related manuals.

Remarks
1. This manual explains functions implemented by the following program products:
   - NEC Storage Manager and NEC Storage BaseProduct
   - NEC Storage PerformanceMonitor
   - NEC Storage PerformanceOptimizer

2. This manual is applicable to the program products of the following versions:
   - NEC Storage Manager Ver2.1
   - NEC Storage BaseProduct Ver2.1

3. The term “iSM” in this text refers to all the NEC Storage Manager program products.

4. Trademarks and registered trademarks
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Other product names and company names, etc. are registered trademarks or trademarks of the associated companies.
6. In this document, matters to which careful attention needs to be paid will be described as follows:

Be sure to observe the contents.

If the indications are ignored and the system is improperly operated, settings which have been already made might be affected.

<table>
<thead>
<tr>
<th>Type of Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Description</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
</tr>
<tr>
<td>Describes contents which require special attention during operation.</td>
</tr>
</tbody>
</table>

The First Edition in May 2002
The Third Edition in April 2003
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Part I  Performance Monitoring Function
Chapter 1 Overview of Performance Monitoring Function

1.1 Performance Monitoring Function

The Performance Monitoring Function provides a performance monitoring function for centrally controlling the storage performance under the control of NEC Storage Manager (hereafter, referred to as iSM). The use of this performance monitoring function is capable of real-time monitoring of loads, detection of overload, and management of statistic information (performance information of the past). The function allows an administrator to investigate the cause of access performance deterioration, detect abrupt increases of accesses, and take proper measures against symptoms of failures (Note 1) on the business server. Thus, this function enables constantly stable operation of storage devices.

Figure 1-1 Configuration of the Performance Monitoring Function

(Note 1)

The Performance Optimization function (NEC Storage PerformanceOptimizer) allows easy operation. Refer to Part II “Performance Optimization Function” for details.
### 1.2 NEC Storage Performance Monitor and Related Product

NEC Storage Performance Monitor requires the following program product as a precondition.
- NEC Storage BaseProduct

### 1.3 System Configuration

Refer to Chapter 3 “System Configuration of NEC Storage Manager” of the “NEC Storage Manager Manual Guide”.

### 1.4 Operation of Performance Monitoring Function

This section describes operations of the Performance Monitoring Function. The Performance Monitoring Function is operated in the flows shown below:

<table>
<thead>
<tr>
<th>Operation flow</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing Performance Monitoring Function</td>
<td>Chapter 2 Installation of Performance Monitoring Function</td>
</tr>
<tr>
<td>Installation of the Performance Monitoring Function is accompanied by installing NEC Storage Manager at the same time.</td>
<td>1.5.1 Real-Time Display of Load State</td>
</tr>
<tr>
<td>Specifying targets of monitoring performances</td>
<td>3.1 Real-Time Display of Load State</td>
</tr>
<tr>
<td>For defining the targets of monitoring performances, specify disk array, ports, logical disks, and physical disks composing logical disks used in operations requiring responsibility such as online processing. Also, specify monitoring items among those allowed for real-time monitoring (I/O Density, transfer rate, etc.). For example, to monitor responses to accesses from an application, average response time and I/O density must be monitored.</td>
<td>1.5.3 Analysis support for statistic information</td>
</tr>
<tr>
<td>Analyzing performances</td>
<td>3.3 Support for Analysis of Statistic Information</td>
</tr>
<tr>
<td>Accumulate the statistic information of performance monitoring target devices, with accesses from business programs. Then analyze the statistic information by summarizing, extracting, and editing. On the basis of the analyzed information, a maximum load level, load fluctuation, and expected period of heavy load and future load regulation are estimated. This analysis is performed regularly. If a problem about performances is expected, an appropriate measure must be taken in advance.</td>
<td>A.1 Commands for Statistic Information File</td>
</tr>
<tr>
<td>Specifying threshold value and monitoring overloads</td>
<td>1.5.2 Monitoring Overloads</td>
</tr>
<tr>
<td>On the basis of performance analysis results, specify threshold values as indexes for detecting overloads. Loads exceeding a specified threshold value are detected by NEC Storage Manager automatically, and are reported on the NEC Storage Manager Client screen.</td>
<td>3.2 Monitoring Overloads</td>
</tr>
</tbody>
</table>

Continued to next page
## Reviewing cause of overload

Display performance information on the real-time basis and check location of overload. Then, analyze the accumulated statistic information to determine the cause of the overload.

## Improving performance

Analysis of statistic information makes it possible to improve performance as shown in the examples provided below.

- If there is a problem with the file arrangement and the access load concentrates in a specific logical disk, the I/O density of the logical disk should be higher than that of other logical disks and its response time should be longer. If this is the case, it is necessary to review the file arrangement and distribute the load.

- If a write operation onto the disk is slow, the cache size is insufficient. A write operation onto physical disks may be simultaneously performed. This status is confirmed by checking to see if the Write Hit ratio is less than 100%. If this is the case, it is recommended that the cache size of the disk array be expanded.

- If response is not quick although the access density from the business server to the logical disk is low, the access density to another logical disk on the same RANK may be high. This state is confirmed by the fact that the Busy Ratio of the RANK is high. If this is the case, use the performance optimization function described in Part II to move the logical disk, which has the high access density, to another RANK and level out the Busy Ratio of each RANK. On the other hand, reviewing the processes of a business application to reduce access operations to a disk or improving access efficiency by batch accessing can be good solutions to some cases.

## Displaying statistic information on a real-time basis

1.5.1 Real-Time Display of Load State
3.1 Real-Time Display of Load State

## Analyzing statistic information

1.5.3 Analysis support for statistic information
3.3 Support for Analysis of Statistic Information
A.1 Commands for Statistic Information File

Against high busy ratio on RANK:
Part II Performance Optimization Function
1.5 Function Overview

The Performance Monitoring function includes Real-Time Display of Load Status, Monitoring Overloads, and Statistic Information Analysis Supporting.

1.5.1 Real-Time Display of Load Status

This function is capable of displaying the latest load state and usage of the disk array and disk array components. The information is displayed upon the iSM client screen, on the real-time basis. The function, which can monitor performances of multiple disk array, allows centralized monitoring on the same view of one iSM client. When storage performance decreases, or symptom of a trouble is seen, use this function to display the performance information of disk array and disk array components, and identify the cause of decreased performances or a fault.

For details of components composing disk array, refer to 3.3 “Hardware” in the “NEC Storage Manager Manual Guide”.

The iSM client screen is capable of displaying the index values for each calculation unit shown in Table 1-1. (Index values applicable to the items indicated by “√” in Table 1-1 are displayed.)

Table 1-1 Available Combinations of Monitored Items and Component types

<table>
<thead>
<tr>
<th>Monitored Item</th>
<th>Component type</th>
<th>Disk Array</th>
<th>Port</th>
<th>Logical Disk</th>
<th>Physical Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>External I/O Density</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>External Average Transfer Length</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>External Average Response Time</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Busy Ratio</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Read Hit Ratio</td>
<td></td>
<td>√</td>
<td>-</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Write Hit Ratio</td>
<td></td>
<td>√</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Internal I/O Density</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Internal Transfer Rate</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Internal Average Transfer Length</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Internal Average Response Time</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
</tbody>
</table>

√: Item displayed    -: Item not displayed

- Displays the latest load status in numerical values

Figure 1-2 Displaying the Numeric Table
Chapter 1  Overview of Performance Monitoring Function

• Displays the latest load state in bar graphs

Figure 1-3 Displaying the Bar Graph
Chapter 1  Overview of Performance Monitoring Function

- Displays the latest load state in time-series graphs

Figure 1-4  Displaying the Time-series Graph
(1) **Monitored Items**

Monitored items are types of index values which indicate status of load or performance. iSM displays values of the following types of monitored items on the client screen.

(i) **External I/O Density**

This is the number of input/output requests received by the disk array from the external per unit time. The unit is IOPS (Input Output Per Second). This is calculated by measuring the external I/O count during the unit measurement period and dividing it by the time interval of the measurement period.

(ii) **External Transfer Rate**

This is the Average Transfer Rate of the input/output process achieved in response to the input/output requests received by the disk array from the external. The unit is megabyte/second. This is calculated by measuring the total of the amount of external data transfer during the unit measurement period and dividing it by the time interval of the measurement period.

(iii) **External Average Transfer Length**

This is the average input/output data length per one input/output request received by the disk array from the external. The unit is kilobyte. This is calculated by measuring the total of the amount of external data transfer and external I/O count during the unit measurement period and dividing the former by the latter.

(iv) **External Average Response Time**

This is the Average Response Time for the input/output requests received by the disk array from the external. The unit is millisecond. This is calculated by measuring the total of the external response time and external I/O count during the unit measurement period and dividing the former by the latter.

(v) **Busy Ratio**

It is the ratio of operation of physical disk. The unit is percentage [%]. It is calculated by following expression; dividing the operating time of physical disk by the time slot of measured segments.

(vi) **Read Hit Ratio**

It is the ratio of case where the READ request has been completed using data stored in the cache without reading from physical disk (Read hit), when the disk array receives the input requests from outside. The unit is percentage [%]. It is calculated by following expression; dividing the number of cache hit I/Os by the number of receiving READ requests during the measuring interval.

(vii) **Write Hit Ratio**

This is the ratio of case where the WRITE request has been completed quickly by writing data only in the cache (Write hit), when the disk array receives the output requests from outside. The unit is percentage [%]. It is calculated by following expression; dividing the number of cache hit I/Os by the number of receiving WRITE requests during the measuring interval.

(viii) **Internal I/O Density**

This is the number of input/output requests issued to the internal disk devices by the control device of the disk array. The unit is IOPS (Input Output Per Second). This is calculated by measuring the internal I/O count during the unit measurement period and dividing it by the time interval of the measurement period.

(ix) **Internal Transfer Rate**

This is the average transfer rate of the input/output requests issued to the internal disk devices by the control device of the disk array. The unit is megabyte/second. This is calculated by measuring the total of the amount of internal
data transfer during the unit measurement period and dividing it by the time interval of the measurement period.

(x) Internal Average Transfer Length
This is the average input/output data length of the input/output process performed for the internal disk devices by the control device of the disk array. The unit is kilobyte. This is calculated by measuring the total of the amount of internal data transfer and internal I/O count during the unit measurement period and dividing the former by the latter.

(xi) Internal Average Response Time
This is the average response time for the input/output requests issued to the internal disk devices by the control device of the disk array. The unit is millisecond. This is calculated by measuring the total of the internal response time and internal I/O count during the unit measurement period and dividing the former by the latter.

(2) Unit to sum up

iSM separately displays values of the monitored items collected in the following units.

(i) Disk array
Statistic information of the entire disk array to be monitored is collected and load status for each disk array is reported. For this component type, the external I/O Density, external Transfer Rate, external Average Transfer Length, external Average Response Time, Read Hit Ratio, and Write Hit Ratio can be reported as monitored items.

(ii) Port
For the monitored disk arrays, statistic information related to each host port is collected separately, and load status for each host port is reported. For this component type, the external I/O Density, external Transfer Rate, external Average Transfer Length, and external Average Response Time can be reported as monitored items. In principle, the sum of the values of a monitored item over all the host ports in one disk array is equal to the sum of the values of the same monitored item over all the disk arrays. However, in a real-world situation, some error may exist due to varied sampling time of the statistic information which is the basis of the values of the monitored item.

(iii) Logical disk
For the monitored disk arrays, statistic information related to each logical disk is collected separately, and load status for each logical disk is reported. For this component type, the external I/O Density, external Transfer Rate, external Average Transfer Length, external Average Response Time, Read Hit Ratio and Write Hit Ratio can be reported as monitored items. In principle, the sum of the values of a monitored item over all the logical disks in one disk array is equal to the sum of the values of the same monitored item over all the disk arrays. However, in a real-world situation, some error may exist due to varied sampling time of the statistic information which is the basis of the values of the monitored item.

(iv) Physical disk
Disk devices installed in a disk array are called physical disks. Statistic information related to each physical disk installed in the monitored disk arrays is collected separately, and load status for each physical disk is reported. For this component type, the internal I/O Density, internal Transfer Rate, internal Average Transfer Length, internal Average Response Time, and Busy Ratio can be reported as monitored items.

You can set the update frequency (Display Refresh Rate) of display on the Numeric Table and the Time-series Graph by using the environment setting at system installation.

You can change the setting from the iSM server menu while the iSM server is operating if the performance monitoring
screen is not started. For details of environment setting, refer to 2.1.3 “Environment Setting”.
The Display Refresh Rate determines the resolution of performance monitoring in the direction of time. Specify the
Display Refresh Rate in the number of updates per minute. Table 1-2 shows relation between Display Refresh Rate and
Display Refresh Interval.

<table>
<thead>
<tr>
<th>Display refresh rate (times/minute)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display refresh interval (second)</td>
<td>60</td>
<td>30</td>
<td>20</td>
<td>15</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

You cannot change the Display Refresh Rate while the Performance Monitoring screen is started. Change to the Display
Refresh Rate applies to all the disk arrays monitored by the server.
Increasing the Display Refresh Rate detects change in the performance information in a shorter interval but the number of
components simultaneously display is decreased. This is because the number of collection of performance information by
a single disk array unit in certain period is restricted not to obstruct file I/O from the application host in the overhead at
collection of performance information. This tendency is eminent especially when statistic information is being stored
simultaneously with real-time displaying.

1.5.2 Monitoring Overloads

Specifying a threshold as an index value of overload allows iSM to automatically detect occurrence of overload in a disk
array or a disk array component (occurrence of a load exceeding specified threshold value). Upon detecting an overload, a
message notifying overload is displayed. At the same time, asterisks (**) are displayed on the location of the Performance
Monitor screen. When occurrence of an overload is reported by a message, an administrator must identify location of the
overload on the Performance Monitor screen.
A threshold value is specifiable for each calculation unit displayed by the Real-Time Display function (refer to Table 1-1). The unit of specifying a threshold is called a threshold monitoring element. Thresholds can be specified by clients with the user level (Note 1) L2 or L3.

(Note 1)
For user levels, refer to 5.2 “Client Start/Stop” of the “NEC Storage Manager User’s Manual” of your OS.

1. **Notifying threshold excess by e-mail**
   You can also e-mail the message notifying you of occurrence of an exceeded threshold to a specified address by using the link function of the iSM server. For details of the link function of the iSM server, refer to 3.6 “Event Link” in the “NEC Storage Manager User’s Manual” of your OS.

2. **Threshold monitoring conditions**
   During a background process of disk array, such as batch processing and fault recovery of physical disks, a threshold value may be temporarily exceeded. Upon such a case, which can occur in usual operation in general, exceeding of threshold should not be reported to an administrator. Specifying the monitoring conditions shown below can prevent such unnecessary reporting of exceeded threshold.

   1. Threshold monitoring interval
      Time interval of judging threshold. Default value is the same as Display Refresh Interval.
   2. Minimum I/O count
      If the number of I/Os in a threshold monitoring interval does not exceed an I/O count specified here, the threshold is not monitored in this interval. A minimum I/O count is specified with the number of I/Os per minute. Default value is 60/minute.

   A threshold is monitored if the number of I/Os in a threshold monitoring interval exceeds the minimum I/O count, and if the threshold is exceeded, threshold exceeding is reported. By operating businesses, analyzing performances, and specifying the threshold monitoring conditions on the basis of the analysis, monitoring of overload appropriate for the businesses. Figure 1-6 shows an outline of the threshold monitoring interval.
(3) **Resetting threshold excess state**

Once a threshold value is exceeded, the value is excluded from threshold monitoring target until the threshold excess occurrence state is reset. This feature prevents repeated reporting of the same event of threshold excess state, under largely fluctuating loads.

The threshold excess state is cancelled by operations on the Performance monitoring screen. Specifying the conditions for resetting threshold excess state allows reset of threshold excess state when the conditions are satisfied.

The following conditions are specifiable for resetting the threshold excess state:

1. **Time of continued values under threshold**
   
   Specify the number of threshold monitoring intervals during which a value is kept under threshold. For each monitoring item satisfying the conditions, threshold excess state is reset. If the number of I/Os does not reach a minimum number of I/Os specified by threshold monitoring conditions, the load of applicable interval is recognized as under threshold.

2. **Time of day**
   
   At a specified time of each day, the threshold excess state is reset for all monitoring items.

Figure I-7 shows an example of resetting threshold excess state when “3” is specified as the number of threshold monitoring intervals for a period of continuous values under threshold.
Figure 1-7  Resetting Threshold Excess State
1.5.3 Analysis Support for Statistic Information

This function is capable of accumulating, concentrating, and editing statistic information about the performances of disk array in a file. Using this function allows long-term accumulation of statistic information which lets you grasp long-term load variations and analysis of performance, for efficient use of the disk array.

A file where statistic information is accumulated is called a statistic information history file. The statistic information history file is stored on the iSM management server, allowing concentrating, extracting, and editing data on the server. In addition, downloading the statistic information history file allows concentrating, extracting, and editing data on an iSM client.

Figure 1-8 Analyzing Statistic Information
1.5.3.1 Accumulating Statistic Information

The statistic information collected from disk array is accumulated in a statistic information history file. One statistic information history file stores the statistic information for one day collected from one disk array. A statistic information history file is automatically created in a directory specified by environment definition.

Figure 1-9 Accumulating Statistic Information

Statistic information history files are created based on the following naming convention.

Naming Convention for Statistic Information History Files:

```
yyyymmdd Disk Array Name [\#nnn].psl
```

(i) yyyymmdd
The year, month, and day when accumulation to the statistic information history file started. If date changes while statistic information is being accumulated, accumulation is done to a new statistic information history file.

(ii) Disk Array Name
This is the name of the disk array. Statistic information history files are created for each disk array.

(iii) nnn
This is a file serial number (between 2 and 999). If a file with the same name exists when accumulation of statistic information starts up, a serial number is assigned. For example, if the iSM server is shut down and started up in operation of one day, the serial number is assigned to accumulated statistic information from the second startup of the iSM server, and the value increments by one. The serial number has the upper limit. If the number exceeds this limit, accumulation of statistic information fails.

To avoid it, move the statistic information history files to the different directory at each shutdown of the iSM server, or summarize/extract statistic information as required, delete the statistic information history files. Then, restart the iSM server.
If accumulation start and stop operations are repeated without shut down and start up of the iSM server, the file serial number is not assigned or incremented and accumulation of statistic information to the same file continues.

For information on how to estimate the size of a statistic information history file, refer to Appendix D “Estimation of NEC Storage Performance Monitor File Size”.

The period of reading statistic information is called the logging Interval. The user can specify the logging Interval from 1 minute to 60 minutes at environment definition of the iSM server. The logging Interval cannot be changed while the iSM server is operating. To change the logging Interval, you must terminate the iSM server.

The accumulating processes of statistic information limits the number of times for collecting statistic information within a specified time, in order not to affect input/output process from the business host. Therefore, too many disk array components may prevent collecting statistic information within a specified logging interval, and may disable starting of the data accumulation process. In such a case, specifying the automatic adjustment of logging interval in the environment definition of the iSM server adjusts the intervals appropriately, and prevents such failures in accumulating processes.

When a logging interval is automatically adjusted, a message notifies the adjustment.

The monitored disk arrays collect various types of statistic information by component/load type in the unit of summarizing. From the statistic information, iSM reads the statistic information of the types shown in Table 1-3 and accumulates the time changes in the statistic information history file. Such statistic information is called basic statistic information.

iSM also records information required for the following purposes in the statistic information history file.

- Component information required to interpret accumulated statistic information
- Name tags used for displaying the results of analysis
### Table 1-3 Types of Statistic Information Accumulated in Statistic Information History Files

<table>
<thead>
<tr>
<th>Unit of Summarizing</th>
<th>By Logical Disk</th>
<th>By Host Port</th>
<th>By Disk Port (Note1)</th>
<th>By Physical Disk</th>
<th>By RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Write</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External I/O Count</td>
<td>External I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
</tr>
<tr>
<td>External Average</td>
<td>External Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Maximum</td>
<td>External Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
</tr>
<tr>
<td><strong>Write Hit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External I/O Count</td>
<td>External I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
<td>Internal I/O Count</td>
</tr>
<tr>
<td>External Average</td>
<td>External Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
<td>Internal Average</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Maximum</td>
<td>External Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
<td>Internal Maximum</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
<td>Internal Transfer Rate</td>
</tr>
<tr>
<td><strong>Read</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External I/O Count</td>
<td>External I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
</tr>
<tr>
<td>External Average</td>
<td>External Average</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Maximum</td>
<td>External Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
</tr>
<tr>
<td><strong>Read Hit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External I/O Count</td>
<td>External I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
</tr>
<tr>
<td>External Average</td>
<td>External Average</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Maximum</td>
<td>External Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
</tr>
<tr>
<td><strong>Prefetch Hit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External I/O Count</td>
<td>External I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
<td>Int. I/O Count</td>
</tr>
<tr>
<td>External Average</td>
<td>External Average</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
<td>Int. Average Response Time</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Maximum</td>
<td>External Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
<td>Int. Maximum</td>
</tr>
<tr>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
<td>Int. Transfer Rate</td>
</tr>
<tr>
<td><strong>Busy</strong></td>
<td>Internal average Busy Ratio</td>
<td>Internal average Busy Ratio</td>
<td>Internal average Busy Ratio</td>
<td>Internal average Busy Ratio</td>
<td>Internal average Busy Ratio</td>
</tr>
<tr>
<td>Others</td>
<td>External I/O Count</td>
<td>External Average</td>
<td>External Average</td>
<td>External Average</td>
<td>External Average</td>
</tr>
<tr>
<td></td>
<td>External Average</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td></td>
<td>External Maximum</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
<td>Response Time</td>
</tr>
<tr>
<td></td>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
<td>External Transfer Rate</td>
</tr>
</tbody>
</table>

(Note 1) Port of a disk director (called a “disk port” hereafter).

(Note 2) For a disk array that is not provided with function for collecting information of operating time, internal Busy Ratio and internal operating time is not accumulated in a statistic information history file.

(Note 3) For a disk array that is not provided with function for collecting information about RANK, information about
RANK is not accumulated in a statistic information history file.
(1) **Types of statistic information**

iSM accumulates the following types of statistic information in statistic information history files.

(i) **External I/O count**
   This is the number of input/output requests received by the disk array from the external in each measurement period. The unit is the number of times.

(ii) **External Average Response Time**
    This is the Average Response Time for the input/output requests received by the disk array from the external in each measurement period. The unit is microsecond. This is calculated by measuring the total of the external response time and external I/O count during the unit measurement period and dividing the former by the latter.

(iii) **External Maximum Response Time**
     This is the maximum response time for the input/output requests received by the disk array from the external in each measurement period. The unit is microsecond.

(iv) **External Transfer Rate**
    This is the average Transfer Rate of the input/output process achieved in response to the input/output requests received by the disk array from the external in each measurement period. The unit is kilobyte/second. 1 kilobyte is 1024 bytes. This is calculated by measuring the total of the amount of external data transfer during the unit measurement period and dividing it by the time interval of the measurement period.

(v) **Internal I/O Count**
    This is the number of input/output requests issued to the internal disk devices by the control device of the disk array in each measurement period. The unit is the number of times.

(vi) **Internal Average Response Time**
    This is the Average Response Time for the input/output requests issued to the internal disk devices by the control device of the disk array in each measurement period. The unit is microsecond. This is calculated by measuring the total of the internal response time and internal I/O count during the unit measurement period and dividing the former by the latter.

(vii) **Internal Maximum Response Time**
    This is the maximum response time for the input/output requests issued to the internal disk devices by the control device of the disk array in each measurement period. The unit is microsecond.

(viii) **Internal Transfer Rate**
    This is the average Transfer Rate of the input/output requests issued to the internal disk devices by the control device of the disk array in each measurement period. The unit is kilobyte/second. 1 kilobyte is 1024 bytes. This is calculated by measuring the total of the amount of internal data transfer during the unit measurement period and dividing it by the time interval of the monitoring period.

(ix) **Internal average Busy Ratio**
    For physical disk and RANK, the value indicates the rate of operation. Unit is percent [%]. The value is calculated by measuring operating time physical disk and RANK, and by dividing the operating time by a time slot of measuring segment.
    A Busy Ratio of logical disk is found by dividing the Busy Ratio of RANK by the ratio of loads on the logical disk.

(x) **Internal Operating Time**
    The value indicates the operating time of physical disk and RANK within a measurement time of unit. Unit is
Chapter 1  Overview of Performance Monitoring Function

millisecond.

(2) **Unit to sum up**

Units to sum up are the units used for summarizing statistic information. iSM summarizes statistic information by the following types of components and accumulates them separately.

(i) By logical disk

Load state of each logical disk of the monitored disk array is accumulated. Statistic information is accumulated for the number of logical disks.

(ii) By host port

Load state of each host port of the monitored disk array is accumulated. Statistic information is accumulated for the number of host ports.

(iii) By disk port

Load state of each disk port of the monitored disk array is accumulated. Statistic information is accumulated for the number of disk ports.

(iv) By physical disk

Load state of each physical disk of the monitored disk array is accumulated. Statistic information is accumulated for the number of physical disks.

(v) By RANK

Load state of each RANK of the monitored disk array is accumulated. Statistic information is accumulated for the number of RANKs.

(3) **Load types**

Load types are the types of loads of the monitored disk array. iSM distinguishes the following types of loads when it accumulates statistic information.

- **Write**  
  Statistic information regarding data write operation.

- **Write Hit**  
  Statistic information about operations that could respond quickly, by writing data to cache only. It is a subset of Write.

- **Read**  
  Statistic information regarding data read operation.

- **Read Hit**  
  Statistic information regarding data read operation which hit cache. It is a subset of Read.

- **Prefetch Hit**  
  Statistic information regarding data read operation which hit data transferred from the physical disk to cache in advance by the prefetch function of the disk device. It is a subset of Read Hit.

- **Busy**  
  Statistic information on the operating rate of a physical disk.

- **Others**  
  Statistic information regarding SCSI command process other than data write and data read.

### 1.5.3.2 Downloading Statistic Information

The statistic information accumulated on the iSM management server can be summarized, extracted and edited by downloading on the iSM client. Downloading is allowed for clients of levels L2 or L3. If the iSM server is operating, downloading is performed on the Performance Monitor screen. If the iSM server is not operating, downloading is allowed with an FTP tool.
1.5.3.3 Summarizing Statistic Information

The statistic information accumulation function described above accumulates statistic information collected in every logging interval in statistic information history file. If statistic information collected in relatively short intervals is accumulated in the long term, the amount of data in the statistic information history file will become enormous and eventually exhaust the free disk space.

For saving disk space, the accumulated statistic data is summarized into the information of a period longer than the logging interval, reducing amount of information included in a file, downsizing the data. This function is called summarizing statistic information. The information after summarizing is output to statistic information summarized file.

When you want to accumulate statistic information in the long term, you can save the disk space by using this function as required to summarize statistic information and deleting the statistic information originally accumulated. For information on how to estimate the size of a statistic information summarized file, refer to Appendix D "Estimation of NEC Storage PerformanceMonitor File Size" of this manual.

(1) Summarizing basic statistic information

The summarizing function statistic information summarizes all basic information stored (refer to table 1-3), and outputs the information to a statistic information summarized file. The following describes basic statistic information after summarizing.

- For statistic information regarding I/O count, the I/O counts within all the measurement periods contained in the period of summarizing are accumulated, and the result is the I/O count of the period of summarizing.
- Statistic information of average response time: On the basis of all average response times and I/O counts within applicable summarizing segments, total response time and total I/O count are found. Average response time is calculated by dividing the former by the latter.
- For statistic information regarding maximum response time, the maximum value is taken from the maximum response times within all the measurement periods contained in the period of summarizing, and it is the maximum response time of the period of summarizing.
- Statistic information of transfer rate: On the basis of all transfer rates within applicable summarizing segments, total transfer length is found. A transfer rate of the summarizing segment is calculated by dividing the total transfer length by the measurement time of the summarizing segment.
- Statistic information of Busy Ratio: All busy time within applicable summarizing segments is accumulated. Average Busy Ratio of the summarizing segment is calculated by dividing the total busy time by the measurement time of the summarizing segment.
- For statistic information regarding operating time, the operating time within all the measurement periods contained in the period of summarizing are accumulated and the result is the operating time of the period of summarizing.

(2) Inserting extended statistic information

For allowing reference to the fluctuation width of statistic information even after summarizing, extension of statistic information is calculated in addition to the summarized basic statistic information and stored in the summarized statistic information file. The extension of statistic information includes the following types.
Chapter 1  Overview of Performance Monitoring Function

### Maximum/minimum

- **External I/O Density**: This is the maximum and minimum values of the external I/O Density in each measurement period contained in the period of summarizing. The unit is count/1000 seconds.
- **External Transfer Rate**: This is the maximum and minimum values of the external transfer rates in each measurement period contained in the period of summarizing. The unit is kilobyte/second.
- **External Busy Rate**: This is the maximum and minimum values of the external busy ratios in each measurement period contained in the period of summarizing. The unit is % (percent).
- **Internal I/O Density**: This is the maximum and minimum values of the internal I/O density in each measurement period contained in the period of summarizing. The unit is count/1000 seconds.
- **Internal Transfer Rate**: This is the maximum and minimum values of the internal transfer rates in each measurement period contained in the period of summarizing. The unit is kilobyte/second.
- **Internal Busy Ratio**: This is the maximum and minimum values of the internal busy ratios in each measurement period contained in the period of summarizing. The unit is % (percent).

#### (3) Inserting configuration information

In addition to the statistics information summarized in the method described in previous sections, configuration information is also stored in the summarized statistic information file. This feature allows easy identification of the various types of statistic information.

#### (4) Types of summarized files

In order to select an appropriate balance between the time resolution and amount of accumulated information, you can create summarized files whose average time interval in the period of summarizing is one hour and summarized files whose average time interval is one day.

A file which contains statistic information summarized in units of hours is called a primary summarized file, and file which contains statistic information summarized in units of days is called a secondary summarized file. In other words, iSM has three types of files which store statistic information, as shown in Table 1-5.

<table>
<thead>
<tr>
<th>Type of File</th>
<th>Average Time Interval of Period of Summarizing</th>
<th>Amount Recorded in One File</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistic Information History File</td>
<td>Logging Interval</td>
<td>For max. of one day</td>
</tr>
<tr>
<td>Statistic Information Primary Summarized File</td>
<td>One hour</td>
<td>For max. of one day</td>
</tr>
<tr>
<td>Statistic Information Secondary Summarized File</td>
<td>One day</td>
<td>For max. of one month</td>
</tr>
</tbody>
</table>

#### (5) Types of summarizing operations

iSM provides the following three types of summarizing functions to deal with the two types of summarized files.
(i) History file → Primary summarized file (primary summarizing)
The input is a statistic information history file, and the output is a primary summarized file. In other words, statistic information in each logging Interval within each period of summarizing in the input file is summarized in units of hours and the result is recorded in the output file.

(ii) History file → Secondary summarized file (direct primary summarizing)
The input is a statistic information history file, and the output is a secondary summarized file. In other words, statistic information in each logging interval within each period of summarizing in the input file is summarized in units of days and the result is recorded in the output file.

(iii) Primary summarized file → Secondary summarized file (secondary summarizing)
The input is a primary summarized file, and the output is a secondary summarized file. In other words, statistic information in each hour within each period of summarizing in the input file is summarized in units of days. For the enhanced statistic information, the maximum and minimum values are selected from the enhanced statistic information of the same type recorded in the primary summarized file.

1.5.3.4 Extracting Statistic Information

Statistic information about disk array collected by iSM is accumulated in statistic information history files and statistic information summarized files. This function can extract and output the information to a CSV format file (delimited by commas).

Use of this function allows displaying values of accumulated statistic information. Furthermore, a spreadsheet program can display the data of CSV format file in graphs, allowing review of long-term load fluctuation and performance analysis. By specifying addition of header upon extracting a CSV file, the header record for the values is added to top of the file. Editing the statistic information with a header record using a spreadsheet program allows easy identification of the statistic data values.

CSV Conversion Tool creates CSV files according to the following naming convention. For information on the structure of a CSV file, refer to Appendix B “CSV File Structure” of this manual.

Naming Convention for CSV Files

"Name of Statistic Information History (Summarized) File"_"Extension of Statistic Information History (Summarized) File".csv

Example: Name of the CSV file for the statistic information history file “20020401NECStorage4100.psl”

20020401NECStorage4100_psl.csv

In statistic information history/summarized files, various types of statistic information regarding components of the disk array are accumulated. You can extract the specified statistic information from the statistic information by giving extraction conditions to CSV Conversion Tool depending on your purpose. The following extraction conditions can be
specified for CSV Conversion Tool.

- Period of extraction
- Component of disk array
- Type of statistic information

In statistic information history/summarized files, the component information of the disk array is accumulated in addition to statistic information. CSV Conversion Tool can also extract component information.
(1) **Extracting statistic information in the specified period**

To extract statistic information in the specified period, specify the period in CSV Conversion Tool. To specify a period, you can specify the extraction starting time and end time, or either one of them.

(i) Specifying the extraction starting time and end time
Statistic information from the extraction starting time to the extraction end time is extracted.

(ii) Specifying the extraction starting time only
Statistic information after the extraction starting time is extracted.

(iii) Specifying the extraction end time only
Statistic information before the extraction end time is extracted.

(2) **Extracting statistic information regarding the specified component**

To extract statistic information of the specified component of the disk array, specify the component of the disk array in CSV Conversion Tool. The following components can be specified.

- Host port
- Disk port
- Logical disk
- Physical disk
- RANK

(3) **Extracting statistic information of the specified type**

Statistic information can be generally categorized into the following types.

(i) Information regarding the number of inputs/outputs
This information contains the number of inputs/outputs, the maximum values of input/output density (IOPS) and minimum values of input/output density.

(ii) Information regarding the response time of the I/O process
This information contains the average response time and the maximum response time.

(iii) Information regarding the Transfer Rate of the I/O process
This information contains Transfer Rate and the maximum and minimum values of Transfer Rate.

(iv) Information regarding the operating status of the devices
Operating time and maximum and minimum values of the operating time are included. A Busy Ratio and maximum and minimum values of the Busy Ratio are included.

In (i) to (iv) above, to extract statistic information of the specified type, specify the type in CSV Conversion Tool.

(4) **Extracting configuration information**

There are the following types for configuration information of a disk array.

(i) Information regarding the disk array and configurations
Information regarding:
- Disk array
- Host port
Chapter 1  Overview of Performance Monitoring Function

- Disk port
- Logical Disk
- Physical Disk
- RANK

(ii) Information regarding changes in logical disk names
This is information regarding changes in logical disk names.

(iii) Information regarding changes in disk array configuration
This is information regarding changes in disk array configuration.

(iv) Information regarding changes in RANK configuration
This is information regarding Logical Disk moving between RANKs by the performance optimization function.

To extract (i) and (ii), you must specify extraction of configuration information in CSV Conversion Tool. (iii) and (iv) is always extracted regardless of specification to CSV Conversion Tool.

When configuration of the disk array and RANK changes, statistic information before and after the change are no longer related. Therefore, you must consider the following to analyze statistic information.

When information (iii) is output, statistic information regarding all configurations collected before and after the output is no longer related.

When information (iv) is output, only statistic information on the RANK collected before and after the output is no longer related.

1.5.3.5  Editing Statistic Information

As described in 1.5.3.4 “Extracting Statistic Information”, a user can create CSV format files using the CSV conversion tool, and can edit the data using spreadsheet software as required. This process makes analysis of the statistic information easier.

Furthermore, use of the functions provided by iSM allows easy analysis without a spreadsheet program. iSM provides the following edit functions for statistic information:

- A program called Performance Report Editor for the user to edit/modify in a format easy for performance analysis and output to a file the statistic information accumulated in statistic information history files and statistic information summarized files.
- Function of displaying graphs (Graph making tool) for files created with the edit tool (performance report).

(1) Performance Report Editor

The Performance Report Editor uses statistic information history/summarized files as inputs and edits modificates the statistic information into a text-format Performance Report. The user can reference the Performance Report to readily analyze the performance of a disk array.

Types and overview of Performance Report are given below. For details of the Performance Report, refer to Appendix C “Report Format of Performance Report Editor” of this manual.

(i) Performance Summary Report
The Performance Summary Report is a component-based summary of statistic information on:
- whole disk array
• host director ports
• disk director ports
• logical disks
• physical disks
• RANKs

Analysis of the Performance Summary Report provides understanding of general load status in the entire disk array and each component of the statistic information collection period.

(ii) Performance Detail Report

The Performance Detail Report summarizes the following statistic information per statistic information logging Interval of the iSM and is assigned chronologically:
• whole disk array
• host director ports
• disk director ports
• logical disks
• physical disks
• RANKs

Analysis of the Performance Detail Report provides understanding of chronological change in the load status of the entire disk array and each component as well as detection of a performance bottleneck.

The Performance Detail Report has six types of report:
• detailed report on the whole disk array
• detailed report on host director ports
• detailed report on disk director ports
• detailed report on logical disks
• detailed report on physical disks
• detailed report on RANKs

The Performance Report Editor creates a Performance Report in accordance with the following naming rule:
• When input is a statistic information history file (xxxxxx.psl):
  xxxxxx_psl_edit type.txt
• When input is a statistic information summarized file (xxxxxx.psa):
  xxxxxx_psa_edit type.txt

One of the following strings is set in the “edit type” depending on the type of Performance Report:

- sum: summary report
- array: detailed report on the whole disk array
- hp: detailed report on host director ports
- dp: detailed report on disk director ports
- ld: detailed report on logical disks
- pd: detailed report on physical disks
- rank: detailed report on RANKs

(2) Performance Report Viewer
The Performance Report Viewer is a tool that uses detailed report on the whole disk arrays created via the Performance Report Editor as inputs to provide graphic representation of statistic information. The user references a graph to understand the load state of disk array and chronological change in the load.

The Performance Report Viewer can be used in an environment where Microsoft® Excel 2000 is installed. An iSM client must be installed in the personal computer for using the Performance Report Viewer.
Chapter 2 Installation of Performance Monitoring Function

2.1 Server Installation

2.1.1 System Requirements

For HW, OS, memory, and disk capacity, the same system requirements as those for iSM are applicable. Refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” for your OS. Required software and applicable storage devices are as follows:

<table>
<thead>
<tr>
<th>Required software</th>
<th>NEC Storage Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable storage device</td>
<td>NEC Storage 4000 series</td>
</tr>
<tr>
<td></td>
<td>NEC Storage 3000 series</td>
</tr>
<tr>
<td></td>
<td>NEC Storage 2000 series</td>
</tr>
<tr>
<td></td>
<td>NEC Storage 1000 series</td>
</tr>
</tbody>
</table>

2.1.2 Installation

Installation of iSM is accompanied by installing the NEC Storage Performance Monitor at the same time. For installing and uninstalling, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” for your OS.

2.1.3 Environment Setting

To use the performance monitoring function, it is necessary to make the environment setting of the iSM server. Create settings for the items below. For information on how to make settings, refer to the Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.

(i) Specify the location of the statistic information history file.
(ii) Specify an interval for collecting statistic information and outputting it into the statistic information history file.
(iii) Specify the number of data updates per minute on the Performance Monitoring screen.
(iv) Specify whether or not to automatically start the output of statistic information with regard to all the disk arrays that have the performance monitoring function available at the start of the iSM server.
(v) Interval for monitoring threshold
(vi) Lower limit value for I/Os within threshold monitoring interval
2.2 **Client Installation**

### 2.2.1 System Requirements

The same system requirements as those for iSM are applicable to the NEC Storage PerformanceMonitor. Refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” for your OS.

### 2.2.2 Installation

For installing the NEC Storage PerformanceMonitor, install the iSM client with specifying a setup type that includes extended functions.

For installation procedures, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” for your OS.
3.1 Real-Time Display of Load Status

Explanation will be made about the operation method for monitoring the load status in real time by using the Performance screen.

(1) Performance Monitoring Starting

Clicking the button for activating the performance monitor function opens the Performance Monitor screen, which starts performance monitoring. The Performance Monitor screen displays the following forms for monitoring latest load states.
- Displays the latest load status in numerical values (Numeric Table)
- Displays changes of the load status in a line graph (Time-series Graph)
- Displays the latest load status in a Bar Graph (Bar Graph)

(2) Numeric Table Display

The Numeric Table screen appears upon activating the performance monitor function. The screen displays the latest load states in the form of numeric table. The Numeric Table screen allows you to monitor the latest load status as well as to perform settings of real-time display. On this screen, a list with rows of monitoring objects and columns of monitored items is displayed according to the specified component type. The latest values are updated according to specified intervals. For setting of the interval, refer to 2.1.3 “Environment Setting” of Part I “Performance Monitoring Function” of this manual.

Figure 3-1 is an example of display when ports are selected as the component type. This display allows you to monitor the latest values of load status and use status of each port.

![Figure 3-1 Numeric Table Screen (When the Port is Selected)
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The performance monitor screen, as shown in Figure 3-1, is composed of areas (i) through (v). The following describes the areas.

(i) Menu bar
The menu bar is used for selecting necessary items from the menu for various operations. For details, refer to Help.

(ii) Tool bar
Among the menu items, the following functions that are frequently used can be activated by a single click of a button. Refer to Help for details of the buttons.

- [File] → [Save of Setting], [Performance Analysis Supporting Tool]
- [View] → [Numeric Table], [Time-series Graph], [Bar Graph], [Threshold], [Show Threshold in graph], [Release Threshold in graph], [I/O Density], [Transfer Rate], [Average Transfer Length], [Average Response Time], [Read Hit Ratio], [Write Hit Ratio], [Busy Ratio]
- [Setting] → [Monitoring Object Logical Disk], [Monitoring Object Physical Disk], [Set Graph Scale]
- [Threshold Monitoring] → [Set Threshold], [Show All Items Specified Threshold]
- [Operation] → [Start/Stop Accumulation of Statistic Information], [Download Statistic Information files]

(iii) Information display area
A numeric table and graph indicating load states are displayed (Note 1).

(iv) Status bar
The status bar at the bottom displays the current status of performance monitoring function. The following describes details of the displayed items.

(a) Display Refresh Interval
A time interval for updating the Performance screen is indicated by the number of seconds. Any one of 10, 12, 15, 20, 30, and 60 is displayed. For specifying a refreshing interval, refer to 2.1.3 “Environment Setting”.

Example 10: Update every 10 seconds (specify 6 as number of updates per minute)

(b) Operating state
- Information acquiring:
  Indicates that the initial information necessary for displaying the load status on the Performance Monitoring screen is being collected from the iSM server.
- Working:
  Indicates that various processing on the Performance Monitoring screen is being performed.
- Stop:
  Indicates that various processing on the Performance Monitoring screen has been terminated due to disconnection of the iSM client from the iSM server or cancellation instruction in the Information acquiring dialog screen. If the system is connection to the iSM server, you can select and execute [Refresh] from the menu function to restart various processing on the Performance screen.

(v) Statistic information storing state
It indicates whether or not the iSM is storing statistic information into a statistic information history file.

- Statistic Information starting:
  Indicates that the iSM is storing statistic information into a statistic information history file.
- Statistic Information stopped:
  Indicates that the iSM is not storing statistic information.
- Checking:
Indicates that iSM has not completed in obtaining statistic information required for displaying client.

(Note 1)

A performance monitor server using older version software may not support some of the displaying functions. In such a case, a hyphen "-" is displayed for an applicable item. For displaying such items, software of the latest version is required.

Figure 3-2 shows an example of display when logical disks are selected as the component type. In this display, you can monitor the latest values of load status and use status of each logical disk.

Figure 3-2  Numeric Table Screen (When [Logical Disk] is selected)

Left-clicking on a tab label of calculation unit (such as disk array and port) switches the numeric table into a table indicating applicable calculation unit. The numeric table displays the following information, in accordance with the calculation unit selected by the procedure.

(i) When the [Disk Array] tab is selected

The Numeric Table indicating load statuses by disk array is displayed. The rows are all the disk arrays which are currently being monitored by the iSM. The columns indicate:

- External I/O Density
- External Transfer Rate
- External Average Transfer Length
- External Average Response Time.
- Read Hit Ratio
- Write Hit Ratio

However, the string “External” is omitted in the labels.

In this display, the list does not change when you change the disk array to be monitored by using the combo box.

(ii) When the [Port] tab is selected

The Numeric Table indicating load statuses by port of the disk array specified in the combo box is displayed. The rows are all the ports which belong to the disk array specified in the combo box. The columns indicate:

- External I/O Density
• External Transfer Rate
• External Average Transfer Length
• External Average Response Time

However, the string “External” is omitted in the labels.

When you change the disk array to be monitored by using the combo box, the display switches to the list of load status by port of the selected disk array.

(iii) When the [Logical Disk] tab is selected

The Numeric Table indicating load state of logical disk of the disk array specified in the combo box is displayed. The rows are the logical disks registered as monitoring objects among the logical disks created in the disk array specified in the combo box. The columns indicate:

• External I/O Density
• External Transfer Rate
• External Average Transfer Length
• External Average Response Time
• Read Hit Ratio
• Write Hit Ratio

However, the string “External” is omitted in the labels.

When you change the disk array to be monitored by using the combo box, the display switches to the list of load status by logical disk of the selected disk array.

(iv) When the [Physical Disk] tab is selected

The Numeric Table indicating load statuses by physical disk of the disk array specified in the combo box is displayed. The rows are the physical disks registered as monitoring objects among the physical disks created in the disk array specified in the combo box. The columns indicate:

• Internal I/O Density
• Internal Transfer Rate
• Internal Average Transfer Length
• Internal Average Response Time
• Busy Ratio

However, the string “Internal” is omitted in the labels.

When you change the disk array to be monitored by using the combo box, the display switches to the list of load status by logical disk of the selected disk array.

If an overload occurs during overload monitoring, asterisks (**) appear on the left of the applicable item. Cells of the items displayed in graphs are displayed in gray.

(3) Sorting the load status list

By clicking a label indicating a type of the monitored item ([Number], [I/O Density], etc.) in the list of load status, you can sort the lines of the list in an ascending or descending order by using the current value of the monitored item you click as a key. Repeatedly clicking the label will switch between ascending and descending orders.
(4) Registering/Deleting logical disks to be monitored

When you click [Setting] and then select [Monitoring Object Logical Disk] on the Numeric Table screen (Figure 3-2), the Registration of Logical Disks dialog box appears (Figure 3-3). This dialog allows you to change the logical disks for performance monitoring in the disk array specified in the combo box of the Numeric Table.

When you click [Setting] and then select [Monitoring Object Logical Disk] on the Numeric Table screen (Figure 3-2), the Registration of Logical Disks dialog box appears (Figure 3-3). This dialog allows you to change the logical disks for performance monitoring in the disk array specified in the combo box of the Numeric Table.

![Registration of Logical Disks](image)

[Monitoring Candidate List] displays unregistered logical disks among all the logical disks created in the specified disk array. [Monitor Object] displays all the logical disks currently registered as monitoring objects. Selecting logical disks in [Monitoring Candidate List] and clicking the [Add] button will register the specified logical disks to the [Monitor Object] list. On the other hand, selecting logical disks in the [Monitor Object] list and clicking the [Delete] button will delete the specified logical disks from the [Monitor Object] list. When you click the [OK] button, all the logical disks currently displayed in the [Monitor Object] list are formally registered as the monitored logical disks and the dialog box closes. When you click the [Cancel] button, the current [Monitor Object] list is ignored and the dialog box closes with the monitored logical disks registered when the dialog box opened unchanged.

(5) Registering/Deleting physical disks to be monitored

When you click [Setting] and select [Monitoring Object Physical Disk] on the Numeric Table screen, the Registration of Physical Disks dialog box appears (Figure 3-4). This screen allows you to register physical disks for performance monitoring among the physical disks installed in the disk array specified in the combo box of the original screen.
Figure 3-4  Registration of Physical Disks Dialog

[Monitoring Candidate List] displays unregistered physical disks among all the physical disks created in the specified disk array.  [Monitor Object] displays all the physical disks currently registered as monitoring objects.  Selecting physical disks in the [Monitoring Candidate List] and clicking the [Add] button will register the specified physical disks to the [Monitor Object] list.  On the other hand, selecting physical disks in the [Monitor Object] list and clicking the [Delete] button will delete the specified physical disks from the [Monitor Object] list.  When you click the [OK] button, all the physical disks currently displayed in the [Monitor Object] list are formally registered as the monitored physical disks and the dialog box closes.  When you click the [Cancel] button, the current [Monitor Object] list is ignored and the dialog box closes with the monitored physical disks registered when the dialog box opened unchanged.

(6) Preparation for graph display

For displaying load states on Time-series Graph screen and Bar Graph screen, items to be displayed on a graph must be registered on the Numeric Table screen.  The maximum number of monitoring objects that can be registered in one graph is 16.
Figure 3-5 Registering to Graphs Menu

On the Numeric Table screen, when you specify a line which shows the latest value (place the cursor over the left cell and click the cell). In Figure 3-5, the line of logical disk 008ch is specified), click [Setting], and then point to [Registration to Graph], all the monitored items for the line are registered as items to be displayed in Time-series Graphs. The cells which have been registered as the items to be displayed in graphs are displayed in gray.

On the other hand, when you specify a line which shows the latest value, click [Setting], and then point to [Delete from Graph], the monitored items of the monitoring object is no longer displayed in Time-series Graphs. In this case, the corresponding cells are displayed in the original background color.

(7) Time-Series Graphs display

If you select [View] → [Time-series Graph], the screen will change to the Time-series Graph screen. The Time-series Graph screen displays the fluctuations of loads in line graphs for seven monitoring items. Figure 3-6 shows an example of the display that appears when a Time-series Graph is selected for port and logical disk and physical disk.
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The “Time-series Graph” screen consists of the menu area and tool bar for performing various operations, the load status display area for showing load status, the legend display area for showing the items displayed in Time-series Graphs, and the status bar for displaying the connection state.

Seven graphs are displayed in the load status display area. The following graphs are individually displayed (Note 1):
- I/O Density
- Transfer Rate
- Average Transfer Length
- Average Response Time
- Read Hit Ratio
- Write Hit Ratio
- Busy Ratio

This section describes the procedures for displaying a line indicating a threshold (index value for overloads) on the graph. For threshold, refer to 3.2 “Monitoring Overloads”.

- On the “Time-series Graph” screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [View] → [Show Threshold in graph].
- On the “Time-series Graph” screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [Show Threshold in graph] from the tool bar.
- On the “Time-series Graph” screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [Show Threshold in graph] from the right-click menu.
The threshold line is displayed on the graph. The line is displayed for time zone from the time the threshold is set to the time it is unset. When past information is displayed, a threshold line is displayed in the time zone for which thresholds have been set. When a value exceeded the threshold line, a time line is displayed in a dark color that shows the time from when a value exceeded the threshold to the time when the Release Threshold Excess function was executed.

Immediately after display of Time-series Graphs has started, only the latest values of the monitored items are displayed, and then, the latest values of the monitored items will be plotted at specified time intervals. When line graphs come to the end of the screen width, they scroll so that the oldest values are out of the screen. Operating the scroll bar will allow you to see the past information. The past information that can be displayed varies depending on the setting for Display Refresh Rate. For example, setting 1 for Display Refresh Rate allows you to see the past information of 24 hours. Setting 6 for Display Refresh Rate allows you to see the past information of 3 hours.

If viewing many time-series graphs of monitoring items displayed on a screen is difficult, whether to display/hide time-series graph and displaying order of graphs can be specified for each monitoring item. To specify display/hide time-series graphs for each monitoring item, select [View] → [Customize Time-series Graph] on menu, and specify whether to display or hide desired monitoring items on the check boxes of the Customize Time-series Graph dialog. To specify displaying order of graphs, select a desired item on the Customize Time-series Graph dialog, and move the item by clicking the [Up] or [Down] button. Figure 3-7 shows the Customize of Graph dialog.

If viewing the lines is difficult behind many overlapping time-series graphs of registered items, double-clicking on the legend for the graph line moves the lines onto the front. Selecting a legend and pressing the Enter key also moves the lines to the front.
A performance monitor server using older version software may not support some of the displaying functions. In such a case, a graph frame only is displayed and graph lines are not displayed. For displaying graph lines, software of the latest version is required.

(8) Showing Bar Graphs

Selecting [View] → [Bar Graph] menu on Numeric Table screen switches the screen to the Bar Graph screen. The Bar Graph screen is capable of showing latest load states of seven monitoring items in bar-graph format. Figure 3-8 shows an example of the display when the ports, and logical disks and physical disks are registered for graph display.

![Figure 3-8  Bar Graph Screen](image)

The Bar Graph screen consists of the menu area and tool bar for performing various operations, the load status display for showing the load status, the legend display area for showing the items displayed in Bar Graphs, and the status bar for displaying the connection state.

The load status display area shows one item selected from the following monitored items.

- I/O Density
- Transfer Rate
- Average Transfer Length
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- Average Response Time
- Read Hit Ratio
- Write Hit Ratio
- Busy Ratio

This section describes the procedures for displaying a line indicating a threshold (index value for overloads) on the graph. For threshold, refer to 3.2 “Monitoring Overloads”.

- On the Bar Graph screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [View] → [Show Threshold in graph].
- On the Bar Graph screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [Show Threshold in graph] from the popup menu by right-click.
- On the Bar Graph screen, select a line or multiple lines for which you want to display threshold from the legend display area, and then select [Show Threshold in graph] from the tool bar.

The threshold line is displayed on the graph. The line is displayed for time zone from the time the threshold is set to the time it is unset. When a value exceeded the threshold line, hatch lines are displayed until the time when the Release Threshold Excess function is executed.

The Bar Graph screen allows changing display items by selecting [View] menu (similar operation is available by toolbar buttons). For example, selecting [I/O Density] allows displaying a bar graph that shows latest values of I/O Density. Switching to other items is allowed by similar operation.

(Note 1)

A performance monitor server using older version software may not support some of the displaying functions. In such a case, a graph frame only is displayed and a bar graph is not displayed. For displaying a bar graph, software of the latest version is required.
(9) Changing Graph Scales

A maximum value of a graph scale displayed on the Bar Graph screen is changeable freely on the Setting Graph Scale dialog. The Setting Graph Scale dialog is displayed by selecting [Setting] → [Set Graph Scale] menu. Figure 3-9 shows an example of display of the Set Graph Scale dialog screen.

For specifying a desired maximum value of a graph scale, uncheck the check box of [Autoscale] on the Setting Graph Scale dialog, and specify a new maximum value. If [Autoscale] check box is checked, graph scales are automatically calculated based on the past load states.

(10) Record Screen Information

When you select [Record Screen Information] from the [View] menu, the current location and size of the Performance Monitoring screen, information on display/non-display of the tool bar and status bar, and the size and arrangement of the graph display area and legend display area can be recorded. When screen information is recorded, next time when you open the Performance Monitoring screen, it is displayed in the state when the location and size of the screen, display/non-display of tool bar and status bar, and the ratio of the graph display area to the legend display area was recorded.

For screen images, refer to Figure 3-6 “Time-series Graphs Screen”.
(11) Saving Settings

To save registration and deletion settings for graphs performed in the [Setting] menu and change settings of logical/physical disks to be monitored, click [File], and then point to [Save of Setting] as shown in Figure 3-10.

The saved settings are restored when the Performance Monitoring screen opens next time.

Figure 3-10  Save of Setting Menu
(12) Performance Monitoring Stop

To close the Performance Monitoring screen, click [File] and then click [Close] Menu as shown in Figure 3-11.

Figure 3-11  Close Menu
3.2 Monitoring Overloads

(1) Thresholds display

When you click [View] and then click [Threshold] on the Numeric Table screen as shown in Figure 3-12, the
threshold column appears next to the current value column, as shown in Figure 3-13, to display thresholds of the
monitored items specified for each monitoring target.

A blank threshold column indicates that a threshold for the threshold monitoring element has not been specified.
The [Threshold] menu is a toggle switch. Clicking the menu again will delete the threshold column and restore
the original screen.
(2) Thresholds setting

On the Numeric Table screen, select the line (Note 1) or cell (Note 2) of the threshold monitoring element for which you want to set a threshold. Then, select [Threshold Monitoring] → [Set Threshold] menu. The Set Threshold dialog appears.

Figures 3-14 and 3-15 are display samples for setting a threshold by selecting the cell of I/O Density of the logical disk number 0003h. Figures 3-16 and 3-17 are display samples for setting a threshold by selecting the line of the logical disk number 0003h.

(Note 1) To select a line, left-click at the left end of the line.
(Note 2) To select a cell, left-click the cell.

Figure 3-14 Set Threshold Menu (Select a cell)
Figure 3-15  Set Threshold Dialog (When displayed by selecting a cell)

Figure 3-16  Set Threshold Menu (Select a line)
When you specify a threshold value in the [Set Threshold] area and click the [OK] button, the value is set as a threshold and the dialog box closes. If the value of the item for which the threshold has been changed is exceeding the threshold, the threshold exceeding state is cleared and the monitoring of the threshold resumes with the new threshold. On the other hand, when you click the [Cancel] button, the values specified in the [Set Threshold] area are ignored, and the dialog box closes without changing the thresholds which had been registered when the dialog box opened.

Furthermore, when you specify multiple cells in the list and select [Set Threshold], the Set Threshold dialog box appears. If the component type on the original screen is disk array, the thresholds of the selected monitored items for the selected disk array can be changed simultaneously. If the component type on the original screen is port, logical disk or physical disk, the thresholds of the selected monitored items for the selected monitoring targets (all the logical disks, etc.) in the disk array specified in the combo box of the original screen can be changed simultaneously.

Thresholds are centrally controlled by the iSM server. If different thresholds are set for the same monitoring target from multiple clients, the threshold most recently specified becomes effective. Therefore, pay careful attention to the settings.
A performance monitor server using older version software does not support some of the threshold value setting functions. In such a case, the applicable fields for setting threshold values are displayed in gray, accepting no settings. For specifying the fields displayed in gray, a performance monitor server using the latest version software is required.

### (3) Thresholds monitoring condition setting

Selecting [Threshold Monitoring] → [Customize Threshold Monitoring Conditions] menu displays the Customize Threshold Monitoring Conditions dialog (Figure 3-18) appears. (Note 1)

#### Figure 3-18  Customize Threshold Monitoring Conditions Dialog

The Customize Threshold Monitoring Conditions dialog specifies the following information:

1. **Monitoring interval**
   - Specifies a time interval for judging threshold. For specifying the same value as display refresh time of real-time display screen, select [Same value as the display refresh rate]. For specifying the same value as definition in the environment setting file, click [Default].

2. **Minimum I/O count**
   - Specifies a lower limit of I/O count within the threshold monitoring interval. If the number of I/Os is under the setting value, a value is not judged. For specifying the same value as definition in the environment setting file, click [Default].

After specifying the above settings, clicking [OK] button defines the values as the conditions for threshold monitoring and the Customize Threshold Monitoring Conditions dialog closes. By clicking [Cancel] button, specified values are ignored. Retaining the values shown at opening Customize Threshold Monitoring Conditions dialog, the dialog closes.
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(4) Customize Resetting Threshold Excess State

On the Numeric Table screen, selecting [Threshold Monitoring] \(\rightarrow\) [Customize Resetting Threshold Excess State] menu displays the Customize Resetting Threshold Excess State dialog (Figure 3-19) appears.  (Note 1)

![Customize Resetting Threshold Excess State Dialog](image)

Figure 3-19  Customize Resetting Threshold Excess State Dialog

The Customize Resetting Threshold Excess State dialog specifies the following information:

- It cancels in the period which the value below a threshold continues.
  
  When exceeding the number of times of the specified threshold monitoring interval, threshold excess state is canceled individually for each monitoring items. In case of no setting for releasing threshold excess, uncheck [Reset Threshold Excess state according to the period below a threshold] check box.

- It cancels at the appointed time.
  
  At the appointed time, threshold excess state is canceled for the entire monitoring disk array. In case of no setting for releasing threshold excess, uncheck [Reset Threshold Excess state at the appointed time] check box.

After specifying the above settings, clicking [OK] button defines the values as the condition to auto release threshold excess state and the Customize Resetting Threshold Excess State dialog closes. By clicking [Cancel] button, specified values are ignored. Retaining the values shown at opening Customize Resetting Threshold Excess State dialog, the dialog closes.
A performance monitor server using older version software may not support some of the threshold excess release specifying functions. In such a case, the Customize Resetting Threshold Excess State dialog is not displayed. For specifying release of threshold excess, software of the latest version is required.

(5) Thresholds deletion

For deleting a threshold that has been specified, select a threshold value to be deleted on the Set Threshold dialog and press the Delete key. Then, click the [OK] button. If the value of the monitored item from which the threshold has been deleted is exceeding the threshold, the threshold exceeding state is cleared. By clicking [Cancel] button, specified values are ignored. Retaining the values shown at opening Set Threshold dialog, the dialog closes. As is the case with specifying thresholds, deleting can be performed for two or more monitoring targets and monitoring items.

![Set Threshold Dialog](image-url)
(6) All thresholds deletion

The threshold values for all monitoring targets included in specified disk array subsystem can be deleted by batch processing. On the Numeric Table screen, selecting [Threshold Monitoring] → [Delete all Thresholds] and clicking [OK] button on the Delete all Thresholds dialog executes delete all Thresholds. If a monitoring target is under the state of threshold excess, the excess state is released. By clicking [Cancel] button, the dialog closes without executing delete all Thresholds.

(7) Show all items specified threshold

On the Numeric Table screen, selecting [Threshold Monitoring] → [Show All Items Specified Threshold] menu displays the Show All Items Specified Threshold dialog appears. The Show All Items Specified Threshold dialog displays a list of devices with threshold values specified. (Figure 3-21)

![Show All Items Specified Threshold Dialog](image)

The Show All Items Specified Threshold dialog screen displays elements for threshold monitoring by component type, such as disk array, port, logical disk, and physical disk. The following describes the display items of each calculation unit.

- Disk array
  Displays the name of the disk array for which a threshold is specified for each monitored item, such as I/O Density, Transfer Rate, Average Transfer Length, Average Response Time, Read Hit Ratio, and Write Hit Ratio. The disk array that has a value which has exceeded the threshold is displayed along with the “**” marks appended to the name.
Port
Displays the name of ports, by disk array, for which a threshold is specified for each monitored item, such as I/O Density, Transfer Rate, Average Transfer Length, and Average Response Time. The port that has a value which has exceeded the threshold is displayed along with the “**” marks appended to the name.

Logical disk
Displays the number of logical disks, by disk array, for which a threshold is specified for each monitored item, such as I/O Density, Transfer Rate, Average Transfer Length, Average Response Time, Read Hit Ratio and Write Hit Ratio. The logical disk that has a value which has exceeded the threshold is displayed along with the “**” marks appended to the number.

Physical disk
Displays the number of physical disks, by disk array, for which a threshold is specified for each monitored item, such as Busy ratio, I/O Density, Transfer Rate, Average Transfer Length, and Average Response Time. The physical disk that has a value which has exceeded the threshold is displayed along with the “**” marks appended to the number.

On the Threshold specified items dialog, selecting a device with threshold indicated and clicking [Delete] button deletes the specified threshold value.

(8) Thresholds exceeding state clearing
When you click [Threshold Monitoring] and then click [Reset Threshold Excess] on the Numeric Table screen, the threshold exceeding states which have occurred to the disk array specified in the combo box are all cleared. The marks indicating the threshold exceeding state are removed and the threshold monitoring operation resumes with regard to the items for which a threshold has been specified. Before this operation is carried out, the Confirm Clear of Threshold Exceeding State dialog appears.

Clicking the [OK] button will clear the threshold exceeding state and then close the dialog box. Clicking the [Cancel] button will close the dialog box without clearing the threshold exceeding state.
3.3 Support for Analysis of Statistic Information

For analyzing statistic information, specify settings to accumulate statistic information history files on the iSM Management server first. By summarizing, extracting, and editing the accumulated statistic information history files on the iSM Management server, the statistic information history is managed. Otherwise, by downloading the accumulated statistic information files and summarizing, extracting, and editing the data on the hard disk of an iSM client, the statistic information history is managed.

3.3.1 Accumulating Statistic Information

To accumulate statistic information in a file by using this function, the following requirements for the accumulation of statistic information must be met.

- It is a disk array which is registered as a target of control by the iSM server.
- It is a disk array which is a target of monitoring by the iSM server.

The following methods are available for controlling the operation of accumulating statistic information of the disk arrays which satisfy the above requirements.

- Method for using the iSMprflog command
- Method for controlling from the real-time display screen
- Method for performing settings in the environment definition file

Each method will be described below.

1. Operations by using the iSMprflog command

   (i) Storing of statistic information

   Two methods are available to start the accumulation of statistic information: a method for specifying a specific disk array and a method for specifying all the disk arrays monitored by the iSM server simultaneously.

   To start the accumulation of statistic information of a specific disk array, assign a disk array name to the end of -d option and then execute the iSMprflog start command. For example, when you start the accumulation of statistic information of a disk array (NECStorage4100), perform the operation below.

   iSMprflog start -d NECStorage4100

   If the specified disk array does not satisfy the requirements for accumulating statistic information or if statistic information is being accumulated, activating this command results in fault.

   On the other hand, when you start the accumulation of statistic information of all the disk arrays which satisfy the above requirements and for which statistic information has not been accumulated, perform the operation below.

   iSMprflog start -a
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(ii) Stop storing of statistic information

Two methods are available to terminate the accumulation of statistic information: a method for specifying a specific disk array and a method for specifying all the disk arrays monitored by the iSM server simultaneously. To terminate the accumulation of statistic information of a specific disk array, assign a disk array name to the end of -d option and then execute the iSMprflog terminate command. For example, when you terminate the accumulation of statistic information of a disk array (NECStorage4100), perform the operation below.

```
iSMprflog stop -d NECStorage4100
```

If a specified disk array has terminated accumulating information already, this command results in an error.

On the other hand, when you terminate the accumulation of current statistic information of all the disk arrays, perform the operation below.

```
iSMprflog stop -a
```

(2) Operations on the real-time display screen

The operation procedures will be described below. To utilize this function, it is required that the user’s level be L2 or L3.

(i) Select [Operation] → [Start/Stop Accumulation of Statistic Information] from the menu to display the Start/Stop Accumulation Statistic Information dialog screen.

(ii) From [Disk Array name] on the dialog screen, select and click the disk array for which the accumulation of statistic information is started or stopped, and then click the [Start] button to start accumulation and click the [Stop] button to terminate accumulation.

You can confirm the settings performed on this dialog screen by looking at the statistic information storing state filed in the Numeric Table (Refer to Figure 3-1 “Numeric Table Screen (When the Port is Selected)”).
(3) Setting in the environment definition file

The operation of accumulating statistic information can be controlled by performing setting in the environment definition file. For detailed setting procedures, refer to 1.3 “Environment Setting” of the “NEC Storage Manager User’s Manual”.

By performing setting for automatic start of the accumulation of statistic information in the environment definition file, it is possible to automatically start the accumulation of statistic information at the start of the iSM server with regard to the disk array for which statistic information had been accumulated when the iSM server was previously in operation.

3.3.2 Download Statistic Information

This section describes the procedures for downloading statistic information history files accumulated on the iSM server onto an iSM client. The following two methods are available for downloading statistic information history files:

- Downloading on performance monitoring function screen
  If the iSM server is operating, downloading is executed on the performance monitoring function screen.

- Downloading with FTP tool
  If the iSM server is not operating downloading with an FTP tool is available.

For file names of accumulated statistic information, refer to 1.5.3.1 “Accumulating Statistic Information”.

The statistic information history files remains after downloading onto the iSM Management server. In consideration of disk spaces on iSM Management server, the statistic information history files must be summarized as necessary. For summarizing operations, refer to 3.3.3 “Summarizing Statistic Information”.

(1) Downloading Statistic Information on the performance monitoring function screen

The following describes the operating procedures for downloading statistic information on the performance monitoring function screen.

(i) Select [Operation] → [Download Statistics Information files] menu to display the Download statistics information files dialog (Figure 3-23). Or, this dialog is displayed by clicking [Download Statistic Information files] button on tool bar.
(ii) Select statistic information files to download, from the [Statistic Information files].

(iii) Specify a downloading target directory for [Download place] field. Specifying by clicking [Browse] is allowed also. By default, data is downloaded in C:\Program Files\NEC\iSMclient\DATA.

(iv) Click [Download] button.

Clicking the [Download] button starts downloading, displaying a dialog that indicates progress. “finished downloading” displayed on the dialog indicates successful completion of downloading. The downloaded statistic information file allows summarizing, extracting, and editing by the performance analysis support tool.

(2) Downloading with FTP tool

If the iSM server is not operating, downloading is available using an FTP tool. For downloading, log in the management server, specify applicable files and downloading target directory, and then execute the FTP tool.
3.3.3 Summarizing Statistic Information

3.3.3.1 Description of Operations (UNIX)

Operations with the Archiver (iSMprfarc) command for summarizing statistic information will be described below.

(1) Files to be summarized and determination of the summarizing method

Before executing Archiver, specify the following items:

- Files to be summarized
  
  Specify statistic information files you want to summarize. You can directly specify files as summarizing objects, or you can specify files in a specified directory in a specific period as summarizing objects.
  
  The names of the statistic information files to be summarized must be in accordance with the naming convention for statistic information files. For naming conditions and rules of statistic information files, refer to 1.5.3.1 “Accumulating Statistic Information”.

  [Naming Convention for Statistic Information Files]
  
  \(<YYYY><MM><DD><NN-N>.psl\) (History file)
  \(<YYYY><MM><DD><NN-N>.psa\) (Primary summarized file)
  \(<YYYY><MM><NN-N>.psa\) (Secondary summarized file)
  
  \(<YYYY\>\) indicates year (4 digits), \(<MM\>\) indicates month (2 digits), \(<DD\>\) indicates day (2 digits), and \(<NN-N\>\) indicates the disk array name.

- Summarizing method

  Select a method (primary summarizing, secondary summarizing, or direct secondary summarizing) of statistic information files.

  If a summarizing period is not an integral multiple of the logging interval specified by an accumulation process, summarizing is not performed evenly. For such cases as I/O count applicable to that condition, refer to statistic information items with no fluctuation by changing period of summarizing, such as I/O density and transfer rate.

(2) Executing Archiver

Specify files, directory and option according to the specified contents and execute Archiver. Archiver operates regardless of the iSM server process. Archiver can be executed in any directory. The names of the summarized files output by Archiver are automatically created in accordance with the naming convention for statistic information files.

Examples of execution of Archiver will be provided below.

Example: Example of summarizing when a file is specified

Assume that the statistic information history file (20020401NECStorage4100.psl) on April 1, 2002 regarding “NECStorage4100” is located in the “/opt/iSMsvr/etc/mon” directory. To summarize this file and output a primary summarized file to the current directory, enter the following command and execute it.
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As a result, the primary summarized file (20020401NECStorage4100.psa) on April 1, 2002 is created in the current directory.

Example: Example 1 of summarizing when a period is specified
Assume that the statistic information history files (20020401NECStorage4100.psl - 20020430NECStorage4100.psl) from April 1, 2002 to April 30, 2002 regarding “NECStorage4100” are located in the “/opt/iSMsvr/etc/mon” directory. Among all files in this directory, if you want to summarize the statistic information history files from April 1, 2002 to April 15, 2002 and output primary summarized files to the same directory, enter the following command in a directory and execute it.

iSMprfarc /opt/iSMsvr/etc/mon/20020401NECStorage4100.psl

As a result, the primary summarized files (20020401NECStorage4100.psa - 20020415NECStorage4100.psa) from April 1, 2002 to April 15, 2002 are created in the “/opt/iSMsvr/etc/mon” directory.

Example: Example 2 of summarizing when a period is specified
Assume that the statistic information history files (20010401NECStorage4100.psl - 20020331NECStorage4100.psl) from April 1, 2001 to March 31, 2002 regarding “NECStorage4100” are located in the “/opt/iSMsvr/etc/mon” directory. Among all files in this directory, if you want to summarize all the statistic information history files collected one month before the current time and output secondary summarized files to the same directory, enter the following command in a directory and execute it.

If the current time is April 15, 2002, the statistic information files in the period from April 1, 2001 to March 15, 2002 are the targets of summarizing.

iSMprfarc -p /opt/iSMsvr/etc/mon -day 1m

As a result, the secondary summarized files (200104NECStorage4100.psa - 200203NECStorage4100.psa) from April, 2001 to March, 2002 are created in the “/opt/iSMsvr/etc/mon” directory.

3.3.3.2 Description of Operations (Windows)

Explanation will be made about the operations to summarize statistic information.

Before summarizing statistic information, specify the following items:

* Files to be summarized
  Specify statistic information files you want to summarize. You can directly specify files as summarizing objects, or you can specify files in a specified directory in a specific period as summarizing objects.

The names of the statistic information files to be summarized must be in accordance with the naming convention for
statistic information files (For details, refer to Part I “Performance Monitoring Function”, 1.5.3.1 “Accumulating Statistic Information” of this manual).

[ Naming Convention for Statistic Information Files ]

- `<YYYY><MM><DD><NN-N>.psl` (History file)
- `<YYYY><MM><DD><NN-N>.psa` (Primary summarized file)
- `<YYYY><MM><NN-N>.psa` (Secondary summarized file)

`<YYYY>` indicates year (4 digits), `<MM>` indicates month (2 digits), `<DD>` indicates day (2 digits), and `<NN-N>` indicates the disk array name.

• Summarizing method

Select a summarizing method (primary summarizing, secondary summarizing, or direct secondary summarizing) of statistic information files.

---

If a summarizing period is not an integral multiple of the logging interval specified by an accumulation process, summarizing is not performed evenly. For such cases as I/O count applicable to that condition, refer to statistic information items with no fluctuation by changing period of summarizing, such as I/O density and transfer rate.

Next, summarize statistic information. Archiver provides the following two operation methods:

- Operations on the “Performance Analysis Supporting Tool” screen


- Operations with the Archiver command

  Specify an option in the iSMprfarc command and execute the command to perform a summarizing operation. The two methods of operation will be described below.

(1) Operations on the "Performance Analysis Supporting Tool" screen

Select the [Archiver] tab on the Performance Analysis Supporting Tool screen, and enter parameters for performing a summarizing operation. Screen images and operations will be described below.
(i) **File Specification**
Select this function when you want to perform a summarizing operation by specifying statistic information files. This function cannot be selected together with Period Specification.

(ii) **Statistic Info File**
Specify statistic information history/summarized files. Multiple files can be specified; however, statistic information files with different summarizing levels, such as statistic information history files and primary summarized files cannot be mixed.

(iii) **Output Directory**
Specify the directory to which summarized files are output. If specification of the output directory is omitted, the summarized files are output to the same directory as the statistic information file specified first. If the file with the same name exists in the output directory, the file is overwritten.

(iv) **Direct Secondary Summarizing**
Select this function when you want to enter statistic information history files and directly create secondary summarized files. If a primary summarized file is specified as an input file, a normal secondary summarizing operation is conducted.

(v) **Period Specification**
Select this function when you want to perform a summarizing operation by specifying the directory in which statistic information files are located and the summarizing period. This function cannot be selected together with File Specification.

(vi) **Summarize Method**
Select either Primary Summarizing or Secondary Summarizing.

(vii) **Input Directory**
Specify the directory in which input statistic information files exist. All of the summarized files are output to the specified directory.
(viii) Date Specification
Specify the target period of summarizing in a Year/Month/Day format (from starting date to end date). If the starting date is omitted, all the days before the end date are set to be the target period of summarizing. The end date cannot be omitted.

(ix) Relative Specification
Select this function to specify the target period of summarizing in a relative period by regarding the current time as the reference point.

(2) Operations with the Archiver command (iSMprfarc command)

Specify files, directory or option and execute Archiver. Archiver operates regardless of the iSM server process. Archiver can be executed in any directory. The names of the summarized files output by Archiver are automatically created in accordance with the naming convention for statistic information files.

Examples of execution of the Archiver will be provided below.

Example: Example of summarizing when a file is specified
Assume that the statistic information history file (20020401NECStorage4100.psl) on April 1, 2002 regarding “NECStorage4100” is located in the “C:\Program files\NEC\iSMsvr\etc\mon” directory.
To summarize this file and output a primary summarized file to the current directory, enter the following command and execute it.

```
iSMprfarc "C:\Program files\NEC\iSMsvr\etc\mon\20020401NECStorage4100.psl"
```

As a result, the primary summarized file (20020401NECStorage4100.psa) on April 1, 2002 is created in the current directory.

To specify a file name or directory name with a space, enclose it in double quotation marks.

Example: Example 1 of summarizing when a period is specified
Assume that the statistic information history files (20020401NECStorage4100.psl-20020430NECStorage4100.psl) from April 1, 2002 to April 30, 2002 regarding “NECStorage4100” are located in the “C:\Program files\NEC\iSMsvr\etc\mon” directory. Among all files in this directory, if you want to summarize the statistic information history files from April 1, 2002 to April 15, 2002 and output primary summarized files to the same directory, enter the following command and execute it.

```
iSMprfarc -p "C:\Program files\NEC\iSMsvr\etc\mon" -hour 20020401.20020415
```

As a result, the primary summarized files (20020401NECStorage4100.psa - 20020415NECStorage4100.psa) from April 1, 2002 to April 15, 2002 are created in the “C:\Program files\NEC\iSMsvr\etc\mon” directory.

Example: Example 2 of summarizing when a period is specified
Assume that the statistic information history files (20010401NECStorage4100.psl-20020331NECStorage4100.psl) from April 1, 2002 to March 31, 2002 regarding “NECStorage4100” are located in the “C:\Program files\NEC\iSMsvr\etc\mon” directory. Among all files in this directory, if you want to summarize the statistic information history files from April 1, 2002 to March 31, 2002 and output primary summarized files to the same directory, enter the following command and execute it.

```
iSMprfarc -p "C:\Program files\NEC\iSMsvr\etc\mon" -hour 20020401.20020331
```

As a result, the primary summarized files (20020401NECStorage4100.psa - 20020331NECStorage4100.psa) from April 1, 2002 to March 31, 2002 are created in the “C:\Program files\NEC\iSMsvr\etc\mon” directory.
directory, if you want to summarize all the statistic information history files collected one month before the current time and output secondary summarized files to the same directory, enter the following command in a directory and execute it.

If the current time is April 15, 2002, the statistic information files in the period from April 1, 2001 to March 15, 2002 are the targets of summarizing.

```
iSMprfarc -p "C:\Program files\NEC\iSMsvr\etc\mon" -day 1m
```

As a result, the secondary summarized files (200104NECStorage4100.psa - 200203NECStorage4100.psa) from April, 2001 to March, 2002 are created in the “C:\Program files\NEC\iSMsvr\etc\mon” directory.

### 3.3.4 Extracting Statistic Information

#### 3.3.4.1 Description of Operations (UNIX)

Operations with the CSV conversion command (iSMprfext) to extract statistic information will be described below.

(1) **Extracting statistic information**

When you specify statistic information history files and summarized files in the CSV conversion command, the CSV conversion command extracts statistic information and creates CSV files. The CSV conversion command creates CSV files in accordance with the following rules:

- If a statistic information history/summarized file is specified, a CSV format file corresponding to the file is created in the same path.
- If a creating path of CSV format file is specified (-p option), the CSV format files are created in the specified path.
- Two or more statistic information history/summarized files and -p option are specified, all CSV format files corresponding to the files are created in the path specified by -p option.
- If files under the same names exist in the path where the CSV format files are created, the existing files are overwritten.

To specify files or directory that include blanks in their names, the names of file or directory must be enclosed by double quotation marks.

For syntax of iSMprfext command, refer to Appendix A “Commands of the Performance Monitoring/Optimization Function”.

Examples of extraction of statistic information are provided below.

Example 1: Extracting statistic information from the statistic information history file “20020401NECStorage4100.psl”

```
iSMprfext -file 20020401NECStorage4100.psl
```

Example 2: Extracting statistic information from the statistic information history files “20020401NECStorage4100.psl” and “20020402NECStorage4100.psa”

```
iSMprfext -file 20020401NECStorage4100.psl
```

```
iSMprfext -file 20020402NECStorage4100.psa
```
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Example 3: Extracting statistic information from the statistic information history file “20020401NECStorage4100.psl” and creating a CSV file in “/temp”

```
iSMprfext -file 20020401NECStorage4100.psl 20020402NECStorage4100.psl -p /temp
```

Example 4: Extracting statistic information from the statistic information history files “20020401NECStorage4100.psl” and “20020402NECStorage4100.psl” and creating CSV files in “/temp”

```
iSMprfext -file 20020401NECStorage4100.psl 20020402NECStorage4100.psl -p /temp
```

(2) Extracting specific statistic information

You can extract specific statistic information by specifying extracting conditions, such as the period of extraction, component of the disk array, type of statistic information, etc. in the CSV conversion command. Multiple conditions can be specified simultaneously. Examples of extraction are provided below.

(a) Extracting statistic information in the specified period

Example 1: Extracting statistic information from 10:00 to 15:30 on April 1, 2002

```
iSMprfext -file file1 -from 20020401/1000 -to 20020401/1530
```

Example 2: Extracting statistic information after 17:30 on April 1, 2002

```
iSMprfext -file file1 -from 20020401/1730
```

(b) Extracting statistic information of the specific component

Example 1: Extracting statistic information of the host port with the director number 10h and port number 0ah

```
iSMprfext -file file1 -hp 10-a
```

Example 2: Extracting statistic information of the logical disk of 001eh and the physical disk with the group number 00h and disk number 01

```
iSMprfext -file file1 -ld 1e -pd 0-1
```
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(c) Extracting statistic information of the specific type
Example 1: Extracting statistic information regarding the number of inputs/outputs

```
iSMprfext -file file1 -iocnt
```

Example 2: Extracting statistic information regarding the number of inputs/outputs and Transfer Rate

```
iSMprfext -file file1 -iocnt -rate
```

(d) Extracting statistic information of the specific component in the specified period
Example 1: Extracting statistic information of the logical disk of 0020h from 10:00 to 15:30 on April 1, 2002

```
iSMprfext -file file1 -from 20020401/1000 -to 20020401/1530 -ld 20
```

(e) Extracting statistic information of the specific type in the specified period
Example 1: Extracting statistic information regarding the response time after 17:30 on April 1, 2002

```
iSMprfext -file file1 -from 20020401/1730 -resp
```

(f) Extracting statistic information of the specific component regarding the specific type in the specified period
Example 1: Extracting statistic information of the logical disk of 0020h regarding the number of inputs/outputs from 10:00 to 15:30 on April 1, 2002

```
iSMprfext -file file1 -from 20020401/1000 -to 20020401/1530 -ld 20 -iocnt
```

Example 2: Extracting statistic information of the logical disk of 0020h and the physical disk with the group number 00h and disk number 01h regarding the Transfer Rate before 16:00 on April 1, 2002

```
iSMprfext -file file1 -to 20020401/1600 -ld 20 -pd 0-1 -rate
```

(3) Notes
(i) If the CSV file with the same name exists in the path in which CSV files are created, the file is overwritten.
(ii) The maximum number of records of a CSV file is 65,536. If the number of records of a CSV file exceeds 65,536, the CSV Conversion Tool outputs an error message and terminates processing.
(iii) CSV file concatenation
The CSV Conversion Tool creates one CSV file for a statistic information history/summarized file. Therefore, it is not possible to put statistic information of multiple statistic information history/summarized files together in one CSV file by using the CSV Conversion Tool.
To put statistic information of multiple statistic information history/summarized files together in one CSV file, follow the procedures below.
(a) Specify multiple files to the CSV Conversion Tool and create corresponding CSV files.

(b) Link the CSV files created in procedure (a) by using the cat command to put the files together in one CSV file.

The following example illustrates how to put statistic information of multiple statistic information history files together in one CSV file.

Example: Extracting statistic information from the statistic information history files “20020401NECStorage4100.psl” and “20020402NECStorage4100.psl” and put them together in a CSV file “NECStorage4100.csv”.

```
ismprfext -file 20020401NECStorage4100.psl 20020402NECStorage4100.psl cat 20020401NECStorage4100_psl.csv 20020402NECStorage4100_psl.csv > NECStorage4100.csv
```

### 3.3.4.2 Description of Operations (Windows)

This section will explain how to extract statistic information. The CSV Conversion Tool provides the following two operation methods:

- **Operations on the Performance Analysis Supporting Tool screen**

- **Operations with the CSV conversion command**
  You can perform an extraction operation by specifying an option in the isMprfext command and executing it. The two operation methods will be described in detail below.

(1) **Operations on the Performance Analysis Supporting Tool screen**

Perform an extraction operation by selecting the [CSV Conversion Tool] tab on the Performance Analysis Supporting Tool screen and entering parameters for the extraction. Screen images and operations will be described below.
(i) Statistic Info File
Specify statistic information history/summarized files. Multiple files can be specified, and statistic information
history files and statistic information summarized files can be mixed.

(ii) Output Directory
Specify a directory in which output files (CSV files) are created. If multiple statistic information files are
specified, all CSV files of the statistic information files are created in the directory specified here. If the
specification of the output directory is omitted, a CSV file is created in the same directory as the statistic
information file. If the file with the same name exists in the output directory, the file is overwritten.

(iii) Summarizing Condition
Select this function to extract statistic information by specifying extracting conditions. In this case, at least one
extracting condition must be selected from component, type, and period. If summarizing conditions are not
specified, all statistic information in the specified statistic information file is extracted.

(iv) Component
Select components for the extraction. Multiple components can be selected. Only statistic information that
matches the selected component identification numbers is extracted. If no component is selected, statistic
information of all components is extracted.

(v) Type
Select types of statistic information for the extraction. Multiple types can be selected. Only statistic
information that matches the selected types is extracted. If no type is selected, statistic information of all types
is extracted.

(vi) Period
Only statistic information in the period specified here is extracted. You can specify the extraction starting time
and end time, or either one of them. If no period is specified, statistic information in all periods is extracted.

(vii) Output Component Info
Select this function to output component information of the disk array in addition to statistic information.

(viii) Output Header Info
Select this function to output header record showing field name to the head of file.

(2) Operations with the CSV conversion command

(i) Extracting statistic information
When you specify statistic information history/summarized files in the CSV conversion command, the CSV conversion command extracts statistic information and creates CSV files. The CSV conversion command creates CSV files in accordance with the following rules:
If a statistic information history/summarized file is specified, a CSV format file corresponding to the file is created in the same path. If a creating path of CSV format file is specified (-p option), the CSV format files are created in the specified path. Two or more statistic information history/summarized files and -p option are specified, all CSV format files corresponding to the files are created in the path specified by -p option. If files under the same names exist in the path where the CSV format files are created, the existing files are overwritten.
To specify files or directory that include blanks in their names, the names of file or directory must be enclosed by double quotation marks.

For syntax of iSMprfext command, refer to Appendix A “Commands of the Performance Monitoring/Optimization Function”.

Examples of extraction of statistic information are provided below.
Example 1: Extracting statistic information from the statistic information history file “20020401NECStorage4100.psl”

```
iSMprfext -file 20020401NECStorage4100.psl
```

Example 2: Extracting statistic information from the statistic information history files “20020401NECStorage4100.psl” and “20020402NECStorage4100.psa”

```
iSMprfext -file 20020401NECStorage4100.psl 20020402NECStorage4100.psa
```

Example 3: Extracting statistic information from the statistic information history file “20020401NECStorage4100.psl” and creating a CSV file in “C:\temp”

```
iSMprfext -file 20020401NECStorage4100.psl -p C:\temp
```

Example 4: Extracting statistic information from the statistic information history files “20020401NECStorage4100.psl” and “20020402NECStorage4100.psl” and creating CSV files in “C:\temp”
(ii) Extracting specific statistic information
You can extract specific statistic information by specifying extracting conditions, such as the period of extraction, component of the disk array, type of statistic information, etc. in the CSV conversion command. Multiple conditions can be specified simultaneously. Examples of extraction are provided below.

(a) Extracting statistic information in the specified period
Example 1: Extracting statistic information from 10:00 to 15:30 on April 1, 2002

iSMprfext -file file1 -from 20020401/1000 -to 20020401/1530

Example 2: Extracting statistic information after 17:30 on April 1, 2002

iSMprfext -file file1 -from 20020401/1730

(b) Extracting statistic information of the specific component
Example 1: Extracting statistic information of the host port with the director number 10h and port number 0ah

iSMprfext -file file1 -hp 10-a

Example 2: Extracting statistic information of the logical disk of 001eh and the physical disk with the group number 00h and disk number 01

iSMprfext -file file1 -ld 1e -pd 0-1

(c) Extracting statistic information of the specific type
Example 1: Extracting statistic information regarding the number of inputs/outputs

iSMprfext -file file1 -iocnt

Example 2: Extracting statistic information regarding the number of inputs/outputs and Transfer Rate

iSMprfext -file file1 -iocnt -rate

(d) Extracting statistic information of the specific component in the specified period
Example 1: Extracting statistic information of the logical disk of 0020h from 10:00 to 15:30 on April 1, 2002
(e) Extracting statistic information of the specific type in the specified period
Example 1: Extracting statistic information regarding the response time after 17:30 on April 1, 2002
```
iSMprfext -file file1 -from 20020401/1730 -resp
```

(f) Extracting statistic information of the specific component regarding the specific type in the specified period
Example 1: Extracting statistic information of the logical disk of 0020h regarding the number of inputs/outputs from 10:00 to 15:30 on April 1, 2002
```
iSMprfext -file file1 -from 20020401/1000 -to 20020401/1530 -ld 20 -iocnt
```
Example 2: Extracting statistic information of the logical disk of 0020h and the physical disk with the group number 00h and disk number 01h regarding the Transfer Rate before 16:00 on April 1, 2002
```
iSMprfext -file file1 -to 20020401/1600 -ld 20 -pd 0-1 -rate
```

(3) Notes
(i) If the CSV file with the same name exists in the path in which CSV files are created, the file is overwritten.
(ii) The maximum number of records of a CSV file is 65,536. If the number of records of a CSV file exceeds 65,536, the CSV Conversion Tool outputs an error message and terminates processing.
(iii) Linking CSV files
The CSV Conversion Tool creates one CSV file for a statistic information history/summarized file. Therefore, it is not possible to put statistic information of multiple statistic information history/summarized files together in one CSV file by using the CSV Conversion Tool.
To put statistic information of multiple statistic information history/summarized files together in one CSV file, follow the procedures below.

(a) Specify multiple files to the CSV Conversion Tool and create corresponding CSV files.
(b) Link the CSV files created in procedure (a) by using the cat command to put them together in one CSV file.

The following example illustrates how to put statistic information of multiple statistic information history files together in one CSV file.

Example: Extracting statistic information from the statistic information history files "20020401NECStorage4100.psl" and "20020402NECStorage4100.psl" and put them together in a CSV file "NECStorage4100.csv".
3.3.5 Editing Statistic Information

3.3.5.1 Description of Operations (UNIX)

This section will explain how to operate the editing tool and the graph making tool.

(1) Editing tool

You can perform an editing operation by specifying an option in the iSMprfedit command and executing it. Multiple statistic information history/summarized files, output directory, and the type of editing reports to be created can be specified. For syntax and operation rules of the editing tool command, refer to Appendix A “Commands of the Performance Monitoring/Optimization Function” of this manual. Examples of execution of the iSMprfedit commands will be provided below.

Example 1: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl”

```
iSMprfedit 20020430NECStorage4100.psl
```

Example 2: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl” in “/tmp”.

```
iSMprfedit -o /tmp 20020430NECStorage4100.psl
```

Example 3: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl” and all detail reports

```
iSMprfedit -det -all 20020430NECStorage4100.psl
```

Example 4: Creating only the detailed report on the whole disk array of the statistic information history file “20020430NECStorage4100.psl”

```
iSMprfedit -nosum -det 20020430NECStorage4100.psl
```

(2) Graph Making Tool

The graph making tool can be used in an environment in which Microsoft® Excel2000 is installed. An iSM client must be installed in the personal computer for using the graph making tool. For information on how to operate the graph making tool, refer to 3.3.5.2 “Description of Operations (Windows)”.

```
3.3.5.2 Description of Operations (Windows)

This section will explain how to operate the editing tool and the graph making tool, and the procedures for editing statistic information using spreadsheet software.

(1) Editing Tool

The editing tool provides the following two operation methods:

- Operations on the Performance Analysis Supporting Tool screen


![Performance Analysis Supporting Tool Screen (Edit Tool)](image)

(i) Statistic Info File

Specify statistic information history/summarized files. Multiple files can be specified, and statistic information history files and statistic information summarized files can be mixed. Specification of the statistic information file cannot be omitted.

(ii) Output Directory

Specify a directory in which editing reports (text file) are created. If multiple statistic information files are specified, all editing reports of each statistic information file are created in the directory specified here. If specification of the output directory is omitted, an editing report is created in the same directory as the statistic information file.
(iii) Select Edit Report
Select this function to output editing reports.

(iv) Summary Report
Specify this function to output summary reports.

(v) Detail Report
Select the detailed report to be output.

(vi) Detail Report About Disk Array
Select this parameter to output a detailed report on the whole disk array.

(vii) Detail Report About HP
Select this parameter to output a detailed report on host director ports.

(viii) Detail Report About DP
Select this parameter to output a detailed report on disk director ports.

(ix) Detail Report About LD
Select this parameter to output a detailed report on logical disks.

(x) Detail Report About PD
Select this parameter to output a detailed report on physical disks.

(xi) Detail Report About RANK
Select this parameter to output a detailed report on RANK.

You can create only a desirable editing report by selecting a specific report and execute the editing tool. You can also create all editing reports by selecting all reports.

- Operations with the editing tool command

To perform an editing operation, specify an option in the iSMprfedit command and then execute it. Similar to the case where the editing tool is operated on the Performance Analysis Supporting Tool screen, multiple statistic information history/summarized files, output directory, type of editing reports to be created can be specified. For syntax and operation rules of the editing tool command, refer to Appendix A “Commands of the Performance Monitoring/Optimization Function” of this manual.

Examples of execution of the iSMprfedit commands are provided below.

Example 1: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl”

```bash
iSMprfedit 20020430NECStorage4100.psl
```

Example 2: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl” in “C:\tmp”.

```bash
iSMprfedit -o C:\tmp 20020430NECStorage4100.psl
```

Example 3: Creating a summary report of the statistic information history file “20020430NECStorage4100.psl” and all detail reports.

```bash
iSMprfedit -det -all 20020430NECStorage4100.psl
```
Example 4: Creating only an detailed report on the whole disk array of the statistic information history file “20020430NECStorage4100.psl”.

```
ismprfedit -nosum -det 20020430NECStorage4100.psl
```

(2) Graph Making Tool

To create graphs, select Storage Performance Report Viewer from the Start menu and specify necessary items on the Storage Performance Report Viewer screen. Screen images and operations will be described below.

The graph making tool (Storage Performance Report Viewer) can be used in an environment in which Microsoft® Excel2000 is installed. An iSM client must be installed in the personal computer for using the graph making tool.

### Storage Performance Report Viewer

#### File

You can specify only a detailed report on the whole disk array created by using the editing tool. If other files are specified, the creation of the graph will fail.

#### Display items in the graph

Specify statistic information to be displayed in a graph. Up to two items can be specified. Applicable statistic information includes:

- **I/O Density**
  This is the number of input/output requests per second (IOPS).

- **Transfer Rate**
  This is the data transfer volume per second. The unit is MB (megabyte)/second.

- **Average Transfer Length**
  This is the Average Transfer Length of a single input/output request. The unit is KB (kilobyte)/second.

---

Figure 3-27 Storage Performance Report Viewer Screen

(i) File

You can specify only a detailed report on the whole disk array created by using the editing tool. If other files are specified, the creation of the graph will fail.

(ii) Display items in the graph

Specify statistic information to be displayed in a graph. Up to two items can be specified. Applicable statistic information includes:

- **I/O Density**
  This is the number of input/output requests per second (IOPS).

- **Transfer Rate**
  This is the data transfer volume per second. The unit is MB (megabyte)/second.

- **Average Transfer Length**
  This is the Average Transfer Length of a single input/output request. The unit is KB (kilobyte)/second.
Chapter 3  Operations of Performance Monitoring Function

- **Average Response Time**
  This is the average response time of a single input/output request. The unit is ms (millisecond).

- **Read Hit Ratio**
  This is a ratio of the number of inputs that hit the cache to the total number of input requests.

- **Prefetch Hit Ratio**
  This is a ratio of the number of inputs that hit the cache via the disk array prefetch function to the total number of inputs that hit the cache.

- **Write Hit Ratio**
  This is a ratio of the number of outputs that hit the cache to the total number of output requests.

- **Write I/O Ratio**
  This is a ratio of output requests to the total number of input/output requests.

(iii) **Display Graph**

Clicking the [Display Graph] button will display a graph in a separate book.

When you create a graph and then want to create another graph with different settings, return to the Storage Performance Report Viewer start screen, change the settings, and then click the [Display Graph] button. A separate book is created to display the graph.

The following illustrates an example in which a graph is created by specifying the I/O density and Transfer Rate:

**DISK ARRAY PERFORMANCE**

*disk array name: NECStorage3300*

*sampling term: 02-11-28/13:05 to 02-11-28/16:55*

![Graph Example](image)

Figure 3-28  Example of Creating a Graph

Items displayed in a graph will be described below.

- **disk array name**: Displays the name of the disk array.
- **sampling term**: Displays the collection period of the statistic information shown in a graph.
- **Ordinate**: Displays the scale of statistic information selected in the Storage Performance Report Viewer start screen. If two types of statistic information are selected, scales are displayed in both ordinates.
- **Abscissa**: Displays the time.
- **Legend**: Displays the name of the statistic information selected on the Storage Performance Report Viewer start screen.
In “Figure 3-28 Example of Creating a Graph”, some points are not linked by lines. The graph making tool (Storage Performance Report Viewer) does not link points with lines when statistic information is no longer continuous in order to accurately express the continuity of the statistic information in the graph. The statistic information loses its continuity in the following cases:

- Configuration of the disk array was changed during the monitoring of performance.
- A fault occurred in the disk array during the monitoring of the performance and the monitoring of the disk array performance could not be continued.
- A user terminated the accumulation of statistic information due to the specification during the monitoring of performance.

If log accumulation interval is adjusted automatically (for giving a higher priority to file input/output from a business host), the intervals between the points increase in accordance with the adjusted time interval.

(3) Editing with spreadsheet software

The statistic information history files extracted with header options specified can be used on spreadsheet software, such as Microsoft® Excel2000. On the software, sorting the output values makes it easier to identify the values. Figure 3-29 shows an example of editing a statistic information history file extracted with header option specified (CSV file), using Microsoft® Excel2000.
Part II  Performance Optimization Function
Chapter 4 Overview of Performance Optimization Function

The Performance Optimization function (NEC Storage PerformanceOptimizer) is capable of analyzing the causes of lowered responses in the NEC Storage series Disk Array Subsystem and improving its performances. An administrator, with use of the Performance Optimization function, analyzes the performances of disk array under the control of iSM, by centralized operations on an iSM client and tunes the performances as necessary.

4.1 Performance Optimization Function

As the volume of business data increases day by day, the scale and capacity of disk array become larger. Access patterns have also been diverted due to the use by multiple business systems. To maintain quick response of the business system, it is necessary to monitor the load state of disk arrays and detect a bottleneck and improve it. This work, however, requires advanced technical knowledge and techniques of performance analysis and tuning operations. Furthermore, when it is necessary to tune the performance, business operations may be stopped for a while, causing inconvenience to business operations.

The NEC Storage PerformanceOptimizer solves such problems. Introduction of the NEC Storage PerformanceOptimizer makes it possible to properly and easily conduct painstaking performance analysis and tuning operations. A tuning operation can be done while business is in operation, thereby maintaining optimal disk performance around the clock without stopping business operations.

Figure 4-1 Concept of NEC Storage PerformanceOptimizer
4.2 NEC Storage PerformanceOptimizer and Related Product

The NEC Storage PerformanceOptimizer is for the following program products:

- NEC Storage BaseProduct
- NEC Storage PerformanceMonitor
- NEC Storage ReallocationControl
- NEC Storage AccessControl

4.3 System Configuration

For system configuration examples, refer to Chapter 3 “Basic Functions” in the “NEC Storage Manager User’s Manual”.
### 4.4 Operation of Performance Optimization Function

This section describes operations of the performance optimization function. The performance optimization function is operated as shown in the following flow:

<table>
<thead>
<tr>
<th>Operation flow</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing Performance optimization function</td>
<td>Chapter 5 Installation of Performance Optimization Function</td>
</tr>
<tr>
<td>Installation of NEC Storage Manager is accompanied by installing the</td>
<td></td>
</tr>
<tr>
<td>Performance optimization function at the same time. For using the</td>
<td></td>
</tr>
<tr>
<td>Performance optimization function, Work Disk for Optimization must be</td>
<td></td>
</tr>
<tr>
<td>specified.</td>
<td></td>
</tr>
<tr>
<td>Monitoring and analyzing load state</td>
<td>Part I Performance Monitoring Function</td>
</tr>
<tr>
<td>Activate the Performance optimization function screen and analyze</td>
<td>4.5.1 Bottleneck Detection Support</td>
</tr>
<tr>
<td>the load state on the basis of Busy Ratios displayed on the screen.</td>
<td>6.2 Operation on Screen</td>
</tr>
<tr>
<td>Because the busy ratio are displayed in different colors and the information</td>
<td></td>
</tr>
<tr>
<td>can be displayed in graphs, the bottlenecks of concentrated I/Os can easily</td>
<td></td>
</tr>
<tr>
<td>be identified. Use of the performance monitoring function also allows more</td>
<td></td>
</tr>
<tr>
<td>effective monitoring and analyzing.</td>
<td></td>
</tr>
<tr>
<td>Replacement Plan</td>
<td>4.5.2 Replacement Plan</td>
</tr>
<tr>
<td>After detecting bottlenecks, replace the logical disks to distribute the</td>
<td>6.2 Operation on Screen</td>
</tr>
<tr>
<td>loads, removing the bottlenecks. Use of the replacement plan function can</td>
<td></td>
</tr>
<tr>
<td>easily prepare an effective planning of replacement.</td>
<td></td>
</tr>
<tr>
<td>Replacement Effect Prediction</td>
<td>4.5.3 Replacement Effect Prediction</td>
</tr>
<tr>
<td>Effectiveness of a replacement plan can be estimated before practicing the</td>
<td>6.2 Operation on Screen</td>
</tr>
<tr>
<td>replacement process. The effectiveness of replacement can be verified by</td>
<td></td>
</tr>
<tr>
<td>comparing the busy ratio before after replacement with each other, which</td>
<td></td>
</tr>
<tr>
<td>are indicated in values and graphs. After verifying sufficient effectiveness</td>
<td></td>
</tr>
<tr>
<td>of replacement, proceed to the next step of performance tuning shown below.</td>
<td></td>
</tr>
<tr>
<td>Performance tuning</td>
<td>4.5.4 Performance Tuning</td>
</tr>
<tr>
<td>Apply the planned replacement practically, and remove the bottlenecks by</td>
<td>6.3 Operation on Screen</td>
</tr>
<tr>
<td>distributing loads.</td>
<td>7.1 Logical Disk Movement Command</td>
</tr>
<tr>
<td>Verifying arrangement of Work Disks for Optimization</td>
<td>A.2 Command for Performance Tuning</td>
</tr>
<tr>
<td>The replacement causes the changes in arrangement of Work Disks for</td>
<td>5.3 Installation of Work Disks for Optimization</td>
</tr>
<tr>
<td>performance optimization. Verify that the arrangement has no problems, and</td>
<td></td>
</tr>
<tr>
<td>if a problem is found, change the settings of Work Disks for performance</td>
<td></td>
</tr>
<tr>
<td>optimization.</td>
<td></td>
</tr>
</tbody>
</table>
4.5 Function Overview

The performance optimization function provides the capability of “Bottleneck Detection Support”, “Replacement Plan”, “Replacement Effect Prediction”, and “Performance tuning”. This section describes outlines of the functions.

4.5.1 Bottleneck Detection Support

Concentration of I/O in a specific physical disk causes I/O competition thereby deteriorating response. The degree of concentration of I/O in a physical disk can be indicated as the physical disk’s operating time per unit time. This value is expressed as the physical disk’s Busy Ratio.

The NEC Storage PerformanceOptimizer monitors the load state of physical disks at specified intervals and displays the obtained Busy Ratio for each physical disk on the dedicated client screen. Analysis of the Busy Ratio displayed on the dedicated client screen allows you to detect a physical disk (bottleneck location) in which I/O concentrates.

The NEC Storage PerformanceOptimizer features the following display of the Busy Ratio, which enables the analysis suitable for the business system and visual detection of the bottleneck.

- The analysis period (Busy Ratio calculation period) can be specified in terms of the exponent condition for the date, days of the week, and time zone.
- Display a Busy Ratio in tri-level with color-coding.
- Display over-time changes of Busy Ratio in three different colors.

4.5.2 Replacement Plan

Upon detecting a physical disk with concentrated I/Os (bottleneck part), logical disks are moved (replaced) to tune performances. This function displays information about the movement destination logical disks, which are best suited for the source logical disk. This function automatically finds the movement destination logical disks that are highly effective for I/O distribution after moving disks, and displays the disks in the order of effectiveness. An administrator is allowed to tune the performances on the basis of the information and remove the bottleneck.

4.5.3 Replacement Effect Prediction

An effect of load distribution after logical disk movement can be estimated before logical disk movement. This function displays the changes of Busy Ratios in source and destination logical disks or RANK, in graph format. An administrator is allowed to verify that I/O will not concentrate after moving disks, and tune the performances on the basis of the estimated effects.

4.5.4 Performance Tuning

The NEC Storage PerformanceOptimizer moves logical disks located in a high load physical disk in which I/O concentrates to a low load RANK so as to distribute the concentration of I/O thereby canceling the I/O competition and removing the bottleneck. This is called performance tuning. The performance tuning can be executed instantly, or at a registered time.

Figure 4-2 shows the concept of performance tuning implement by the performance optimization function. The work disks shown in the figure are logical disks dedicated to the use for the performance tuning (The Work Disk for
By moving a logical disk, the arrangement of the Moved Material Logical Disk and the Work Disk for Optimization is switched.

The logical disks are moved inside the disk array without affecting any business system. As a result, performance tuning is possible while business is in operation. Transfer of logical disks will not require any changes of SG or access methods to business systems.

High-load physical disk (Bottleneck)
I/O concentrates in logical disks (LDx, LDy, LDz) causing a high load state.

I/O to LDx has been moved to the low-load physical disk thereby canceling the high-load state.

Due to performance tuning effect and so on, the performance optimization by the performance tuning function has limitation. Logical disks cannot be moved in the cases described below. When you perform the tuning operation or configuration setting of the disk array, please note the following:

*Cases in which logical disks cannot be moved

- A Moved Material Logical Disk is located in the same RANK as a Work Disk for Optimization.
- A Moved Material Logical Disk and a Work Disk for Optimization are different in capacity.
- A Moved Material Logical Disk is a multiple RANK type.
Chapter 5  Installation of Performance Optimization Function

5.1  Server Installation

5.1.1  Operating Environment

The operating environment of the target HW, operation OS, memory, and disk Capacity is the same as that of iSM.

For the operating environment, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.

Required software and target storage are as follows:

<table>
<thead>
<tr>
<th>Table 5-1  Operating Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Required software</strong></td>
</tr>
<tr>
<td>NEC Storage Manager</td>
</tr>
<tr>
<td>NEC Storage PerformanceMonitor</td>
</tr>
<tr>
<td>NEC Storage ReallocationControl</td>
</tr>
<tr>
<td>NEC Storage AccessControl</td>
</tr>
<tr>
<td><strong>Target storage</strong></td>
</tr>
<tr>
<td>NEC Storage 4000 series</td>
</tr>
<tr>
<td>NEC Storage 3000 series</td>
</tr>
</tbody>
</table>

5.1.2  Installation

The NEC Storage PerformanceOptimizer is simultaneously installed when the iSM is installed. For installation and uninstall, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.

5.1.3  Environment Setting

You can specify the operating environment of NEC Storage PerformanceOptimizer by using the environment setting of iSM. The following is the items to be specified:

- Location of an optimization log file
  Specify the location of a file which accumulates Busy Ratio information for the disk (optimization log file).

- Interval for outputting optimization logs
  The NEC Storage PerformanceOptimizer outputs Busy Ratio information for the disk to the optimization log file at specified intervals. You can specify either from 1 minute to 60 minutes (The default setting is 5 minutes) as the interval. The interval must be specified in accordance with the statistic information output interval of the performance monitoring function.

- Interval for updating the progress of logical disk movement
  The NEC Storage PerformanceOptimizer checks the progress of logical disk movement at specified intervals and displays the state on the dedicated client screen. You can specify the interval time in the range from 5 seconds to 30 seconds (The default setting is 10 seconds).

For specification method, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.
Chapter 5  Installation of Performance Optimization Function

5.2  Client Installation

5.2.1  Operating Environment

The operating environment of the NEC Storage PerformanceOptimizer is the same as that of iSM. For the operating environment, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.

5.2.2  Installation

To install the NEC Storage PerformanceOptimizer, specify a setup type that includes the expanding function and install the iSM client. For the installation method, refer to Part I “Installation and Setting of NEC Storage Manager” of the “NEC Storage Manager User’s Manual” of your OS.
Chapter 5  Installation of Performance Optimization Function

5.3 Installation of Work Disks for Optimization

The NEC Storage PerformanceOptimizer moves logical disks on a high-load physical disk to a low-load physical disk to distribute the concentration of I/O thereby canceling the bottleneck. When a logical disk is moved, another logical disk which is hidden from all business systems and no access is ensured is required. This logical disk is called a Work Disk for Optimization.

5.3.1 Setting Work Disks for Optimization

You can set Work Disks for Optimization by using the LD Administrator function of the iSM (NEC Storage ReallocationControl). For the setting method, refer to the “NEC Storage Manager Configuration Setting Tool User’s Manual (GUI)” (IS007).

Due to NEC Storage PerformanceOptimizer’s limitation of logical disk movement and the nature of the Work Disk for Optimization, logical disks listed below cannot be specified as Work Disks for Optimization. Please note this point when you specify configuration of the disk array.

- A multiple RANK type logical disk
- A logical disk set in pairs of DDR/RDR (Note 1)

In addition, the maximum number of Work Disks for Optimization which can be set for each disk array is predetermined. The maximum number of Work Disks for Optimization depends on the specification of each disk array. Therefore, check the number when you configure the settings for the disk array. On the other hand, for moving cache-resident logical disk, a logical disk of one-logical disk/1-RANK configuration (RAID1 only) must be selected as a work disk for optimization.

(Note 1) For details of DDR/RDR, refer to the “NEC Storage Data Replication User’s Manual (Function Guide)” and “NEC Storage Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

5.3.2 Arrangement of Work Disks for Optimization

Generally, a bottleneck in performance occurs due to an increase of the amount of data, which results from an increase of the amount of work, or an access pattern change. Work Disks for Optimization are to be used when NEC Storage PerformanceOptimizer eliminates the cause of a bottleneck in performance. There is no need to arrange them when installing a disk array subsystem.

If the amount of work increases, usually distribute the load by adding physical disks. When tuning performance with NEC Storage PerformanceOptimizer, arrange Work Disks for Optimization on the added physical disks (RANK) and move logical disks from high-load physical disks.

Note the following when arranging Work Disks for Optimization:
Chapter 5  Installation of Performance Optimization Function

- Capacity of a Work Disk for Optimization
  The capacity of the Moved Material Logical Disk must be identical to that of the Work Disk for Optimization. Set the Work Disk for Optimization in accordance with the capacity of the Moved Material Logical Disk.

- RAID type of a Work Disk for Optimization
  A logical disk can be moved even if the RAID type is different between the logical disk and Work Disk for Optimization. However, be careful that if the RAID types are different, the effect of tuning cannot be predicted.

The method of arranging Work Disks for Optimization at installation of a disk array subsystem is one of operation modes. If Work Disks for Optimization are allocated beforehand, performance can be tuned without physical disks being added. However, since it is difficult to predict occurrence of a bottleneck in performance, arrangement of Work Disks for Optimization needs to be designed after due consideration.

Note the following when arranging Work Disks for Optimization at installation of a disk array subsystem:

- Load on physical disks (RANK) on which Work Disks for Optimization are arranged
  When physical disks with Work Disks for Optimization being arranged are subjected to a high load, they cannot be used as the move destinations of logical disks.

- Utilization ratio of a disk array subsystem
  Work Disks for Optimization cannot be used for business. Be careful for the utilization ratio of the disk array subsystem not to decrease because of the setting of Work Disks for Optimization.
Chapter 6 Operation of Performance Optimization Function (GUI)

This chapter will describe the composition of the NEC Storage PerformanceOptimizer dedicated client screen and its method of operation.

6.1 Description of Screen

Figure 6-1 shows the NEC Storage PerformanceOptimizer dedicated client screen. This section will describe the composition of the screen.

The screen is divided into eight areas from (1) to (8), as shown in Figure 6-1. Descriptions for each area are as follows:

(1) Menu Bar
Select necessary items from the menu to perform operations. For details, refer to Help.

Figure 6-1  NEC Storage PerformanceOptimizer Screen
(2) Tool Bar

Among menu functions, buttons for frequently used menu functions are provided to enable the one-click operation. For details about each button, refer to Help.

Menu functions provided as tool bar buttons

- Saving Settings
- Start LD Movement
- Stop LD Movement
- Change LD Movement Speed
- Change LD Movement Schedule
- Analysis Property
- Replacement Plan
- Replacement Effect Prediction
- Busy Ratio Graph

(3) Analysis Period Display Area

Displays the current analysis period (Busy Ratio calculation period).

(4) Configuration Display Area

Configuration of the disk array that uses the NEC Storage PerformanceOptimizer is separated into the “disk array layer” and the “RANK layer” and displayed in a tree view form. Figure 6-2 shows an example of the display.

![Figure 6-2  Example of Display of Disk Array Configuration](image)

At the start of the screen or when you select “Update to The Current Information” from the menu, only a disk array layer which is the initial state of the screen is displayed.

In Figure 6-2, the number (i) indicates a disk array layer and (ii) indicates a RANK layer. Table 6-1 provides descriptions of each layer.
Table 6-1  Disk Array Layer and RANK Layer

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Array layer</td>
<td>Displays icons and the disk array name which correspond to respective disk array models. An icon for the disk array which is not monitored by the iSM server is displayed in gray.</td>
</tr>
<tr>
<td>RANK layer</td>
<td>Displays the number and icon for the RANKs built in the disk array. Signal colors indicating the degree of the Busy Ratio are appended to the icon. The signal colors can be changed on the Analysis Property dialog ([Sort of Busy Ratio] tab). Refer to 6.2.2 “Setting Sort of Busy Ratio” for Analysis Property dialog ([Sort of Busy Ratio] tab).</td>
</tr>
<tr>
<td></td>
<td>• When the RANK is in the Ready mode</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (High) ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (Medium) ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (Low) ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (No information) ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>• When the RANK is not in the Ready mode</td>
</tr>
<tr>
<td></td>
<td>Attn. ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>Fault ........ [ ]</td>
</tr>
<tr>
<td></td>
<td>An icon for the disk array which is not monitored by the iSM server is displayed in gray.</td>
</tr>
</tbody>
</table>

(5) Detailed Display Area

Lists detailed information of the component located one layer below the layer selected in the configuration display area.

• When the iSM server is selected
  Detailed information of the disk array is displayed.

• When the disk array is selected
  Detailed information of the RANK is displayed.

• When the RANK is selected
  Detailed information of the logical disk is displayed.

The detail display items for the disk array, RANK, and logical disk will be described below.

(i) Detailed information of the disk array

Figure 6-3 shows an example of display of detailed information of the disk array. Table 6-2 provides descriptions of each display item.

![Table 6-2 Detailed Information of Disk Array](image)

Figure 6-3  Example of Display of Detailed Information of Disk Array
Table 6-2  Detailed Information Display Items for the Disk Array

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Array Subsystem</td>
<td>Displays the disk array name.</td>
</tr>
<tr>
<td>Monitoring State</td>
<td>Running ........Indicates that the iSM server is monitoring the state.</td>
</tr>
<tr>
<td></td>
<td>Stop ........Indicates that the iSM server is stopping monitoring the state.</td>
</tr>
<tr>
<td>Logging State</td>
<td>Accumulate ........Indicates that Busy Ratio information is being accumulated.</td>
</tr>
<tr>
<td></td>
<td>Stop ........Indicates that the accumulation of Busy Ratio information is stopping.</td>
</tr>
<tr>
<td>Logging Start Time</td>
<td>Indicates time when accumulation of Busy Ratio information started.</td>
</tr>
<tr>
<td>Logging End Time</td>
<td>Displays the time of latest accumulation of Busy Ratio information.</td>
</tr>
</tbody>
</table>

(ii) Detailed Information of the RANK

Figure 6-4 shows an example of display of detailed information of the RANK. Table 6-3 provides descriptions of each display item.

Table 6-3  Detailed Information Display Items for RANK

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Displays icons and numbers of RANKs. Display format of the icon is the same as that of the Configuration Display Area.</td>
</tr>
<tr>
<td>Busy Ratio [%]</td>
<td>Displays the Busy Ratio of RANKs. For the RANK that does not have valid Busy Ratio information, an asterisk (***)) is displayed. Note: When a logical disk in the RANK is moved, Busy Ratio information which has been accumulated is no longer related with Busy Ratio information which is to be accumulated after the movement. Therefore, immediately after a logical disk has been moved, there is no valid Busy Ratio information for the RANK. This state will be cancelled when Busy Ratio information is accumulated at the next interval.</td>
</tr>
<tr>
<td>Completion Time</td>
<td>Displays the time when the transfer of the last logical disk in the RANK has been completed. When logical disks are not moved, “Un-carrying” is displayed.</td>
</tr>
<tr>
<td>RAID</td>
<td>Displays the RAID type of the RANK.</td>
</tr>
<tr>
<td>Status</td>
<td>Ready ........Indicates that the RANK is in the normal state.</td>
</tr>
<tr>
<td></td>
<td>Attn ........Indicates that an event (reduce, formatting, etc.) is occurring in the RANK and attention is necessary.</td>
</tr>
<tr>
<td></td>
<td>Fault .......Indicates that a fault is occurring in the RANK. When “fault” is displayed, logical disks in the RANK cannot be moved.</td>
</tr>
</tbody>
</table>

(iii) Detailed Information of the logical disk

Figure 6-5 shows an example of display of detailed information of the logical disk. Table 6-4 provides descriptions of each display item.
Figure 6-5  Example of Display of Detailed Information of Logical Disk

Table 6-4  Detailed Information Display Items for the Logical Disk

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Displays icons and numbers of logical disks. Similar to RANKs’ icons, logical disks’ icons are also displayed in the three stages expressed in different colors depending on Busy Ratio.</td>
</tr>
<tr>
<td></td>
<td>• When the logical disk is in the Ready mode</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (High)</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (Medium)</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (Low)</td>
</tr>
<tr>
<td></td>
<td>Busy Ratio (No information)</td>
</tr>
<tr>
<td></td>
<td>• When the logical disk is not in the Ready mode</td>
</tr>
<tr>
<td></td>
<td>Attn</td>
</tr>
<tr>
<td></td>
<td>Fault</td>
</tr>
<tr>
<td>Type</td>
<td>Displays the type of volume of the logical disk. Displays the same information of the logical disk type that is displayed on the iSM state monitoring screen.</td>
</tr>
<tr>
<td>LD Name</td>
<td>Displays nicknames of logical disks.</td>
</tr>
<tr>
<td>Status</td>
<td>Displays information of the logical disk that is displayed on the iSM state monitoring screen.</td>
</tr>
<tr>
<td>RAID</td>
<td>Displays the RAID type of the logical disk.</td>
</tr>
<tr>
<td>Capacity [GB]</td>
<td>Displays the capacity of the logical disk in GB.</td>
</tr>
<tr>
<td>RANK</td>
<td>Displays the RANK number for which logical disks have been bound. For the multiple RANK types, all RANKs’ numbers are displayed in a row.</td>
</tr>
</tbody>
</table>

(6) Work Disk for Optimization Display Area

When you double-click a [Logical Disk] listed in the detailed display area, the list of Work Disks for Optimization which are the destination candidates are displayed in the Work Disk for Optimization Display Area. Only Work Disks for Optimization which satisfy the following requirements are listed:

• The capacity of the optimization logical disk is the same as that of the logical disk selected in the detailed display area.
The optimization logical disk is bound for a different RANK from the logical disk selected in the detailed display area. Figure 6-6 shows an example of display of detailed information of the Work Disk for Optimization. Table 6-5 provides descriptions of each display item.

### Table 6-5  Detailed Information Display Items for the Work Disk for Optimization

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Array Subsystem in “Moved Material Logical Disk”</td>
<td>Displays the disk array name for the transfer target moved material logical disk selected in the Detailed Display Area.</td>
</tr>
<tr>
<td>RANK in “Moved Material Logical Disk”</td>
<td>Displays the RANK number for the transfer target moved material logical disk selected in the Detailed Display Area.</td>
</tr>
<tr>
<td>LD No. in “Moved Material Logical Disk”</td>
<td>Displays the logical disk number for the transfer target moved material logical disk selected in the Detailed Display Area.</td>
</tr>
<tr>
<td>RANK %Busy in “Moved Material Logical Disk”</td>
<td>Displays the estimated Busy Ratio of the RANKs after target moved material logical disk selected in the Detailed Display Area have been moved.</td>
</tr>
<tr>
<td>Number</td>
<td>Displays icons and logical disk number of Work Disks for Optimization.</td>
</tr>
<tr>
<td>LD Name</td>
<td>Displays nicknames of Work Disks for Optimization.</td>
</tr>
<tr>
<td>Status</td>
<td>Displays the state of Work Disks for Optimization. Detailed Information is the same as that of the logical disks.</td>
</tr>
<tr>
<td>RANK</td>
<td>Displays the RANK numbers of Work Disks for Optimization.</td>
</tr>
<tr>
<td>RANK %Busy</td>
<td>When target moved material logical disk selected in the Detailed Display Area have been moved to the Work Disks for Optimization, the estimated Busy Ratio of the RANKs for the Work Disks for Optimization is displayed. Note: If the RAID type of the Work Disk for Optimization is different from that of the transfer target Material Logical Disk, the Busy Ratio after the disk is moved cannot be estimated; therefore, an asterisk (*** is displayed.</td>
</tr>
<tr>
<td>RAID</td>
<td>Displays the RAID type of Work Disks for Optimization.</td>
</tr>
</tbody>
</table>

(7) Movement Progress Information Display Area

A list of progress information about movement of logical disks is displayed. Figure 6-7 shows an example of display of disk transfer progress information. Table 6-6 provides descriptions of each display item.
### Table 6-6  Detailed Information Display Items for Movement Progress Information

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Array Subsystem</td>
<td>Displays the disk array name for a logical disk being moved.</td>
</tr>
<tr>
<td>Source RANK</td>
<td>Displays the RANK number for a logical disk being moved.</td>
</tr>
<tr>
<td>Source LD</td>
<td>Displays the logical disk number being moved.</td>
</tr>
<tr>
<td>Destination RANK</td>
<td>Displays the RANK number for the destination Work Disk for Optimization.</td>
</tr>
<tr>
<td>Destination LD</td>
<td>Displays the logical disk number for the destination Work Disk for Optimization number.</td>
</tr>
<tr>
<td>Progress Ratio [%]</td>
<td>Displays the movement progress rate in percentage.</td>
</tr>
<tr>
<td>State</td>
<td>Displays the movement state. Displayed contents are as follows:</td>
</tr>
<tr>
<td></td>
<td>Moving  ..... Indicates that a disk is being moved.</td>
</tr>
<tr>
<td></td>
<td>Complete ..... Indicates that the disk transfer has been finished normally.</td>
</tr>
<tr>
<td></td>
<td>Discontinue ..... Indicates that the disk transfer is being cancelled.</td>
</tr>
<tr>
<td></td>
<td>Discontinuation ..... Indicates that the disk transfer has cancelled due to a cancellation request.</td>
</tr>
<tr>
<td></td>
<td>Scheduled ..... Indicates that movement has been registered in schedule.</td>
</tr>
<tr>
<td></td>
<td>Changing schedule ..... Indicates that registered movement schedule is being changed.</td>
</tr>
<tr>
<td></td>
<td>Schedule canceled ..... Indicates that registered movement schedule has been canceled.</td>
</tr>
<tr>
<td></td>
<td>Schedule failed ..... Indicates that register movement schedule has failed.</td>
</tr>
<tr>
<td></td>
<td>Fault ..... Indicates that abnormal termination of the disk transfer has occurred due to a fault.</td>
</tr>
<tr>
<td>Speed of Movement</td>
<td>By moving a logical disk, all data contained in the source logical disk is copied to the destination Work Disk for Optimization. This area displays the speed of moving the data. Displayed contents are as follows:</td>
</tr>
<tr>
<td></td>
<td>auto ..... The movement speed is automatically adjusted according to the operating state of the disk array.</td>
</tr>
<tr>
<td></td>
<td>high ..... A disk is moved at maximum data transfer speed.</td>
</tr>
<tr>
<td>Start Time</td>
<td>Displays the disk transfer start time.</td>
</tr>
<tr>
<td>End Time</td>
<td>Displays the disk transfer end time. A blank is displayed if the state is “Moving” or “Scheduled”. If the state is “Schedule canceled”, time of canceling the schedule is displayed, and if the state is “Interrupted” or “Fault”, time of interrupting movement is displayed.</td>
</tr>
</tbody>
</table>
(8) Status Bar

Displays the operating state of the NEC Storage PerformanceOptimizer client. Table 6-7 provides descriptions of each display item.

<table>
<thead>
<tr>
<th>Display item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating state</td>
<td>Displays the current operating state. Displayed contents are as follows:</td>
</tr>
<tr>
<td>Information acquiring</td>
<td>Indicates that disk array configuration information or Busy Ratio information is being collected from the iSM server.</td>
</tr>
<tr>
<td>Working</td>
<td>Indicates that the NEC Storage PerformanceOptimizer client is operating.</td>
</tr>
<tr>
<td>Stop</td>
<td>Indicates that the NEC Storage PerformanceOptimizer client has stopped due to a disconnection with the iSM server or a cancellation instruction provided on the Information acquiring dialog screen. When the client is connected to the iSM server, the operation can be resumed by selecting “Update to The Current Information” from the menu.</td>
</tr>
<tr>
<td>Interval for updating logical disk transfer progress information</td>
<td>Numerical values displayed next to the operating state are the interval for updating logical disk transfer progress information. This interval is for updating logical disk transfer progress information shown on the screen. The value is the same as the interval for checking transfer progress of a logical disk specified in the environment setting of the iSM server. Numerical values in the range from 5 seconds to 30 seconds are displayed.</td>
</tr>
</tbody>
</table>
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6.2  Operation on Screen

6.2.1  Setting Analysis Period

The Busy Ratios of RANKs and logical disks are displayed on the screen. The displayed values are average values during the specified period. This period is called an analysis period.

The time zone in which the disk array is used depends on the business system. The following is the examples.

- The time zone in which the disk array is used is limited to a specific time zone for a day.
- The business peak comes on weekends which increase the load on the disk array.
- The business peak comes at the end of the month which makes the load on the disk array highest.

When the use of the disk array is limited to a specific time zone or period, or when the period during which it is expected that there will be a high load on the disk array, an analysis period must be adjusted according to such a time zone or period. This adjustment allows displaying appropriate Busy Ratios and appropriate analysis for the business system operations.

This section describes the dialog for specifying an analysis period and the specifying procedures.

(1) Displaying Analysis Property dialog ([Analysis Period] tab)

Select [Setting]→[Analysis Property] menu on the main screen of the performance optimization function. On the displayed Analysis Property dialog box, select [Analysis Period] tab that displays an area for specifying an analysis period. A period within the time including past 1 month can be specified for an analysis period. The following shows the default values for an analysis period.

Initial values for the analysis period

- Period to Calculate: Starting from one month before to the present
- Days of the Week to Calculate: All days of the week
- Time Zone to Calculate: 24 hours from 0:00

Figure 6-8 shows an example of displayed Analysis Property dialog ([Analysis Period] tab), and Table 6-8 provides descriptions of the areas in the dialog.
(2) Procedures for setting analysis period

This section describes the procedures for specifying an analysis period on the Analysis Property dialog ([Analysis Period] tab). The specified analysis period can be saved by selecting [File] → [Save Settings] menu on the main screen of the performance optimization function, for settings upon activating next time.

(i) Specification of the period

You can specify the period by selecting [Absolute Date] or [Period to Calculate]. The usage of [Absolute Date] and [Period to Calculate] is described below. Effectively select either one of them according to the purpose of analysis.

- Absolute date
- Period to calculate
Select this function to analyze a specific period in the past.

- **Period to calculate**
  
  Select this function to analyze data in a specified period periodically such as daily, weekly or monthly. For example, if you set the period from six days ago to the present, you can perform weekly analysis of the week without changing settings.

(ii) **Specification of the days of the week**

Specify the analysis target days of the week.

(iii) **Specification of the time zone**

Specify the analysis target time zone. A Time Zone spanning over two days (e.g. 8 hours starting from 20:00) can be specified.

(iv) **Determination of the analysis period**

When you specify a period, days of the week and time zone and then click the [OK] button on the Analysis Property dialog screen, the specified analysis period is registered. Clicking the [Cancel] button will cancel the specified analysis period and restore the original analysis period.

The analysis period is set under the power conditions of the period, the day(s) of the week, and the time zone that have been specified. The following is the examples of the analysis period setting.

**Example: Setting analysis period**

**Analysis Period to be specified**

From 10:00 to 17:00 on Thursdays, Fridays and Saturdays for the past 20 days

(Assume that the current date is January 31, 2002.)

**Specification on the Setup the Analysis Period dialog screen**

- **Period**
  
  **Absolute Date:** Specify the start day and end day as follows:
  
  Opening - 2002 Year 01 Month 11 Day
  
  End - 2002 Year 01 Month 31 Day
  
  **Period to Calculate:** Specify from 20 days before to the present.
  
  **Day of the Week to Calculate**
  
  Activate check boxes of Thursday, Friday and Saturday.
  
  **Time Zone to Calculate**
  
  Specify 7 hours from 10:00.

### 6.2.2 Setting Sort of Busy Ratio

The signal color corresponding to the Busy Ratio is appended to the icon of a RANK and logical disk. The color allows you to visually recognize the degree of the Busy Ratio so that the bottleneck can be detected easily.

Furthermore, by specifying classes of Busy Ratios, reference level values for executing replacement are specified. Replacement plan is applicable to the RANKs and logical disks that reached the caution zone or danger zone. For replacement plan, refer to 6.2.5 “Replacement Plan”.

Explanation will be given below about Analysis Property dialog ([Sort of Busy Ratio] tab) screen and setting
(1) Displaying Analysis Property dialog ("Sort of Busy Ratio" tab)

Select [Setting]→[Analysis Property] menu on the main screen of the performance optimization function. On the displayed Analysis Property dialog box, select [Sort of Busy Ratio] tab that displays an area for specifying [Sort of Busy Ratio]. Figure 6-9 shows an example display of Analysis Property dialog ("Sort of Busy Ratio" tab).

The Busy Ratio range with the yellow signal color has spin buttons. Use these spin buttons to set the three stages of the Busy Ratio.

As shown in Table 6-9, three signal colors are provided: red, yellow, and blue.

<table>
<thead>
<tr>
<th>Signal color</th>
<th>Meaning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Caution zone</td>
<td>The Busy Ratio has reached the Caution zone. Tuning is necessary. The RANKs reaching caution zone are applicable to “Replacement Plan”. The default value ranges from 81 to 100%.</td>
</tr>
<tr>
<td>Yellow</td>
<td>Danger zone</td>
<td>The Busy Ratio has not reached the caution zone yet, but attention is required. Carefully continue the monitoring. The RANKs reaching danger zone are applicable to “Replacement Plan”. The default value ranges from 51 to 80%.</td>
</tr>
<tr>
<td>Blue</td>
<td>Safety zone</td>
<td>The Busy Ratio is normal. No tuning is required. The default value ranges from 0 to 50%.</td>
</tr>
</tbody>
</table>
(2) Procedures for setting Sort of Busy Ratio

This section describes the procedures for specifying the Sort of Busy Ratio on the Analysis property dialog ([Sort of Busy Ratio] tab). The Sort of Busy Ratio can be saved by selecting [File] → [Save Settings] menu on the main screen of the performance optimization function, for settings upon activating next time.

(i) Specification of the Busy Ratio range

Use spin buttons provided for the Busy Ratio range with the yellow signal to specify the three stages of the Busy Ratio range. Specifying the upper limit value of the yellow zone automatically results in specifying the “limit value + 1” as the lower limit of red (danger zone). On the other hand, specifying the lower limit value of the yellow zone (caution zone) automatically results in specifying the “limit value - 1” as the upper limit of blue (safety zone).

(ii) Setting Busy Ratio zones

Clicking [OK] button on the Setup the Busy Ratio dialog screen will activate the specified Busy Ratio zones. Clicking [Cancel] button will cancel the Busy Ratio zones and restore the original Busy Ratio zones.

6.2.3 Setting Folder to Store Data

For executing “Busy Ratio Graph” and “Replacement Effect Prediction” functions, the optimization log files recording the Busy Ratio information must be downloaded from the iSM server to iSM client, and must be stored in a Folder to store data. The folder to store data for storing downloaded optimization log files can be created in an arbitrary folder. This section describes the dialog for setting the folder to store data and the setting procedures.

(1) Displaying Analysis Property dialog ([Folder to Store Data] tab)

Select [Setting] → [Analysis Property] menu on the main screen of the performance optimization function. On the displayed Analysis Property dialog box, select [Folder to Store Data] tab that displays an area for specifying a folder to store data.

Or when “Busy Ratio Graph” and “Replacement Effect Prediction” functions are displayed and a download overwriting confirmation dialog is displayed, clicking [Change Folder] button displays this dialog.

Figure 6-10 shows an example of displayed Analysis Property dialog ([Folder to Store Data] tab), and Table 6-10 provides descriptions of the areas in the dialog.
Figure 6-10 Analysis Property Dialog ([Folder to Store Data] tab)

Table 6-10 Description of Analysis Property dialog (“Folder to store data” tab)

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folder to Store Data</td>
<td>Specifies a folder to be a folder to store data.</td>
</tr>
</tbody>
</table>

(2) Setting Folder to Store Data

Enter an arbitrary folder as a folder to store data, or click the [Browse] button and select a directory on the
Browse for Folder dialog. After specifying a folder to store data, click [OK] button.
A folder to store data is specified at the installation folder\TMP\ by default.

After specifying a folder to store data, executing downloading operation downloads the performance optimization log file in the specified directory. When “Busy Ratio Graph” or “Replacement Effect Prediction” function is activated, the information is displayed on the basis of the performance optimization log file stored in this folder.

6.2.4 Showing the Busy Ratio Graph

The Busy Ratio of logical disks and RANKs can be displayed using time-series graphs, as well as by the numeric values displayed on the Detailed Display Area.
This section describes the dialog for showing the Busy Ratio Graph and the displaying procedures.

(1) Showing the Busy Ratio Graph

For selecting the applicable items for displaying Busy Ratio in graph, display the [Busy Ratio Graph] dialog.
Three procedures are provided for displaying [Busy Ratio Graph] dialog. Open the [Busy Ratio Graph] dialog
by one of the following three procedures:

- **Popup menu**
  
  Select disk array or RANK on the Configuration Display Area or Detailed Display Area, and display a popup menu by right-clicking. Select [Busy Ratio Graph] on the popup menu.

- **Menu**
  
  Select disk array or RANK on the Configuration Display Area or Detailed Display Area, and select [Operation] → [Busy Ratio Graph].

- **Tool button**
  
  Select disk array or RANK on the Configuration Display Area or Detailed Display Area, and select [Busy Ratio Graph] on the toolbar.

Figure 6-11 shows an example of displayed the [Busy Ratio Graph] dialog, and Table 6-11 provides descriptions of the areas in the dialog.
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Figure 6-11  [Busy Ratio Graph] Dialog

Table 6-11  Descriptions of The Busy Ratio Graph Dialog

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANK selection area (when disk array is selected on Configuration display area or Detailed Display Area)</td>
<td>Displays a list of RANKs included in selected disk array. For display items, refer to Table 6-3 “Detailed Information Display Items for RANK”.</td>
</tr>
<tr>
<td>LD selection area (when RANK is selected on Configuration Display Area or Detailed Display Area)</td>
<td>Displays a list of LDs included in selected RANK. For display items, refer to Table 6-4 “Detailed Information Display Items for the Logical Disk”.</td>
</tr>
<tr>
<td>Target period area</td>
<td>Specifies start date and end date of a period for displaying the Busy Ratio Graph.</td>
</tr>
</tbody>
</table>

(2) Specifying display items on Busy Ratio Graph

On the [Busy Ratio Graph] dialog, select RANKs or logical disks to be displayed on a Busy Ratio Graph, specify start date or end date, and then click the [Show Graph] button. Up to 8 RANKs or 8 logical disks are selectable for displaying at the same time.

(3) Downloading optimization log files that records Busy Ratio

Clicking [Show Graph] button on the [Busy Ratio Graph] dialog displays [Download Selection] dialog. Figure 6-12 shows an example of Download Selection dialog. Table 6-12 describes the areas on the [Download Selection] dialog.
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Table 6-12  [Download Selection] dialog

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show graph after downloading insufficient data</td>
<td>Downloads optimization log file recording Busy Ratios onto the iSM client.</td>
</tr>
<tr>
<td>Show graph using data already downloaded</td>
<td>Displays Busy Ratio Graph without downloading optimization log file.</td>
</tr>
</tbody>
</table>

Selecting [Show graph after downloading insufficient data] and clicking [OK] button downloads the performance optimization log files accumulated on the iSM server onto the iSM client, and the optimization log files stored in a folder to store data is updated into a latest file.  For the folder to store data, refer to 6.2.3 “Setting Folder to Store Data”.  Selecting [Show graph using data already downloaded] and clicking [OK] button displays Busy Ratio Graphs without downloading performance optimization log files form the iSM server.  In this case, Busy Ratio Graphs are displayed for a log accumulation period of the optimization log files that have already been downloaded. If the optimization log files of the specified period have already been downloaded for showing the Busy Ratio Graph, the Confirmation of Overwriting dialog is displayed.  Figure 6-13 shows the Confirmation of Overwriting dialog.

Clicking [OK] on the Confirmation of Overwriting dialog overwrites the existing data.  Clicking [Change Folder] button allows changing the folders to store data to be downloading destination.  For changing the folders to store data, refer to 6.2.3 “Setting Folder to Store Data”.

When downloading is executed, the performance optimization log files stored in the folder to store data of the
iSM client are updated and the data older than one month old is deleted. Upon attempting execution of download process, if a performance optimization log file storing Busy Ratios does not exist on the iSM server, the process results in an error without executing downloading. Meanwhile, upon attempting execution of Busy Ratio Graph without downloading performance optimization log file, the process results in an error without showing the Busy Ratio Graph if no data exists in the folder to store data of the iSM client. Clicking [Cancel] on the Downloading dialog during execution of download process or closing the main screen of performance optimization function interrupt the download process. If a process is interrupted, the performance optimization log files must be downloaded again.

(4) Showing the Busy Ratio Graph

Clicking [OK] button on the Download Selection dialog displays the [Busy Ratio Graph] screen. The [Busy Ratio Graph] screen displays the graphs indicating fluctuations of Busy Ratio for specified logical disks or RANKs.

Figure 6-14 shows an example of the [Busy Ratio Graph] screen displayed when RANKs are selected. Table 6-13 describes the areas on the [Busy Ratio Graph] screen.

Figure 6-14  [Busy Ratio Graph] Screen

<table>
<thead>
<tr>
<th>Number</th>
<th>Average Busy Ratio [$%$]</th>
<th>Maximum Busy Ratio [$%$]</th>
<th>Maximum Busy Ratio...</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h-02h</td>
<td>11</td>
<td>80</td>
<td>2002/11/27 18:44</td>
</tr>
<tr>
<td>02h-04h</td>
<td>41</td>
<td>70</td>
<td>2002/11/27 10:44</td>
</tr>
<tr>
<td>04h-06h</td>
<td>40</td>
<td>71</td>
<td>2002/11/27 10:44</td>
</tr>
</tbody>
</table>
Table 6-13 Description of The Busy Ratio Graph screen

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph scale setting area</td>
<td>Selects a time range of Busy Ratio Graphed on screen. A range is specified by hours (3/6/12/24), days (1 to 31), or weeks (1 to 4). Setting is allowed within a period specified by the target period area on the Busy Ratio Graph dialog. Upon activation of the Busy Ratio Graph screen, all ranges specified for the target period are displayed on one screen.</td>
</tr>
<tr>
<td>Graph display area</td>
<td>Fluctuations of Busy Ratios of RANKs or logical disks are displayed in graphs. A maximum of 8 graph lines are displayed.</td>
</tr>
<tr>
<td></td>
<td>• Vertical axis</td>
</tr>
<tr>
<td></td>
<td>Indicates Busy Ratio</td>
</tr>
<tr>
<td></td>
<td>• Horizontal axis</td>
</tr>
<tr>
<td></td>
<td>Indicates target period. (period indicated by markings is variable by value of Graph scale setting area)</td>
</tr>
<tr>
<td></td>
<td>• Horizontal axis label</td>
</tr>
<tr>
<td></td>
<td>Indicates graph display time. Display intervals by a label are as follows: 1-hour period: 20-minute interval 2-hour period: 30-minute interval 3-hour period or longer: Interval variable by value specified in Graph scale setting area</td>
</tr>
<tr>
<td>Legend display area</td>
<td>Displays the items listed below:</td>
</tr>
<tr>
<td></td>
<td>• Number</td>
</tr>
<tr>
<td></td>
<td>Indicates icons and numbers of RANKs or logical disks</td>
</tr>
<tr>
<td></td>
<td>• LD Name</td>
</tr>
<tr>
<td></td>
<td>Indicates logical disk name. Displayed only when Busy Ratio of logical disks are shown.</td>
</tr>
<tr>
<td></td>
<td>• Average Busy Ratio [%]</td>
</tr>
<tr>
<td></td>
<td>Indicates an average Busy Ratio within the target period.</td>
</tr>
<tr>
<td></td>
<td>• Maximum Busy Ratio [%]</td>
</tr>
<tr>
<td></td>
<td>Indicates a maximum Busy Ratio within the target period.</td>
</tr>
<tr>
<td></td>
<td>• Maximum Busy Ratio Detection time</td>
</tr>
<tr>
<td></td>
<td>Indicates time when a maximum Busy Ratio was detected.</td>
</tr>
</tbody>
</table>

Upon activation of the Busy Ratio Graph screen, the Busy Ratio Graphs all ranges specified for target periods on one screen. For changing graph scale, specify a range to be displayed on one screen (hours(3/6/12/24), days (1 to 31), or weeks (1 to 4)) and then click the [Apply] button.

If system configuration is changed within a target period (including movement of logical disks), the graph lines become discontinuous. The average/maximum Busy Ratios after a configuration change are calculated on the basis of the system configuration after the changes. If configuration change is performed for two or more times, the average/maximum Busy Ratios are displayed on the basis of configuration after the latest change. However, the change occurs at the end of or after the target period, "***" is displayed for average/maximum Busy Ratios.
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6.2.5 Replacement Plan

This function detects High Load RANK and makes the most effective replacement plan. A list of replacement plans expecting higher effects of I/O distribution after moving is made for replacing source/destination logical disks. The replacement plan is applicable to the RANKs reaching danger zone and critical zone specified on the Analysis Property dialog (“Sort of Busy Ratio” tab). For description of [Sort of Busy Ratio] tab, refer to 6.2.2 “Sort of Busy Ratio”.

This section describes Replacement Plan dialog that makes replacement plan, and operating procedures.

(1) Displaying Replacement Plan dialog

Three procedures are provided for displaying the [Replacement Plan] dialog. Open a [Replacement Plan] dialog by one of the following three procedures:

- **Popup menu**
  Select Disk Array on the Configuration Display Area or Detailed Display Area, and display a popup menu by right-clicking. Select [Replacement Plan] on the popup menu.

- **Menu**
  Select Disk Array on the Configuration Display Area or Detailed Display Area, and select [Operation] → [Replacement Plan].

- **Tool button**
  Select Disk Array on the Configuration Display Area or Detailed Display Area, and select [Replacement Plan] on the toolbar.

On the Replacement Plan dialog, a list of replacement plans for source/destination logical disks, which can expect higher effects of I/O distribution after moving. Figure 6-15 shows an example of displayed Replacement Plan dialog, and Table 6-14 provides descriptions of the areas in the dialog.
Table 6-14 Description of [Replacement Plan] Dialog

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Array Subsystem</td>
<td>Nicknames of selected disk arrays are displayed.</td>
</tr>
<tr>
<td>High Load RANK</td>
<td>RANK numbers of the bottleneck RANKs area displayed. The applicable RANKs to be displayed in the replacement plan display area can be changed by selecting RANKs on a pull-down menu. RANK numbers are listed in order of heavy-load.</td>
</tr>
<tr>
<td>Replacement plan display area</td>
<td>The candidate movement destination logical disks are listed in the order of effectiveness in I/O distribution. The following are items to be displayed.</td>
</tr>
</tbody>
</table>
|                           |   - Recommendation Rating  
|                           |     Ranking of effectiveness in I/O distribution after logical disk movement is displayed.                                                      |
|                           |   - Source LD No.  
|                           |     Icon and number of source LD are displayed. Icons displayed are the same as those in Configuration Display Area.                           |
|                           |   - Source LD Name  
|                           |     Source logical disk names are displayed.                                                                                                  |
|                           |   - Destination RANK  
|                           |     Icons and numbers of destination RANKs are displayed. RANK icons displayed are the same as those in Configuration Display Area and Detailed Display Area. |
|                           |   - Destination LD No.  
|                           |     Icons and numbers of destination logical disks are displayed. Icons displayed are the same as those in Work Disk for Optimization Display Area. |
|                           |   - Destination LD Name  
|                           |     Destination logical disk names are displayed.                                                                                              |
|                           |   - Source RANK %Busy  
|                           |     Expected change of Busy Ratio is displayed.                                                                                               |
|                           |   - Destination RANK %Busy  
|                           |     Expected change of Busy Ratio is displayed.                                                                                               |

On the Replacement Plan dialog, selecting a line of a replacement plan on the Replacement plan display area and clicking [Start LD Movement] button or selecting [Start LD Movement] on right-click popup menu starts movement of the logical disks. For starting moving of logical disks, refer to 6.2.7 “Start LD Movement”.

On the Replacement Plan dialog, selecting a line of a replacement plan on the Replacement plan display area and clicking [Replacement Effect Prediction] button or selecting [Replacement Effect Prediction] on right-click popup menu can estimate the effectiveness of replacement after logical disk movement. For the replacement effectiveness of replacement after logical disk movement, refer to 6.2.6 “Replacement Effect Prediction”.

Replacement plan is unavailable in the following cases:

- Busy Ratio information is not stored in performance optimization log file.
- Busy Ratio information of an analysis period does not exist in performance optimization log file.

A suggested replacement plan is invalid in the following cases:

- A source logical disk on heavy-load RANK has been moved.
- Movement schedule has been registered for a source logical disk on heavy-load RANK.
6.2.6 Replacement Effect Prediction

The performance optimization function is capable of estimating an effect of load distribution after logical disk movement. By executing this function, the changes of Busy Ratios in source and destination logical disk or RANKs are displayed in graphs.

This section describes the dialog for displaying an effect of replacement and the displaying procedures.

(1) Display Replacement Effect Prediction dialog

For selecting the items for displaying graphs of replacement effect, the [Graph Indicating Replacement Effect Prediction] dialog must be displayed. Four procedures are provided for displaying the Displaying Replacement Effect Prediction graph dialog. Display the Replacement Effect Prediction dialog with one of the following procedures:

- **Popup menu**
  - Select a work disk on Work Disk for Optimization Display Area, and display a popup menu by right-clicking.
  - Select [Replacement Effect Prediction] on the popup menu.

- **Menu**
  - Select a work disk on Work Disk for Optimization Display Area, and select [Operation] → [Replacement Effect Prediction].

- **Tool button**
  - Select a work disk on Work Disk for Optimization Display Area, and select [Replacement Effect Prediction] on the toolbar.

- **Replacement Plan dialog**
  - Click the [Replacement Effect Prediction] button on the Replacement plan dialog. Refer to 6.2.5 “Replacement Plan” for details of the Replacement Plan dialog.

Figure 6-16 shows an example of displayed the [Graph Indicating Replacement Effect Prediction] dialog, and Table 6-15 provides descriptions of the areas in the dialog.

![Graph Indicating Replacement Effect Prediction Dialog](image)

Figure 6-16 The Graph Indicating Replacement Effect Prediction Dialog
Table 6-15  The [Graph Indicating Replacement Effect Prediction] dialog

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target period area</td>
<td>Specifies start date and end date of a period for displaying Replacement</td>
</tr>
<tr>
<td></td>
<td>Effect Prediction graph.</td>
</tr>
</tbody>
</table>

(2) Specify period for Replacement Effect Prediction

On the [Graph Indicating Replacement Effect Prediction] dialog, specify a period for Replacement Effect Prediction of logical disks. Specifying a period when a bottleneck occurred makes it easier to know the effect of replacing applicable logical disks. Specify a start date and end date, and then click the [Show Graph] button.

(3) Download performance optimization log file containing Busy Ratios

Clicking [Show Graph] button on the [Graph Indicating Replacement Effect Prediction] dialog displays the Download Selection dialog.

Figure 6-17 shows an example of Download Selection dialog. Table 6-16 describes the areas on the Download Selection dialog.

![Download Selection Dialog](image)

Selecting [Show graph after downloading insufficient data] and clicking [OK] button downloads the performance optimization log files accumulated on the iSM server onto the iSM client, and the optimization log files stored in a folder to store data is updated into a latest file. For the folder to store data, refer to 6.2.3 “Setting Folder to Store Data”.

Selecting [Show graph using data already downloaded] and clicking [OK] button results in estimating replacement effect without downloading performance optimization log files form the iSM server. In this case, replacement effect is estimated for a log accumulation period of the optimization log files that have already been downloaded.

If the optimization log files of the specified period have already been downloaded for estimating replacement effect, the Confirmation of Overwriting dialog is displayed. Figure 6-18 shows the Confirmation of Overwriting dialog.
Figure 6-18  Confirmation of Overwriting Dialog

Clicking [OK] on the Confirmation of Overwriting dialog overwrites the existing data. Click the [Change Folder] button allows changing the folders to store data to be downloading destination. For changing the folder to store data, refer to 6.2.3 “Setting Folder to Store Data”.

When downloading is executed, the performance optimization log files stored in the folder to store data of the iSM client are updated and the data older than one month old is deleted.

Upon attempting execution of download process, if a performance optimization log file storing Busy Ratios does not exist on the iSM server, the process results in an error without executing downloading. Meanwhile, upon attempting execution of Replacement Effect Prediction without downloading performance optimization log file, the process results in an error without Replacement Effect Prediction if no data exists in the folder to store data of the iSM client.

Clicking [Cancel] on the Downloading dialog during execution of download process or closing the main screen of performance optimization function interrupt the download process. If a process is interrupted, the performance optimization log files must be downloaded again.

(4) Display Replacement Effect Prediction

Clicking [OK] button on the Download Selection dialog displays the Replacement Effect Prediction screen. The Replacement Effect Prediction screen displays the graphs indicating changes of Busy Ratios for specified source and destination RANKs.

Figure 6-19 shows an example of the Replacement Effect Prediction screen. Table 6-17 describes the areas on Replacement Effect Prediction screen.
Figure 6-19  Replacement Effect Prediction Screen

Table 6-17  Description of Replacement Effect Prediction screen (1/2)

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph scale setting area</td>
<td>Selects a time range of Replacement Effect Prediction graph displayed on one screen. A range is specified by hours (3/6/12/24), days (1 to 31), or weeks (1 to 4). Setting is allowed within a period specified by the target period area on the [Graph Indicating Replacement Effect Prediction] dialog. Upon activation of the Prediction of Replacement screen, all ranges specified for the target period are displayed on one screen.</td>
</tr>
</tbody>
</table>
| Graph display area          | Changes of Busy Ratios of source and destination RANKs before and after moving are displayed in graphs.  
• Vertical axis  
  Indicates Busy Ratio  
• Horizontal axis  
  Indicates target period. (period indicated by markings is variable by value of Graph scale setting area)  
• Horizontal axis label  
  Indicates graph display time. Display intervals by a label are as follows:  
  1-hour period : 20-minute interval  
  2-hour period : 30-minute interval  
  3-hour period or longer: Interval variable by value specified in Graph scale setting area |
Table 6-17  Description of Replacement Effect Prediction screen (2/2)

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legend display area</td>
<td>Displays the items listed below:</td>
</tr>
<tr>
<td></td>
<td>• Number</td>
</tr>
<tr>
<td></td>
<td>Indicates icon and number of RANK.</td>
</tr>
<tr>
<td></td>
<td>• Average Busy Ratio [%]</td>
</tr>
<tr>
<td></td>
<td>Indicates an average Busy Ratio within the target period.</td>
</tr>
<tr>
<td></td>
<td>• Maximum Busy Ratio [%]</td>
</tr>
<tr>
<td></td>
<td>Indicates a maximum Busy Ratio within the target period.</td>
</tr>
</tbody>
</table>

Upon activation of Replacement Effect Prediction screen, the graph displays all ranges specified for target periods on one screen. For changing graph scale, specify a range to be displayed on one screen (hours (3/6/12/24), days (1 to 31), or weeks (1 to 4)) and then click the [Apply] button.

If system configuration is changed within a target period (including movement of logical disks), the graph lines become discontinuous. The average/maximum Busy Ratios after a configuration change are calculated on the basis of the system configuration after the changes. If configuration change is performed for two or more times, the average/maximum Busy Ratios are displayed on the basis of configuration after the latest change. However, the change occurs at the end of or after the target period, “***” is displayed for average/maximum Busy Ratios.

### 6.2.7 Start LD Movement

If a RANK with Busy Ratio reaching a caution zone or an danger zone is detected, the logical disks on the RANK must be moved to balance the I/O density. The tuning can be executed instantly or at a specified time and date by registering a schedule.

Explanation will be made below about the procedures for logical disk movement.

(1) **From deciding logical disks to be moved to starting disk moving/registering disk LD movement schedule**

(i) Selecting a RANK

Select a RANK to be tuned in the Configuration Display Area or in the detailed information display area.

You can specify a RANK in which the Busy Ratio has not reached the critical zone or attention zone yet as a tuning target. It is possible to perform tuning for precautions or perform a tuning operation when short-term I/O concentration has been detected by NEC Storage Performance Monitor.

Figure 6-20 shows an example of selecting a RANK to be tuned in the detailed information display area.
Double-clicking the target RANK will display logical disks bound for the RANK in the Detailed Display Area.

(ii) Selecting Moved Material Logical Disks/Selecting Work Disk for Optimization

Among logical disks bound for the RANK to be tuned, select a Moved Material Logical Disk. It is not always right to move a logical disk which has the highest Busy Ratio. Points to consider when logical disk movement are as follows:

Points to consider the moved material logical disks

- After logical disks have been moved, the Busy Ratio of the destination RANK (the RANK for which Work Disks for Optimization are bound) should become nearly equal to that of the source RANK.
- When there are multiple destination candidates (Work Disks for Optimization), select one that satisfies the above item (i) and has the lowest Busy Ratio.

Example 1) Example of correct transfer

<table>
<thead>
<tr>
<th>Busy Ratio of the source RANK</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy Ratio of the moved material logical disk:</td>
<td>30%</td>
</tr>
<tr>
<td>Busy Ratio of the destination RANK</td>
<td>25%</td>
</tr>
</tbody>
</table>

Busy Ratio after the moved material logical disk:

<table>
<thead>
<tr>
<th>Busy Ratio of the source RANK</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy Ratio of the destination RANK</td>
<td>55%</td>
</tr>
</tbody>
</table>

Example 2) Example of incorrect transfer

<table>
<thead>
<tr>
<th>Busy Ratio of the source RANK</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy Ratio of the moved material logical disk:</td>
<td>45%</td>
</tr>
<tr>
<td>Busy Ratio of the destination RANK</td>
<td>25%</td>
</tr>
</tbody>
</table>

Busy Ratio after the moved material logical disk:

<table>
<thead>
<tr>
<th>Busy Ratio of the source RANK</th>
<th>45%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy Ratio of the destination RANK</td>
<td>70%</td>
</tr>
</tbody>
</table>

The destination RANK may have a bottleneck ×

When you double-click a logical disk in the detailed information display area, destination candidates are displayed in the Work Disk for Optimization Display Area. Then, based on the above-mentioned points, select a Moved Material Logical Disk and a destination Work Disk for Optimization. The logical disks displayed in gray cannot be selected. Gray display indicates that movement of logical disks is being executed, or that movement schedule has been registered.

Also, a reassignment plan prepared by the performance optimization function can be selected for moved material logical disk and work disk for optimization. For details, refer to 6.2.5 “Replacement Plan”.
(iii) Start LD Movement/Register LD Movement Schedule

After deciding logical disk movement and work disk for optimization, start moving or register a movement schedule. Start of moving or registration of moving is specified on the Start LD Movement dialog. Four procedures are provided for displaying the Start LD Movement dialog. Display the Start LD Movement dialog with one of the following procedures:

- **Popup menu**
  Select a work disk for optimization of the movement target, on the Work Disk for Optimization Display Area, and display a popup menu by right-clicking. Select [Start LD Movement] on the popup menu.

- **Menu**
  Select a work disk for optimization of the movement target, on the work disk for optimization display area, and select [Operation] \(\rightarrow\) [Start LD Movement].

- **Tool Bar button**
  Select a destination Work Disk for Optimization from the Work Disk for Optimization Display Area and then click the [Start LD Movement] button on the tool bar.

- **Replacement Plan dialog**
  Click the [Start LD Movement] button on the Replacement Plan dialog. Refer to 6.2.5 “Replacement Plan” for details of Replacement Plan dialog.

Figure 6-22 shows an example of displayed Start LD Movement dialog, and Table 6-18 provides descriptions of the areas in the dialog.
Figure 6-22 Start LD Movement Dialog

Table 6-18 Description of Start LD Movement Dialog

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement Speed area</td>
<td>Select Moving speed between “auto” and “high”. The following describes the two speeds.</td>
</tr>
<tr>
<td>auto</td>
<td>The disk array automatically adjusts movement speeds in accordance with the load state, minimizing the influence of moving operation to the business system. A recommended moving speed is used, and this is selected by default.</td>
</tr>
<tr>
<td>high</td>
<td>Data is copied in a maximum data transfer rate. Although this setting completes moving process in a shorter time than “auto”, it causes greater influences to the business system. This setting is specified in a specific case, such as a case where the system tuning takes precedence over business operations.</td>
</tr>
<tr>
<td>Start Schedule area</td>
<td>This area specifies whether to Start LD Movement immediately or at a specified time.</td>
</tr>
<tr>
<td>Start Immediately</td>
<td>Starts logical disk movement operation immediately.</td>
</tr>
<tr>
<td>Start at Specified time</td>
<td>Starts logical disk movement operation at a specified time. Specifies time of starting moving and time of continuing re-execution (time of continuing retries if starting process fails). Starting time can be specified as late as 1 month later. Specifying up to 24 hours is allowed for continuing retries.</td>
</tr>
</tbody>
</table>

When starting logical disk movement, specify a movement speed on the Start LD Movement dialog, select [Start Immediately] on the start schedule setting area, and click the [OK] button. A confirmation dialog appears. Clicking [Yes] button starts moving the logical disks.
When registering a LD movement schedule of the logical disks, specify a movement speed and select [Start at Specified Time] and specify moving start time and time of continuing re-execution. Click the [OK] button. A confirmation dialog appears. Clicking [Yes] button registers the LD movement schedule.

Note that logical disks cannot be moved in the following cases:

- When the user’s level is L1.
- When the number of transfers has exceeded the maximum number of transfers simultaneously available in a disk array.
- A specified source or destination logical disk is already in moving process.
- Movement schedule has already been registered to a specified source or destination.
- When a disk array is not monitored by the iSM.
- When a disk array, RANK, and logical disk are in the fault state.

LD movement schedule cannot be registered in the following cases:

- User level is L1.
- Movement start time has already past the time on the server.
- Specified source or target logical disks are already in moving process.
- Movement schedule has been registered for a specified source or target logical disk.
- Disk array is not monitored by iSM.
- Disk array, RANK, or logical disk is faulty.

(2) Viewing movement progress operation/register movement schedule

Movement progress operation and register movement schedule can be viewed on the state field of Movement Progress Information Display Area on the main screen of performance optimization function. Figure 6-23 displays an example display of the moving progress information display area.

```
<table>
<thead>
<tr>
<th>Disk Array Subsystem</th>
<th>Source RANK</th>
<th>Source LD</th>
<th>Destination</th>
<th>Destination</th>
<th>Progress %</th>
<th>Status</th>
<th>Speed</th>
<th>St</th>
</tr>
</thead>
<tbody>
<tr>
<td>NECSorage:31:00</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>Scheduled</td>
<td>auto</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>NECSorage:31:00</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>00h-00h</td>
<td>45 Moving</td>
<td>High</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
```

Figure 6-23  Example of Movement Progress Information Display

The display items can be selected among the choices displayed when selecting [View] → [Movement Progress Display] menu on the main screen of performance optimization function. The following lists the selectable items:

- All of Movement Information
  Displays logical disks in current moving process and scheduled moving process.
- Movement Under Processing
  Displays only logical disks that are currently being moved.
• Scheduled Movement

Displays only logical disks that are scheduled to be moved.

The Movement Progress Information is updated according to the interval time specified in the environment definition of the iSM. For the check interval, refer to Chapter 5 “Installation of Performance Optimization Function”.

After completion of logical disk movement, the relation between the logical disk and the RANK changes. This configuration change is detected by the iSM simultaneously with the completion of the transfer and is reflected on the state monitoring screen of the iSM as well as on the NEC Storage PerformanceOptimizer screen.

(3) Exceptional Operations

After the transfer of a logical disk has started or the movement schedule has registered, there is a possibility of canceling the movement, changing the speed and changing (canceling) the movement schedule for some reason.

Canceling the movement

• A wrong logical disk has been moved.

Changing the speed

• The transfer speed will be changed to “high” because the disk has to be moved as soon as possible.
• The speed setting will be changed to “auto” because the business system is greatly affected by the maximum speed.

Changing (canceling) movement schedule

• Due to circumstances that does not allow executing a move at a scheduled time, movement start time must be changed or registered movement schedule must be canceled.

As described above, interrupting disk movement, changing movement speed, and changing (canceling) movement schedule are unusual operations. For such exceptional operations, the screen allows interrupting disk movement, changing movement speed, and changing (canceling) movement schedule. However, pay extra attention in operations of interrupting disk movement, changing movement speed, and changing (canceling) movement schedule. These operations are allowed for users of L2 level or higher only.

The following describes the procedures for stopping movement, changing movement speed, and changing (canceling) movement schedule.

Canceling LD movement

(i) Select a logical disk to stop the movement

Click the logical disk you want to stop its transfer from the Movement Progress Information Display Area.

(ii) Displaying the Stop LD Movement dialog

Three types of procedures are available for displaying the Stop LD Movement dialog. Use any one of them to display the Stop LD Movement dialog screen.

• Popup menu

Perform right-clicking to display the popup menu, and then click [Stop LD Movement] from the popup menu.

• Menu

Click [Operation] and then click [Stop LD Movement] from the menu.
• Tool Bar button
Click the [Stop LD Movement] button on the tool bar.

Figure 6-24 shows an example of Stop LD Movement dialog. When you want to cancel transfer, click the [OK] button on the Stop LD Movement dialog screen.

![Stop LD Movement Dialog](image)

(iii) Cancellation
When you click the [OK] button on the Stop LD Movement dialog screen, the confirmation dialog screen appears. When you click [Yes] on this screen, the transfer is cancelled. If you click [No], the transfer is not cancelled.

Changing speed
(i) Select the logical disk of which transfer speed you want to change.
Click the logical disk of which transfer speed you want to change in the Movement Progress Information Display Area.
(ii) Displaying the Change LD Movement Speed dialog
Three types of procedures are available for displaying the Change LD Movement Speed dialog screen. Use any one of them to display the Change LD Movement Speed dialog screen.
• Popup menu
Perform right-clicking to display the popup menu, and then click [Change LD Movement Speed] from the popup menu.
• Menu
Click [Operation] and then click [Change LD Movement Speed] from the menu.
• Tool Bar button
Click the [Change LD Movement Speed] button on the tool bar.

Figure 6-25 shows an example of Change LD Movement Speed dialog.
(iii) Specifying movement speed after change
Select auto or high in the movement speed change area.

(iv) Executing change of moving speed
Clicking [OK] button on the Change LD Movement Speed dialog displays a confirmation dialog.
Clicking [Yes] on the confirmation dialog changes the moving speeds. Clicking [No] button cancels the change of moving speed.

Change (cancel) of logical disk movement schedule

(i) Select logical disks of movement schedule to be changed or canceled
On the Movement Progress Information Display Area, click to select logical disks of movement schedule to be changed or canceled.

(ii) Display Change LD Movement Schedule dialog
Three procedures are provided for displaying the Change LD Movement Schedule dialog Display the Change LD Movement Schedule dialog with one of the following procedures:
- Popup menu
  Display a popup menu, and select [Change LD Movement Schedule] on the popup menu.
- Menu
  Select [Operation] → [Change LD Movement Schedule] on the menu.
- Tool Bar button
  Select [Change LD Movement Schedule] button on the toolbar.

Figure 6-26 shows an example screen of Change LD Movement Schedule dialog.
(iii) Change (cancel) movement schedule

- For changing time of starting disk movement, or time of continuing re-execution
  
  Change the setting value and click the [Change Schedule] button.

- For canceling disk movement schedule
  
  Click the [Cancel Schedule] button.
This chapter explains how to operate a command provided by NEC Storage PerformanceOptimizer. The command provided by NEC Storage PerformanceOptimizer can be executed on the server on which NEC Storage Manager is operating.

## 7.1 Logical Disk Movement Command

As explained previously, logical disks can be moved through operation on the client screen of NEC Storage PerformanceOptimizer. NEC Storage PerformanceOptimizer also enables logical disks to be moved by this command as well as screen operation.

If a shell script or batch file is prepared beforehand, the movement of logical disks can be scheduled by using the command.

Use the iSMprfctl command to move logical disks. For details on the iSMprfctl command syntax, refer to Appendix A “Commands of the Performance Monitoring/Optimization Function” of this manual.

### (1) Command specification

Use the logical disk movement function (start_ldmv) of the iSMprfctl command to move logical disks. If a logical disk is to be moved by the command when a bottleneck is detected or preventive maintenance is performed, do the following beforehand: checking information necessary on the client screen of NEC Storage PerformanceOptimizer and then specifying the information in the command options. The following information needs to be specified in the iSMprfctl command:

- **Disk Array Subsystem**
  
  Name of the Disk Array Subsystem containing the Moved Material Logical Disk. Specify the name in the -arrayname option.

- **Source logical disk**
  
  Logical disk on the RANK that is a bottleneck in performance due to the concentration of I/O operations. The logical disk number or name should be specified. Specify the logical disk number in the -ldn option or the logical disk name in the -ldname option.

- **Work Disk for Optimization**
  
  Destination Work Disk for Optimization. The logical disk number or name should be specified. Specify the logical disk number in the -wkldn option or the logical disk name in the -wkldname option.

- **LD movement speed**
  
  Speed at which data is copied when the logical disk is moved. The speed can be specified by selecting auto or high in the same manner as for screen operation. The default is auto as the recommended speed.

Predetermine the combination of a source logical disk and a Work Disk for Optimization so that the RANK Busy Ratio will be leveled. To do so, use the client screen of NEC Storage PerformanceOptimizer.

Consider the business operation state when moving a logical disk and specify the optimum volume movement speed.
Chapter 7  Operation of Performance Optimization Function (CLI)

The following shows examples of specifying the iSMprfctl command:

Example 1: Move data between the logical disk 000ah and the Work Disk for Optimization 0010h. Select the default volume movement speed (auto).

```
iSMprfctl start_ldmv -arrayname NECStorage3100/10 -ldn ah -wkldn 10h
```

Example 2: Move data between the logical disk 000ah and the Work Disk for Optimization 0010h. Select the maximum data transfer rate (high) as the volume movement speed.

```
iSMprfctl start_ldmv -arrayname NECStorage3100/10 -ldn ah -wkldn 10h -speed high
```

Example 3: Specify a volume name to move data between the logical disk 000ah and the Work Disk for Optimization 0010h. Select the default volume movement speed (auto).

```
iSMprfctl start_ldmv -arrayname NECStorage3100/10 -ldname NX:VOL000a -wkldname NX:WK0010
```

Example 4: Specify a volume name to move data between the logical disk 000ah and the Work Disk for Optimization 0010h. The volume name is specified with the volume format being omitted. Select the default volume movement speed (auto).

```
iSMprfctl start_ldmv -arrayname NECStorage3100/10 -ldname VOL000a -wkldname WK0010
```

(2) Confirmation of movement

The start_ldmv function of the iSMprfctl command starts moving a logical disk. This command does not wait until moving of the logical disk is completed.

If having moved a logical disk by executing the command, confirm the start and completion of moving by the following methods:

- **Start of movement**
  
  Make sure of the message for the iSMprfctl command and the NEC Storage PerformanceOptimizer message that is output to the iSM operation log. When the logical disk starts moving normally, the following messages are output:
  
  - Message for the iSMprfctl command: iSMprfctl 001
  - Message output to the iSM operation log: iSM09002

- **Completion of movement**

  Make sure of the NEC Storage PerformanceOptimizer message that is output to the iSM operation log.

  - Message output to the iSM operation log: iSM09003
The iSM09003 message is output both when moving has terminated normally and when it has terminated abnormally. Therefore, you can confirm the completion of moving by this message.

(3) Notes

• The iSMprfctl command is executable only on the server on which NEC Storage Manager is operating. Do not execute the command on a Business Server or while NEC Storage Manager is in stopped state.
• The iSMprfctl command is available with a client PC only when Telnet is connected. It is not available with Terminal Service.
Appendix A  Commands of Performance Monitoring/Optimization Function

A.1  Commands for Statistic Information File

A.1.1  Statistic Log Storing

[ NAME ]

iSMprflog - Operates accumulation of statistic information log file.

[ SYNOPSIS ]

iSMprflog start [-a] [-d Disk Array Subsystem name]
iSMprflog stop [-a] [-d Disk Array Subsystem name]

[ DESCRIPTION ]
iSMprflog command starts/stops accumulation of statistic information log file. This command is executable only when the iSM server is operating. Operations are applicable only to the disk array monitored by the iSM server.

Options

start

Starts accumulation of statistic information log file.

stop

Stops accumulation of statistic information log file.

-a

Make all disk array monitored by the iSM server applicable to operations.

-d

Make only specified applicable to operations.

[ RETURN VALUE ]

None.

[ DIAGNOSTICS ]

A message is output to standard output if iSMprflog is successfully executed, or a message is output to standard error output upon a failure.
[ USAGE ]
Example: Start accumulation of statistic information log file of all disk array monitored by the iSM server.

    isMprflog start -a

Example: Start accumulation of statistic information log file of a disk array (NECStorage4000/10) monitored by the iSM server.

    isMprflog start -d NECStorage4000/10

A.1.2 Archiver

[ NAME ]
iSMprfarc - Summarizes statistic information and outputs to a file.

[ SYNOPSIS ]
iSMprfarc [-v] -p Directory -hour Target Period of Summarizing
iSMprfarc [-v] -p Directory -day Target Period of Summarizing

[ DESCRIPTION ]
iSMprfarc is a command which summarizes statistic information in the input statistic information file and outputs the summarized statistic information to a file. Summarizing statistic information makes the time density of the statistic information coarser but saves file capacity.
iSMprfarc creates a file (statistic information primary summarized file) which summarizes the statistic information for one day in units of hours from the statistic information history file (primary summarizing). Further more, it creates a file (statistic information secondary summarized file) which summarizes the statistic information for one month in units of days from the primary summarized file (secondary summarizing). Also, it can create a statistic information secondary summarized file directly from the statistic information history file without creating a primary summarized file (direct secondary summarizing).
iSMprfarc can summarize statistic information during the period the user specifies such as change of date. The user can directly specify the statistic information file to summarize, or specify the statistic information file indirectly by specifying the directory where the statistic information file exists and the target period of summarizing.

(i) File Specification
iSMprfarc enters the File Specification Mode if a file is specified in the argument and summarizes statistic information by using the specified file as an input file. The summarized file is output to the
current directory. The names of the output files follow the naming convention for statistic information files (See Remark). A file name indicates the disk array name from which statistic information is collected and the date (or month) of collection. If the file with the same name exists, the file is overwritten.

iSMprfarc automatically switches between summarizing processes depending on the type of the specified file.

If a statistic information history file is specified as an input file, iSMprfarc performs primary summarizing and outputs a primary summarized file. The name of the output file consists of string indicating the disk array name and date of collection with the extension of the summarized file. You can specify multiple statistic information history files for different disk arrays with different collection dates. In this case, each file is summarized separately and a primary summarized file is created respectively.

If a primary summarized file is specified as an input file, iSMprfarc performs secondary summarizing and outputs a statistic information secondary summarized file. Basically, you need to specify primary summarized files for one month which have a name indicating the same disk array and collection dates in the same month. If the files are for less than one month, the specified files are summarized. The name of the output file consists of string indicating the disk array name and month of collection (collection dates of the files minus days) with the extension of the summarized file. You can specify multiple primary summarized files for different disk arrays or primary summarized files on collection dates in different months mixed together. In this case, summarizing is performed for each disk array and for each collection month, and a statistic information secondary summarized file is created respectively.

If a statistic information history file is specified as an input file with the -d option, iSMprfarc performs direct secondary summarizing. It creates a statistic information secondary summarized file from a set of statistic information history files for one month which have a name indicating the same disk array and collection dates in the same month. The file output conditions are the same as secondary summarizing described above. If a primary summarized file is specified with the -d option, the operation is the same as the normal secondary summarizing.

The -o option changes the destination of files to the directory specified in the argument. Statistic information history files and primary summarized files cannot be mixed. If they are mixed, an error occurs.

With Windows, you cannot use wildcard (e.g. * and ?) in a file name. To specify a file name with spaces, enclose it in double quotation marks.

(ii) Period Specification

If the input/output directory (the -p option), unit of summarizing (the -hour or -day option), and target period of summarizing (argument of the -hour or -day option) are specified, iSMprfarc summarizes in the Period Specification Mode. They are mandatory options and cannot be omitted.
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iSMprfarc selects the statistic information files corresponding to the specified period from the files in the specified directory, and summarizes statistic information in the specified unit of summarizing. If statistic information files for multiple disk arrays exist in the directory, it performs summarizing process for each disk array.

In the argument of the -p option, specify the directory where files are input/output. With Windows, to specify a directory name with spaces, enclose it in double quotation marks.

If the -hour option is specified, primary summarizing is performed for the statistic information history files in the specified directory. Summarizing process is done for each target period of summarizing for each day for each disk array.

If the -day option is specified, secondary summarizing is performed for the primary summarized files in the specified directory. Summarizing process is done for each month for each disk array. Periods less than one month are summarized in one file as long as they are consecutive.

If the -day option is specified but no primary summarized files in the period exist but statistic information history files do, direct secondary summarizing is performed. The conditions of summarizing files are the same as the secondary summarizing above. If statistic information history files and primary summarized files of the same day coexist, the primary summarized files are used as input and secondary summarizing is performed.

In the arguments of the -hour and -day options, specify the target period of summarizing.

To specify a target period of summarizing, you can either specify the date in the Year/Month/Day format or specify the period before the relative point in time with respect to the current time.

**Date Specification yyyy-mm-dd[.YYYYMMDD]**

Connect the 8-digit value indicating year, month, and day by periods. The target period of summarizing is from `yyyy-mm-dd` to `YYYYMMDD`. If an 8-digit value is specified, the target period of summarizing is before `yyyy-mm-dd` including today.

Example: The target period of primary summarizing is from April 1, 2002 to April 30, 2002.

```
-hour 20020401.20020430
```

Example: The target period of secondary summarizing or direct secondary summarizing is before April 30, 2002.

```
-day 20020430
```

**Relative Specification num<SUFFIX>**

The target period of summarizing is before the relative point in time with respect to the current time. "num" is a value greater than or equal to 0.

For SUFFIX, specify either year (y), month (m), or day (d). SUFFIX cannot be omitted.

Example: The target period of primary summarizing is 30 days before the present date and earlier.

(If the present date is April 15, 2002, the target period of summarizing is before March 16, 2002.)
Example: The target period of secondary summarizing or direct secondary summarizing is 2 months before the present date and earlier.
(If the present date is August 15, 2002, the target period of summarizing is before February 15, 2002.)

The -v option outputs the detailed information of summarizing process in the standard output.
For secondary summarizing and direct secondary summarizing, iSMprfarc detects missing information in the target files of summarizing. If it determines that the statistic information is discontinuous, it outputs a warning message as the standard error. Summarizing process of the statistic information continues and configuration information is inserted into the discontinuous point. It assumes that the configuration has changed from that point.
The summarizing process of iSMprfarc is described below.
First, iSMprfarc determines the period of summarizing in which statistic information is summarized. When summarizing is done every hour, the period of summarizing starts when the time of obtaining the first statistic information contained in the set of statistic information recorded in one logging Interval (statistic information record) crosses over one boundary of time, and ends immediately before the time of obtaining the first statistic information contained in the successive statistic information record crosses over the next boundary of time. When summarizing is done every day, the period of summarizing starts when the time of obtaining the first statistic information contained in the statistic information record crosses over the change of date and ends on the current date.
If a configuration change occurs, the period of summarizing is divided at the time. A period of summarizing is also divided at the start and end of recording of statistic information.
iSMprfarc performs the following summarizing processes for various information in the file.

**Interval time**
For the interval time of each item of statistic information, interval times in each interval of the input file are accumulated in the period of summarizing. The cumulative value is provided as the interval time after summarizing.

**I/O count**
For statistic information items regarding I/O count, the I/O counts in each interval of the input file are accumulated in the period of summarizing. The cumulative value is provided as the I/O count after summarizing.

**Average Response Time**
For statistic information items regarding average response time, the average response time in each interval of the input file is converted to the average response time of the period of summarizing.
The value is provided as the average response time after summarizing. More specifically, in each interval of the input file, the product of each interval time and each average response time is calculated. The products are summed within the period of summarizing, and the total response time in the period of summarizing is calculated. The average response time of the period of summarizing is calculated by dividing the total response time in the period of summarizing by the interval time after summarizing.

**Average Transfer Rate**

For statistic information items regarding average transfer rate, the average transfer rate in each interval of the input file is converted to the average transfer rate of the period of summarizing. The value is provided as the average transfer rate after summarizing. More specifically, in each interval of the input file, the product of each interval time and each average transfer rate is calculated. The products are summed within the period of summarizing, and the total amount of transfer in the period of summarizing is calculated. The average transfer rate of the period of summarizing is calculated by dividing the total amount of transfer in the period of summarizing by the interval time after summarizing.

**Maximum Response Time**

For statistic information items regarding maximum response time, the maximum response time in the period of summarizing is selected from the maximum response times in the intervals of the input file. The value is provided as the maximum response time after summarizing.

**Average Busy Ratio**

For statistic information items regarding an average busy ratio, the average busy ratio in each interval of the input file is converted to the average busy ratio of the period of summarizing. The value is provided as the average busy ratio after summarizing.

**Average Operating Time**

For statistic information items regarding (average) operating time, the (average) operating time in each interval of the input file is accumulated in the period of summarizing. The cumulative value is provided as the (average) operating time after summarizing.

**Additional information**

When statistic information is summarized, if it is summarized into one value, information regarding time changes in each logging Interval is lost. iSMprfarc add additional information of statistic information to the summarized file. For I/O count, the maximum and minimum values of time density of I/O count in each logging Interval are added. For average transfer rate, the maximum and minimum values of average busy ratio in each logging Interval are added. For average response time and maximum response time, no additional information is added because maximum and minimum values are useless.

**Maximum and Minimum Values of Time Density of I/O Count**

The maximum and minimum values of time density of I/O count in each logging Interval in the
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period of summarizing are provided as additional information. If the input file is a statistic information history file (primary summarizing and direct secondary summarizing), I/O count in each logging Interval is divided by each logging Interval time, and time density of I/O count is calculated. Then, the maximum and minimum values in the period of summarizing are selected. If the input file is a primary summarized file (secondary summarizing), the maximum and minimum values in the period of summarizing are selected from the additional information recorded in the input file.

Maximum and minimum values of Average Transfer Rate
The maximum and minimum values of average transfer rate in each logging Interval in the period of summarizing are provided as additional information. If the input file is a statistic information history file (primary summarizing and direct secondary summarizing), the maximum and minimum values in the period of summarizing are selected from the average transfer rates in the logging Intervals. If the input file is a primary summarized file (secondary summarizing), the maximum and minimum values in the period of summarizing are selected from the additional information recorded in the input file.

Maximum and Minimum Values of the Average Busy Ratio
The maximum and minimum values of the average busy ratio in each logging Interval in the period of summarizing are provided as additional information. If the input file is a statistic information history file (primary summarizing or direct secondary summarizing), the maximum and minimum values in the period of summarizing are selected from the average busy ratio in the logging Intervals. If the input file is a primary summarized file (secondary summarizing), the maximum and minimum values in the period of summarizing are selected from the additional information recorded in the input file.

Other time information
Statistic information acquisition time is obtained from the statistic information acquisition time contained in the last statistic information record in the period of summarizing. Output time of the statistic information record is obtained from the output time of the last statistic information record in the period of summarizing.

Configuration information
When configuration information indicating a configuration change is detected, the configuration information is written to the statistic information summarized file at the point in time. However, the auxiliary configuration information contained in configuration information is not written to the statistic information summarized file.

Nickname change information
When nickname change information is detected, it is written to the statistic information summarized file at the point in time. Summarizing process continues. Therefore, when nickname change information exists within the period of summarizing, the nickname change information is written to the file earlier than the statistic information summarizing the period.
[ NOTES ]

Naming Convention for Statistic Information Files
The year, month, and day in the file name indicates the day or month of collection of the statistic information.

YYYYMMDDNNN~NN.psl : Statistic information history file (in n minutes/day; n depends on the configuration)
YYYYMMDDNNN~NN.psa : Primary summarized file (every hour for one day)
YYYYMMNNN~NN.psa   : Secondary summarized file (everyday for one month)

YYYY : Year (4-digit value)
MM : Month (2-digit value from 01 through 12)
DD : Day (2-digit value from 01 through 31)
NNN - NN : “Disk Array Name” + “Identification Number(#n)”

* n in the identification number is a numerical value of 2 or over. Not appended when a file of the same name is not found.

[ RESTRICTION ]

Auxiliary configuration information is not summarized. It is not written to statistic information summarized files.
A.1.3 CSV Conversion Tool

[ NAME ]

iSMprfext - Extracts statistic information, converts it to the CSV format, and outputs it to a file.

[ SYNOPSIS ]

iSMprfext -file File Name [File Name...... ]

[ -from Time ] [ -to Time ]
[ -hp [ Host Port [Host Port...... ] ] ]
[ -dp [ Disk Port [Disk Port...... ] ] ]
[ -rank [ RANK [ RANK...... ] ] ]
[ -iocnt ] [ -resp ] [ -rate ] [ -busy ]
[ -p Path Name ]
[ -compo ]

[ DESCRIPTION ]

The iSMprfext command extracts statistic information in the statistic information history (summarized) file of iSM, converts it to the CSV format (separated by commas), and outputs it to a file. You can extract the specific statistic information by specifying component of the disk array, type of the statistic information, and period of extraction.

Multiple options to specify the component of disk array (-hp -dp -ld -pd -rank) as well as multiple options to specify the type of the statistic information (-iocnt -resp -rate -busy) can be specified. If multiple options are specified, all statistic information which satisfy the specified conditions is extracted.

Options

-file File Name

Specify statistic information history (summarized) files. Multiple files can be specified, and statistic information history files and statistic information summarized files can be mixed. To specify files, absolute path specification, relative path specification, and specification without path are all available. If no path is specified, the files in the current paths become the targets. This option cannot be omitted.

With Windows, you cannot use wild card (e.g. * and ?) in a file name. To specify a file name with spaces, enclose it in double quotation marks.

-from Time

Specify the starting time of extraction to extract statistic information by specifying a period. Time is specified in the yyyyymmd/hhmm format. The specified time is interpret from left to right as shown below.

yyyy - Year (4 digits)
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- **mm**  - Month [01-12]
- **dd**  - Day (in one month) [01-31]
- **hh**  - Hour (in 24-hour time) [00-23]
- **mm**  - Minute [00-59]

**-to**  Time

Specify the end time of extraction to extract statistic information by specifying a period. The method and interpretation of time are the same as the -from option.

- **hp**  Host Port (Port in Host Director)

Specified if you want to extract statistic information of the specified host port. For this option, specify the host port number or the range of host port numbers. Up to 10 host ports can be specified. To specify multiple host ports, separate them by spaces. You can omit the identification number. In this case, statistic information for all host ports is extracted.

A host port number is expressed by linking a director number (in hexadecimal) and port number (in hexadecimal) by a hyphen.

Director Number - Port Number

You can use “%” only if you specify a host port number. In this case, statistic information of all ports with the specified director number is extracted.

Director Number - %

When you specify a range of host port numbers, link the host port numbers by colons. If you specify a range, statistic information of all host ports in the range is extracted.

Director Number - Port Number: Director Number - Port Number

- **dp**  Disk Port (Port in Disk Director)

Specified if you want to extract statistic information of the specified disk port. The format and method of specification are the same as a host port.

- **ld**  Logical Disk

Specified if you want to extract statistic information of the specified logical disk. For the identification number, specify the logical disk number (in hexadecimal) or the range of logical disk numbers. Up to 10 logical disks can be specified. To specify multiple logical disks, separate them by spaces. You can omit the logical disk number. In this case, statistic information for all logical disks is extracted. When you specify a range of logical disk numbers, link the logical disk numbers by colons. If you specify a range, statistic information of all logical disks in the range is extracted.

Logical Disk Number: Logical Disk Number
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- pd  Physical Disk
  Specified if you want to extract statistic information of the specified physical disk. For the
  identification number, specify the physical disk number or the range of logical disk numbers. Up
  to 10 physical disks can be specified. To specify multiple physical disks, separate them by
  spaces. You can omit the physical disk number. In this case, statistic information for all
  physical disks is extracted. A physical disk number is expressed by linking a group number (in
  hexadecimal) and disk number (in hexadecimal) by a hyphen.
  Group Number - Disk Number
  You can use “%” only if you specify a physical disk number. In this case, statistic information
  of all physical disks with the specified group number is extracted.
  Group Number - %
  When you specify a range of physical disk numbers, link the physical disk numbers by colons.
  If you specify a range, statistic information of all physical disks in the range is extracted.
  Group Number - Disk Number: Group Number - Disk Number

- rank  RANK
  Specified if you want to retrieve statistic information on the specified RANK. For the
  identification number, specify the RANK number or the range of RANK numbers. Up to 10
  RANKs can be specified. To specify multiple RANKs, separate them by spaces. You can omit
  the RANK number. In this case, statistic information for all RANKs is retrieved. A RANK
  number is expressed by linking a group number (in hexadecimal) and RANK number (in
  hexadecimal) by a hyphen.
  Group Number-RANK Number
  You can use “%” only if you specify a RANK group number. In this case, statistic information
  of all RANKs with the specified group number is retrieved.
  Group Number-%
  When you specify a range of RANK numbers, link the RANK numbers by colons. If you
  specify a range, statistic information of all RANKs in the range is retrieved.
  Group Number-RANK Number: Group Number-RANK Number

- iocnt
  Specified if you want to extract statistic information regarding the number of inputs/outputs.
  Statistic information regarding the number of inputs/outputs is the following.
  Number of Inputs/Outputs
  Maximum number of Input/Output density (I/OPS)
  Minimum number of Input/Output density (I/OPS)

- resp
  Specified if you want to extract statistic information regarding the response time. Statistic
  information regarding the response time is the following.
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Average Response Time
Maximum Response Time

-rate
Specified if you want to extract statistic information regarding the Transfer Rate. Statistic information regarding the Transfer Rate is the following.
Transfer Rate
Maximum Transfer Rate
Minimum Transfer Rate

-busy
Specified if you want to retrieve statistic information regarding a busy ratio. Statistic information regarding the busy ratio is as follows:
Busy Ratio of RANK
Busy Ratio of LD
Busy Ratio of PD

-p  Path Name
Specify the path where output files (CSV files) are created. To specify a path, both absolute path specification and relative path specification are available. If this option is specified with multiple statistic information history (summarized) files specified, all the CSV files for the statistic information history (summarized) files are created in the path specified by this option. If this option is omitted, the CSV files are created in the same path as the statistic information history (summarized) files.
To specify a path name with spaces, enclose it in double quotation marks.

-compo
Specified if you want to extract component information of the disk array.

-header
Output a header record at the head of file, indicating a field name.

[ DIAGNOSTICS ]
If the iSMprfext command terminates normally, it outputs a message to indicate normal termination as the standard output. If it terminates abnormally, it outputs an error message as the standard error output.

[ USAGE ]
The following extracts all statistic information of file1.

iSMprfext -file file1

The following extracts only statistic information from 10:30, April 30, 2002.

iSMprfext -file file1 -from 20020430/1030
Appendix A  Commands of Performance Monitoring/Optimization Function

The following extracts statistic information from 10:30 to 14:00 on April 30, 2002.

```
iSMprfext  -file file1  -from 20020430/1030  -to 20020430/1400
```

The following extracts statistic information of host ports with the director number: 10 and port number: 1e.

```
iSMprfext  -file file1  -hp 10-1e
```

The following extracts only statistic information of host ports with the director number: 10.

```
iSMprfext  -file file1  -hp 10-%
```

The following extracts only statistic information of host ports from the director number: 10 and port number: 1 to director number: 20 and port number: 10.

```
iSMprfext  -file file1  -hp 10-1:20-10
```

The following extracts only statistic information of logical disks with the logical disk number: a.

```
iSMprfext  -file file1  -ld a
```

The following extracts only statistic information of logical disks with the logical disk number from a to 20.

```
iSMprfext  -file file1  -ld a:20
```

The following extracts only statistic information of physical disks with the group number: 0 and disk number: 10.

```
iSMprfext  -file file1  -pd 0-10
```

The following extracts only statistic information of physical disks.

```
iSMprfext  -file file1  -pd
```

The following extracts only statistic information of physical disks from the group number: 0 and disk number: 1 to group number: 5 and disk number: 0.

```
iSMprfext  -file file1  -pd 0-1:5-0
```
The following extracts only statistic information of disk ports with the director number: 30 and port number: 10 as well as physical disks with the group number: 2 and disk number: a.

\[ \text{iSMprfext -file file1 -dp 30-10 -pd 2-a} \]

The following extracts only statistic information regarding the number of inputs/outputs.

\[ \text{iSMprfext -file file1 -iocnt} \]

The following extracts only statistic information regarding the response time and Transfer Rate.

\[ \text{iSMprfext -file file1 -resp -rate} \]

The following extracts only statistic information regarding the number of inputs/outputs to 17:30, April 30, 2002.

\[ \text{iSMprfext -file file1 -to 20020430/1730 -iocnt} \]

The following extracts only statistic information regarding the Transfer Rate of host ports with the director number: 10 and port number: 1e.

\[ \text{iSMprfext -file file1 -hp 10-1e -rate} \]

The following extracts configuration information as well as statistic information.

\[ \text{iSMprfext -file file1 -compo} \]

The following extracts statistics information with putting corresponding record types and field name to the head of the file.

\[ \text{iSMprfext -file file1 -header} \]

The following creates CSV files in C:\temp. (only for Windows)

\[ \text{iSMprfext -file file1 -p C:\temp} \]

**A.1.4 Editor Tool**

[ NAME ]

\[ \text{iSMprfedit} \]  Edits statistic information and outputs the resulting information to a text file.
[ SYNOPSIS ]

iSMprfedit  [ -o directory name]
[ -nosum ]
[ -det [ [ -all ] | [ -array ] [ -rank ] [ -hp ] [ -dp ] [ -ld ] [ -pd ] ] ]

[ DESCRIPTION ]

The iSMprfedit command edits/modifies statistic information in the statistic information history (summarized) file of the specified iSM and outputs information useful for performance analysis of the disk array in a report (text format). It is possible to specify and edit plural statistic information history (summarized) files at a time. When plural files are specified, separate reports are created that correspond to each specified statistic information history (summarized) files. The iSMprfedit command creates the following reports:

(i) Performance summary report

This report summarizes the following statistic information:
- Entire disk array
- Host director port
- Disk director port
- Logical Disk
- Physical Disk
- RANK

(ii) Performance detail report

Six types of report are created:
- Entire disk array performance detail report
- RANK performance detail report
- Host director port performance detail report
- Disk director port performance detail report
- Logical disk performance detail report
- Physical disk performance detail report

Performance summary report is a report output as a default value. You can specify the output inhibition option (-nosum) to inhibit output of a performance summary report. You can also select a report to output and output a specific report or all the reports.

The iSMprfedit command creates report files by using the following naming rules:

When the input is statistic information history file (xxxxxx.psl):


xxxxxx_psl_edit type.txt

When the input is statistic information summarized file (xxxxxx.psa):
xxxxxx_psa_edit type.txt
In the above “edit type” is specified one of the following strings depending on the type of report:
“sum” : Performance summary report
“array” : Entire disk array performance detail report
“rank” : RANK performance detail report
“hp” : Host Director Port Performance Detail Report
“dp” : Disk director port performance detail report
“ld” : Logical disk performance detail report
“pd” : Physical disk performance detail report

Options
- o  Directory Name
    Specify the directory where reports are created. You can specify either an absolute path or a relative path. When plural statistic information history (summarized) files are specified while this option is used, reports of all the statistic information history (summarized) files are created in the specified directory. If this option is omitted, reports are created in respective statistic information history (summarized) files and directories. If a report of the same name exists, the report is overwritten with the latest data.
- nosum
    Inhibits output of a performance summary report.
- det
    Outputs a performance summary report. You can specify the option to designate the type of performance detail report (-all -array -rank -hp -dp -ld -pd) together with this option to output a specific performance detail report. If the type of performance detail report is not specified, only an entire disk array report is output.
- all
    Outputs of all types of performance detail reports.
- array
    Outputs an entire disk array report.
- rank
    Outputs a RANK performance detail report.
- hp
    Outputs a Host director port performance detail report.
- dp
    Outputs a disk director port performance detail report.
- ld
    Outputs a logical disk performance detail report.
- pd
Appendix A  Commands of Performance Monitoring/Optimization Function

Outputs a physical disk performance detail report.

File Name
Specify the statistic information history file (.psl) and statistic information summarized file (.psa)
to be edited.

[Diagnostics]
The iSMprfedit command, on normal termination, outputs a normal termination message in the standard
output, and in abnormal termination, outputs an error message in the standard error output.

[Usage]
file1 and file2 represent statistic information history (summarized) files.

This example creates a performance summary report.

iSMprfedit file1

This example creates a performance summary report under the directory C:\tmp. (only for Windows)

iSMprfedit -o C:\tmp file1

This example creates a performance summary report and all the performance detail reports.

iSMprfedit -det -all file1

This example creates only an entire disk array report.

iSMprfedit -nosum -det file1

This example creates only a logical disk performance detail report.

iSMprfedit -nosum -det -ld file1

This example creates a performance summary report and a Host director port performance detail
report.

iSMprfedit -det -hp file1

This example creates a performance summary report, logical disk performance detail report, and
physical disk performance detail report.

iSMprfedit -det -ld -pd file1

This example creates file1 and file2 performance summary reports under the directory C:\tmp. (only
for Windows)

iSMprfedit -o C:\tmp file1 file2
A.2 Command for Performance Tuning

A.2.1 LD Movement Command

[ NAME ]

iSMprfctl - Moves logical disks.

[ SYNOPSIS ]

iSMprfctl start_ldmv
  -arrayname Disk Array Subsystem name
  | -ldn logical-disk-number | -ldname [volume-format:] logical-disk-name
  | -wkldn logical-disk-number | -wkldname [volume-format:] logical-disk-name
  [ -speed | auto | high | ]

[ DESCRIPTION ]

The iSMprfctl command moves logical disks for optimizing performance. If a RANK is a bottleneck in performance due to the concentration of I/O operations, you can move logical disks from the RANK to a low-load RANK by using the logical disk movement function (start_ldmv) of the iSMprfctl command. The logical disks on the low-load RANK as the destination are dedicated disks called work disks for optimization. The work disks for optimization need to be preset by the LD Administrator function of iSM.

Do not attempt to move the following logical disks in order to maintain the effect of tuning. Be very careful in determining the disk array configuration.

- The capacity of the logical disk to be moved is different from that of the work disk for optimization.
- The logical disk to be moved and the work disk for optimization are on the same RANK.
- The logical disk to be moved is of the multi-RANK type.

The logical disk movement function only starts moving logical disks and terminates soon after starting the target logical disk. To confirm information about the progress of the logical disk moving, view the client screen dedicated to performance optimization. To confirm the completion of moving, view the client screen dedicated to performance optimization or the message output to the operation log.

Options

- arrayname Disk Array Subsystem name
  Specify the nickname of the disk array on which the logical disk to be moved is bound.
Appendix A  Commands of Performance Monitoring/Optimization Function

-ldn  Logical disk number of the move-source logical disk

Specify the logical disk number of the logical disk to be moved. If the logical disk number is specified with “h” suffixed, it is processed as a hexadecimal number. With “h” being omitted, it is processed as a decimal number.

-ldname  Nickname of the move-source logical disk

Specify the nickname of the logical disk to be moved in the format below.
[volume-format (up to 8 characters):] logical-disk-name (up to 24 characters)
To specify a logical disk for which a volume format has not been set, specify only “:” for volume-format. Specification of a volume format can be omitted. However, if it is omitted and the disk array contains a logical disk of the same name, iSMprfctl terminates abnormally.

-wkldn  Logical disk number of the work disk for optimization

Specify the logical disk number of the work disk for optimization. The specification method is the same as for the -ldn option.

-wkldname  Nickname of the work disk for optimization

Specify the nickname of the work disk for optimization. The specification method is the same as for the -ldname option.

-speed  LD movement speed

Specify the speed at which data is copied when the logical disk is moved.
   auto
   The disk array automatically adjusts the LD movement speed in accordance with the load state.
   Selecting auto minimizes influence on the business system. auto is the default of -speed.
   high
   Data is copied at the maximum transfer rate. Selecting high makes the moving time shorter than when auto is selected, but increases a load on the business system. Select max in a special case like when you want to give higher priority to tuning than business operation.

[ RETURN VALUE ]

The iSMprfctl command returns either of the following values when it terminates:
0: Normal termination
1: Abnormal termination

[ DIAGNOSTICS ]

When the iSMprfctl command has terminated normally, it outputs a message, indicating the normal termination, to the standard output file. When it has terminated abnormally, it outputs an error message to the standard error output file.
Appendix A  Commands of Performance Monitoring/Optimization Function

[USAGE ]

Example: Move data between the logical disk 000ah and the work disk for optimization 0010h. Select the default LD movement speed (auto).

iSMprfctl start_ldmv -arrayname NECStorage4100/10 -ldn ah -wkldn 10h

Example: Move data between the logical disk 10 and the work disk for optimization 16. Select the default LD movement speed (auto).

iSMprfctl start_ldmv -arrayname NECStorage4100/10 -ldn 10 -wkldn 16

Example: Move a logical disk by specifying the nickname. The volume formats of both the logical disk to be moved and the logical disk for optimization are “NX”. The volume name of the logical disk to be moved is “nx1/c22”, and the volume name of the logical disk for optimization is “nx1/c23”. Select the default LD movement speed (auto).

iSMprfctl start_ldmv -arrayname NECStorage4100/10 -ldname NX:nx1/c22 -wkldname NX:nx1/c23

Example: Move a logical disk by specifying the nickname. Omit the volume formats. The volume name of the logical disk to be moved is “nx1/c22”, and the volume name of the logical disk for optimization is “nx1/c23”. Select the default LD movement speed (auto).

iSMprfctl start_ldmv -arrayname NECStorage4100/10 -ldname nx1/c22 -wkldname nx1/c23

Example: Move data between the logical disk 000ah and the work disk for optimization 0010h. Select the maximum data transfer rate (high) as the LD movement speed.

iSMprfctl start_ldmv -arrayname NECStorage4100/10 -ldn ah -wkldn 10h -speed high
A CSV file is a set of records with data separated by commas. Records are separated by a line feed character. The maximum number of records is 65,536. The types of records which comprise a CSV file are as follows.

File information record
Statistic information record
Configuration information record

These records are described below.

(1) File information record

These records store attribute information of statistic information/summarized files. Only one file information record exists at the beginning of a CSV file. The record format is described below. “Save location” in the table indicates the order of the data separated by commas in the record. The save location of the leftmost data is 1.

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_FHDR</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_FHDR” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when information in the statistic information history (summarized) file was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when information in the statistic information history (summarized) file was collected.</td>
</tr>
<tr>
<td>4</td>
<td>File Revision</td>
<td>File revision</td>
<td>Hexadecimal</td>
<td>Revision value of the statistic information history (summarized) file</td>
</tr>
<tr>
<td>5</td>
<td>Archive Unit</td>
<td>Unit of summarizing</td>
<td>Character</td>
<td>Information indicating the type of unit of summarizing of statistic information. For statistic information history files: “L”: Logging Interval For statistic information summarized files: “H”: Hour “D”: Day</td>
</tr>
</tbody>
</table>
(2) Statistic information record

This record contains statistic information for each component of the disk array. There are the following types of statistic information records.

- Statistic information record of a host port (a port of the host director)
- Statistic information record of a disk port (a port of the disk director)
- Statistic information record of a physical disk
- Statistic information record of a logical disk
- Statistic information record of a RANK

The record formats of the statistic information records are described below. “Save location” in the table indicates the order of the data separated by commas in the record. The save location of the leftmost data is 1. If the type of statistic information is specified as an extraction condition and the data is excluded from the targets of extraction, or if data does not exist, the save location of the data does not change. In this case, only a comma is written to the location.

“Period of Accumulation” and “Period of Summarizing” in the table have the following meaning respectively.

**Accumulation Period**

The period in which statistic information of the statistic information history file is accumulated. It corresponds to logging interval time.

**Summarizing Period**

The period in which statistic information of the statistic information history file is summarized. It is either 1 hour or 1 day.

The shaded parts in the table are provided only when statistic information of the statistic information summarized file is extracted.

### (i) Statistic information record format for host ports

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_STA_HP</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_STA_HP” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd</td>
<td>Date when information in the record was collected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>yyyy-Year</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>dd-Day</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss</td>
<td>Time when information in the record was collected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hh-Hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ss-Second</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Interval (milli sec)</td>
<td>Period of accumulation</td>
<td>Decimal</td>
<td>Period of accumulation of statistic information (millisecond). For a statistic information summarized file, the period of accumulation of the original statistic information history file is stored as it is.</td>
</tr>
<tr>
<td>5</td>
<td>Director No</td>
<td>Director number</td>
<td>‘Hexadecimal’</td>
<td>Director number of the host port</td>
</tr>
</tbody>
</table>
## CSV File Structure

<table>
<thead>
<tr>
<th>No.</th>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Port No</td>
<td>Port number of the host port</td>
</tr>
<tr>
<td>8</td>
<td>Write Count</td>
<td>Total count of Write I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>9</td>
<td>Average Write Response Time (micro sec)</td>
<td>Average response time of Write I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>10</td>
<td>Max Write Response Time (micro sec)</td>
<td>Maximum response time of Write I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>11</td>
<td>Write Transfer Rate (KB/S)</td>
<td>Transfer rate (kilobyte/second) of Write I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>12</td>
<td>Read Count</td>
<td>Total count of Read I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>13</td>
<td>Average Read Response Time (micro sec)</td>
<td>Average response time of Read I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>14</td>
<td>Max Read Response Time (micro sec)</td>
<td>Maximum response time of Read I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>15</td>
<td>Read Transfer Rate (KB/S)</td>
<td>Transfer rate (kilobyte/second) of Read I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>16</td>
<td>Others Count</td>
<td>Total count of Other I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>17</td>
<td>Average Others Response Time (micro sec)</td>
<td>Average response time of Other I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>18</td>
<td>Max Others Response Time (micro sec)</td>
<td>Maximum response time of Other I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>19</td>
<td>Others Transfer Rate (KB/S)</td>
<td>Transfer rate (kilobyte/second) of Other I/O in period of accumulation/summarizing.</td>
</tr>
<tr>
<td>20</td>
<td>Max Write Count</td>
<td>Maximum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>21</td>
<td>Min Write Count</td>
<td>Minimum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>22</td>
<td>Max Write Transfer Rate (KB/S)</td>
<td>Maximum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>23</td>
<td>Min Write Transfer Rate (KB/S)</td>
<td>Minimum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>24</td>
<td>Max Read Count</td>
<td>Maximum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>25</td>
<td>Min Read Count</td>
<td>Minimum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
</tbody>
</table>
## Appendix B  CSV File Structure

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Max Read Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>26</td>
<td>Min Read Transfer Rate(KB/S)</td>
<td>Min. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
</tbody>
</table>

(ii) Statistic information record format for disk ports

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_STA_DP</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_STA_DP” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Interval (milli sec)</td>
<td>Period of accumulation</td>
<td>Decimal</td>
<td>Period of accumulation of statistic information (millisecond). For a statistic information summarized file, the period of accumulation of the original statistic information history file is stored as it is.</td>
</tr>
<tr>
<td>5</td>
<td>Director No</td>
<td>Director number</td>
<td>‘Hexadecimal’</td>
<td>Director number of the disk port</td>
</tr>
<tr>
<td>6</td>
<td>Port No</td>
<td>Port number</td>
<td>‘Hexadecimal’</td>
<td>Port number of the disk port</td>
</tr>
<tr>
<td>7</td>
<td>Write Count</td>
<td>Write I/O count</td>
<td>Decimal</td>
<td>Total count of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>8</td>
<td>Average Write Response Time (micro sec)</td>
<td>Average response time of Write I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>9</td>
<td>Max Write Response Time (micro sec)</td>
<td>Maximum response time of Write I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>10</td>
<td>Write Transfer Rate(KB/S)</td>
<td>Transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>11</td>
<td>Read Count</td>
<td>Read I/O count</td>
<td>Decimal</td>
<td>Total count of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>12</td>
<td>Average Read Response Time (micro sec)</td>
<td>Average response time of Read I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>13</td>
<td>Max Read Response Time (micro sec)</td>
<td>Maximum response time of Read I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>14</td>
<td>Read Transfer Rate(KB/S)</td>
<td>Transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Read I/O in period of accumulation/summarizing</td>
</tr>
</tbody>
</table>
### Appendix B  CSV File Structure

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Max Write Count</td>
<td>Max. of I/O density of Write I/O</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>16</td>
<td>Min Write Count</td>
<td>Min. of I/O density of Write I/O</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>17</td>
<td>Max Write Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>18</td>
<td>Min Write Transfer Rate (KB/S)</td>
<td>Min. transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>19</td>
<td>Max Read Count</td>
<td>Max. of I/O density of Read I/O</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>20</td>
<td>Min Read Count</td>
<td>Min. of I/O density of Read I/O</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>21</td>
<td>Max Read Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>22</td>
<td>Min Read Transfer Rate(KB/S)</td>
<td>Min. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
</tbody>
</table>

(iii) Statistic information record format for physical disks

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_STA_PD</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_STA_PD” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Interval (milli sec)</td>
<td>Period of accumulation</td>
<td>Decimal</td>
<td>Period of accumulation of statistic information (millisecond). For a statistic information summarized file, the period of accumulation of the original statistic information history file is stored as it is.</td>
</tr>
<tr>
<td>5</td>
<td>Pd Group No</td>
<td>Group number</td>
<td>‘Hexadecimal’</td>
<td>Group number of the physical disk</td>
</tr>
<tr>
<td>6</td>
<td>Pd No</td>
<td>Physical disk number</td>
<td>‘Hexadecimal’</td>
<td>Physical disk number</td>
</tr>
<tr>
<td>7</td>
<td>Write Count</td>
<td>Write I/O count</td>
<td>Decimal</td>
<td>Total count of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Type</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Average Write Response Time (micro sec)</td>
<td>Average response time of Write I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>9</td>
<td>Max Write Response Time (micro sec)</td>
<td>Maximum response time of Write I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>10</td>
<td>Write Transfer Rate(KB/S)</td>
<td>Transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>11</td>
<td>Read Count</td>
<td>Read I/O count</td>
<td>Decimal</td>
<td>Total count of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>12</td>
<td>Average Read Response Time (micro sec)</td>
<td>Average response time of Read I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>13</td>
<td>Max Read Response Time (micro sec)</td>
<td>Maximum response time of Read I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>14</td>
<td>Read Transfer Rate(KB/S)</td>
<td>Transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>15</td>
<td>Busy Ratio[%]</td>
<td>Average busy ratio</td>
<td>Decimal</td>
<td>Average busy ratio (percent) in the period of accumulation/summarizing</td>
</tr>
<tr>
<td>16</td>
<td>Busy Time (milli sec)</td>
<td>Operating time</td>
<td>Decimal</td>
<td>Operating time (millisecond) in the period of accumulation/summarizing</td>
</tr>
<tr>
<td>17</td>
<td>Max Write Count</td>
<td>Max. of I/O density of Write I/O</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Write I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>18</td>
<td>Min Write Count</td>
<td>Min. of Write I/O</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Write I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>19</td>
<td>Max Write Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>20</td>
<td>Min Write Transfer Rate (KB/S)</td>
<td>Min. transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>21</td>
<td>Max Read Count</td>
<td>Max. of I/O density of Read I/O</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Read I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>22</td>
<td>Min Read Count</td>
<td>Min. of I/O density of Read I/O</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Read I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>23</td>
<td>Max Read Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>24</td>
<td>Min Read Transfer Rate(KB/S)</td>
<td>Min. transfer rate of Read I/O</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>25</td>
<td>Max Busy Ratio[%]</td>
<td>Max. of average busy ratio</td>
<td>Decimal</td>
<td>Maximum value of the average busy ratio in each accumulation period in the period of summarizing</td>
</tr>
</tbody>
</table>
### Appendix B  CSV File Structure

<table>
<thead>
<tr>
<th>No.</th>
<th>Field name</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_STA_LD</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_STA_LD” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Interval (milli sec)</td>
<td>Period of accumulation</td>
<td>Decimal</td>
<td>Period of accumulation of statistic information (millisecond). For a statistic information summarized file, the period of accumulation of the original statistic information history file is stored as it is.</td>
</tr>
<tr>
<td>5</td>
<td>No</td>
<td>Logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Logical disk number</td>
</tr>
<tr>
<td>6</td>
<td>Write Count</td>
<td>Write I/O count</td>
<td>Decimal</td>
<td>Total count of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>7</td>
<td>Average Write Response Time (micro sec)</td>
<td>Average response time of Write I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>8</td>
<td>Max Write Response Time (micro sec)</td>
<td>Maximum response time of Write I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>9</td>
<td>Write Transfer Rate(KB/S)</td>
<td>Transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>10</td>
<td>Write Hit Count</td>
<td>CacheHit Write I/O count</td>
<td>Decimal</td>
<td>Total count of CacheHit Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>11</td>
<td>Average Write Hit Response Time(micro sec)</td>
<td>Average response time of CacheHit Write I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of CacheHit Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>12</td>
<td>Max Write Hit Response Time (micro sec)</td>
<td>Maximum response time of CacheHit Write I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of CacheHit Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>13</td>
<td>Write Hit Transfer Rate (KB/S)</td>
<td>Transfer rate of CacheHit Write I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of CacheHit Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>14</td>
<td>Read Count</td>
<td>Read I/O count</td>
<td>Decimal</td>
<td>Total count of Read I/O in period of accumulation/summarizing</td>
</tr>
</tbody>
</table>

(iv) Statistic information record format for logical disks
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Average Read Response Time (micro sec)</td>
<td>Average response time of Read I/O</td>
<td>Decimal. Average response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>16</td>
<td>Max Read Response Time (micro sec)</td>
<td>Maximum response time of Read I/O</td>
<td>Decimal. Maximum response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>17</td>
<td>Read Transfer Rate(KB/S)</td>
<td>Transfer rate of Read I/O</td>
<td>Decimal. Transfer rate (kilobyte/second) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>18</td>
<td>Read Hit Count</td>
<td>Read I/O count</td>
<td>Decimal. Total count of CacheHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>19</td>
<td>Average Read Hit Response Time(micro sec)</td>
<td>Average response time of CacheHit Read I/O</td>
<td>Decimal. Average response time (microsecond) of CacheHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>20</td>
<td>Max Read Hit Response Time(micro sec)</td>
<td>Maximum response time of CacheHit Read I/O</td>
<td>Decimal. Maximum response time (microsecond) of CacheHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>21</td>
<td>Read Hit Transfer Rate(KB/S)</td>
<td>Transfer rate of CacheHit Read I/O</td>
<td>Decimal. Transfer rate (kilobyte/second) of CacheHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>22</td>
<td>Prefetch Read Hit Count</td>
<td>PrefetchHit Read I/O count</td>
<td>Decimal. Total count of PrefetchHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>23</td>
<td>Average Prefetch Read Hit Response Time(micro sec)</td>
<td>Average response time of PrefetchHit Read I/O</td>
<td>Decimal. Average response time (microsecond) of PrefetchHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>24</td>
<td>Max Prefetch Read Hit Response Time(micro sec)</td>
<td>Maximum response time of PrefetchHit Read I/O</td>
<td>Decimal. Maximum response time (microsecond) of PrefetchHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>25</td>
<td>Prefetch Read Hit Transfer Rate(KB/S)</td>
<td>Transfer rate of PrefetchHit Read I/O</td>
<td>Decimal. Transfer rate (kilobyte/second) of PrefetchHit Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>26</td>
<td>Busy Ratio[%]</td>
<td>Average busy ratio</td>
<td>Decimal. Average busy ratio (percent) in the period of accumulation/summarizing</td>
</tr>
<tr>
<td>27</td>
<td>Max Write Count</td>
<td>Max. of I/O density of Write I/O</td>
<td>Decimal. Maximum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>28</td>
<td>Min Write Count</td>
<td>Min. of Write I/O</td>
<td>Decimal. Minimum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>29</td>
<td>Max Write Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Write I/O</td>
<td>Decimal. Maximum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>30</td>
<td>Min Write Transfer Rate (KB/S)</td>
<td>Min. transfer rate of Write I/O</td>
<td>Decimal. Minimum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>31</td>
<td>Max Write Hit Count</td>
<td>Max. of I/O density of CacheHit Write I/O</td>
<td>Decimal. Maximum value of I/O density of CacheHit Write I/O in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>32</td>
<td>Min Write Hit Count</td>
<td>Min. of I/O density of CacheHit Write I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>33</td>
<td>Max Write Hit Transfer Rate(KB/S)</td>
<td>Max. transfer rate of CacheHit Write I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>34</td>
<td>Min Write Hit Transfer Rate(KB/S)</td>
<td>Min. transfer rate of CacheHit Write I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>35</td>
<td>Max Read Count</td>
<td>Max. of I/O density of Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>36</td>
<td>Min Read Count</td>
<td>Min. of I/O density of Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>37</td>
<td>Max Read Transfer Rate (KB/S)</td>
<td>Max. transfer rate of Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>38</td>
<td>Min Read Transfer Rate(KB/S)</td>
<td>Min. transfer rate of Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>39</td>
<td>Max Read Hit Count</td>
<td>Max. of I/O density of CacheHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>40</td>
<td>Min Read Hit Count</td>
<td>Min. of I/O density of CacheHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>41</td>
<td>Max Read Hit Transfer Rate(KB/S)</td>
<td>Max. transfer rate of CacheHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>42</td>
<td>Min Read Hit Transfer Rate(KB/S)</td>
<td>Min. transfer rate of CacheHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>43</td>
<td>Max Prefetch Hit Count</td>
<td>Max. of I/O density of PrefetchHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>44</td>
<td>Min Prefetch Hit Count</td>
<td>Min. of I/O density of PrefetchHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>45</td>
<td>Max Prefetch Hit Transfer Rate(KB/S)</td>
<td>Max. transfer rate of PrefetchHit Read I/O</td>
<td>Decimal</td>
</tr>
<tr>
<td>46</td>
<td>Min Prefetch Hit Transfer Rate(KB/S)</td>
<td>Min. transfer rate of PrefetchHit Read I/O</td>
<td>Decimal</td>
</tr>
</tbody>
</table>
### CSV File Structure

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_STA_RANK</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_STA_RANK” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when statistic information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when statistic information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Interval (milli sec)</td>
<td>Period of accumulation</td>
<td>Decimal</td>
<td>Period of accumulation of statistic information (millisecond). For a statistic information summarized file, the accumulation period of the original statistic information history file is saved as it is.</td>
</tr>
<tr>
<td>5</td>
<td>Pd Group No</td>
<td>Group number</td>
<td>‘Hexadecimal’</td>
<td>Physical disk group number</td>
</tr>
<tr>
<td>6</td>
<td>Rank No</td>
<td>RANK number</td>
<td>‘Hexadecimal’</td>
<td>RANK number</td>
</tr>
<tr>
<td>7</td>
<td>Write Count</td>
<td>Write I/O count</td>
<td>Decimal</td>
<td>Total count of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>8</td>
<td>Average Write Response Time (micro sec)</td>
<td>Average response time of Write I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>9</td>
<td>Max Write Response Time (micro sec)</td>
<td>Maximum response time of Write I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>10</td>
<td>Write Transfer Rate(KB/S)</td>
<td>Transfer rate of Write I/O</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Write I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>11</td>
<td>Read Count</td>
<td>Read I/O count</td>
<td>Decimal</td>
<td>Total count of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>12</td>
<td>Average Read Response Time (micro sec)</td>
<td>Average response time of Read I/O</td>
<td>Decimal</td>
<td>Average response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>13</td>
<td>Max Read Response Time (micro sec)</td>
<td>Maximum response time of Read I/O</td>
<td>Decimal</td>
<td>Maximum response time (microsecond) of Read I/O in period of accumulation/summarizing</td>
</tr>
</tbody>
</table>
Appendix B  CSV File Structure

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Data Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Read Transfer Rate(KB/S)</td>
<td>Decimal</td>
<td>Transfer rate (kilobyte/second) of Read I/O in period of accumulation/summarizing</td>
</tr>
<tr>
<td>15</td>
<td>Busy Ratio[%]</td>
<td>Decimal</td>
<td>Average busy ratio (percent) in the period of accumulation/summarizing</td>
</tr>
<tr>
<td>16</td>
<td>Busy Time (milli sec)</td>
<td>Decimal</td>
<td>Operating Time (milli sec) in the period of accumulation/summarizing</td>
</tr>
<tr>
<td>17</td>
<td>Max Write Count</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>18</td>
<td>Min Write Count</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>19</td>
<td>Max Write Transfer Rate (KB/S)</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>20</td>
<td>Min Write Transfer Rate (KB/S)</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Write I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>21</td>
<td>Max Read Count</td>
<td>Decimal</td>
<td>Maximum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>22</td>
<td>Min Read Count</td>
<td>Decimal</td>
<td>Minimum value of I/O density of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>23</td>
<td>Max Read Transfer Rate (KB/S)</td>
<td>Decimal</td>
<td>Maximum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>24</td>
<td>Min Read Transfer Rate(KB/S)</td>
<td>Decimal</td>
<td>Minimum transfer rate (kilobyte/second) of Read I/O in each accumulation period in the period of summarizing.</td>
</tr>
<tr>
<td>25</td>
<td>Max Busy Ratio[%]</td>
<td>Decimal</td>
<td>Maximum value of the average busy ratio in each accumulation period in the period of summarizing</td>
</tr>
<tr>
<td>26</td>
<td>Min Busy Ratio[%]</td>
<td>Decimal</td>
<td>Minimum value of the average busy ratio in each accumulation period in the period of summarizing</td>
</tr>
</tbody>
</table>

(3) Configuration information record

This record stores configuration information of each component of the disk array. There are the following types of configuration information records.

- Configuration information record of a disk array
- Configuration information record of a host port (a port of the host director)
- Configuration information record of a disk port (a port of the disk director)
- Configuration information record of a physical disk
- Configuration information record of a logical disk
- Configuration information record of a RANK
- Logical disk name change record
- Configuration change record
- Logical disk move record
“Save location” in the table indicates the order of the data separated by commas in the record.
The save location of the leftmost data is 1.

(i) Configuration information record format for disk array

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_COMPO_ARY</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_ARY” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Product Name</td>
<td>Product name</td>
<td>String</td>
<td>Product name of the disk array</td>
</tr>
<tr>
<td>5</td>
<td>Serial No</td>
<td>Serial number</td>
<td>String</td>
<td>Serial number of the disk array.</td>
</tr>
<tr>
<td>6</td>
<td>Name</td>
<td>Device name</td>
<td>String</td>
<td>Name of the disk array.</td>
</tr>
<tr>
<td>7</td>
<td>Saa</td>
<td>SAA</td>
<td>String</td>
<td>SAA of the disk array.</td>
</tr>
<tr>
<td>8</td>
<td>Ld Num</td>
<td>No. of logical disks</td>
<td>Decimal</td>
<td>No. of logical disks of the disk array.</td>
</tr>
<tr>
<td>9</td>
<td>Pd Num</td>
<td>No. of physical disks</td>
<td>Decimal</td>
<td>No. of physical disks of the disk array.</td>
</tr>
<tr>
<td>10</td>
<td>Product Revision</td>
<td>Product revision</td>
<td>String</td>
<td>Product revision of the disk array.</td>
</tr>
</tbody>
</table>

(ii) Configuration information record format for host ports

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_COMPO_HP</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_HP” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Director No</td>
<td>Director number</td>
<td>‘Hexadecimal’</td>
<td>Director number of the host port.</td>
</tr>
<tr>
<td>5</td>
<td>Port No</td>
<td>Port number</td>
<td>‘Hexadecimal’</td>
<td>Port number of the host port.</td>
</tr>
</tbody>
</table>
### (iii) Configuration information record format for disk ports

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R_COMPO_DP</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_DP” is set.</td>
</tr>
<tr>
<td>1</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>2</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Director No</td>
<td>Director number</td>
<td>‘Hexadecimal’</td>
<td>Director number of the host port.</td>
</tr>
<tr>
<td>4</td>
<td>Port No</td>
<td>Port number</td>
<td>‘Hexadecimal’</td>
<td>Port number of the host port.</td>
</tr>
</tbody>
</table>

### (iv) Configuration information record format for logical disks

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R_COMPO_LD</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_LD” is set.</td>
</tr>
<tr>
<td>1</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd mm-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>2</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
<td>Logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Logical disk number</td>
</tr>
<tr>
<td>4</td>
<td>Resident</td>
<td>CACHE state</td>
<td>‘Hexadecimal’</td>
<td>0x01: CACHE resident disk. 0x00: Not CACHE resident disk.</td>
</tr>
<tr>
<td>5</td>
<td>Capacity(KB)</td>
<td>Capacity</td>
<td>Decimal</td>
<td>Capacity (kilobyte) of the logical disk.</td>
</tr>
<tr>
<td>6</td>
<td>Os Type</td>
<td>Volume format of the expanded volume name</td>
<td>String</td>
<td>Volume format of the expanded volume name of the logical disk.</td>
</tr>
<tr>
<td>7</td>
<td>Name</td>
<td>Expanded volume name</td>
<td>String</td>
<td>Expanded volume name of the logical disk.</td>
</tr>
</tbody>
</table>
### (v) Configuration information record format for physical disks

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R_COMPO_PD</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_PD” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Pd Group No</td>
<td>Group number</td>
<td>‘Hexadecimal’</td>
<td>Group number of the physical disk</td>
</tr>
<tr>
<td>5</td>
<td>Pd No</td>
<td>Physical disk number</td>
<td>‘Hexadecimal’</td>
<td>Number of the physical disk</td>
</tr>
<tr>
<td>6</td>
<td>Cycle(rpm)</td>
<td>Round per minute</td>
<td>Decimal</td>
<td>Round per minute (rpm) of the physical disk</td>
</tr>
<tr>
<td>7</td>
<td>Capacity(KB)</td>
<td>Capacity</td>
<td>Decimal</td>
<td>Capacity (kilobyte) of the physical disk</td>
</tr>
<tr>
<td>8</td>
<td>Serial No</td>
<td>Serial number</td>
<td>String</td>
<td>Serial number of the physical disk</td>
</tr>
<tr>
<td>9</td>
<td>Product Name</td>
<td>Product ID</td>
<td>String</td>
<td>Product ID of the physical disk</td>
</tr>
</tbody>
</table>

### (vi) Configuration information record format for RANK

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R_COMPO_RANK</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_RANK” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd yyyy-Year mm-Month dd-Day</td>
<td>Date when configuration information in the record was collected.</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss hh-Hour mm-Minute ss-Second</td>
<td>Time when configuration information in the record was collected.</td>
</tr>
<tr>
<td>4</td>
<td>Pd Group No</td>
<td>Group number</td>
<td>‘Hexadecimal’</td>
<td>Physical disk group number</td>
</tr>
<tr>
<td>5</td>
<td>Rank No</td>
<td>RANK number</td>
<td>‘Hexadecimal’</td>
<td>RANK number</td>
</tr>
<tr>
<td>6</td>
<td>Raid</td>
<td>RAID configuration</td>
<td>Decimal</td>
<td>RAID configuration for the RANK</td>
</tr>
<tr>
<td>7</td>
<td>Capacity(KB)</td>
<td>RANK size</td>
<td>Decimal</td>
<td>Size (kilobyte) of the RANK</td>
</tr>
<tr>
<td>8</td>
<td>Ld No(List)</td>
<td>Logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Numbers of all logical disks bound for the RANK</td>
</tr>
<tr>
<td>9</td>
<td>Pd No(List)</td>
<td>Physical disk number</td>
<td>‘Hexadecimal’</td>
<td>Numbers of all Physical disks constituting the RANK</td>
</tr>
</tbody>
</table>
### (vii) LD Name Change Record Format

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_COMPO_NNC</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_NNC” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd</td>
<td>Date when the logical disk name was changed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>yyyy-Year</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>dd-Day</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss</td>
<td>Time when the logical disk name was changed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hh-Hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ss-Second</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>Logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Number of the logical disk whose name was changed.</td>
</tr>
<tr>
<td>5</td>
<td>Name</td>
<td>New logical disk name</td>
<td>String</td>
<td>Logical disk name after change</td>
</tr>
</tbody>
</table>

### (viii) Configuration change record format

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_COMPO_CHG</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_CHG” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd</td>
<td>Date when configuration of the disk array was changed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>yyyy-Year</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>dd-Day</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss</td>
<td>Time when configuration of the disk array was changed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hh-Hour</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm-Minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ss-Second</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Interval(sec)</td>
<td>Logging interval</td>
<td>Decimal</td>
<td>Logging interval time (seconds) for statistic information.</td>
</tr>
</tbody>
</table>
### (ix) Logical disk move record format

<table>
<thead>
<tr>
<th>Save Location</th>
<th>Field name (-header specified)</th>
<th>Content</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R_COMPO_LDM</td>
<td>Record identifier</td>
<td>String</td>
<td>“R_COMPO_LDM” is set.</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
<td>Date</td>
<td>yyyy/mm/dd</td>
<td>yyyy-Year mm-Month dd-Day</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Time</td>
<td>hh:mm:ss</td>
<td>hh-Hour mm-Minute ss-Second</td>
</tr>
<tr>
<td>4</td>
<td>Pd Group No</td>
<td>Group number of the source logical disk</td>
<td>‘Hexadecimal’</td>
<td>Physical disk group number of the RANK for which the source logical disk has been bound</td>
</tr>
<tr>
<td>5</td>
<td>Rank No</td>
<td>RANK number of the source logical disk</td>
<td>‘Hexadecimal’</td>
<td>RANK number of RANK for which the source logical disk has been bound</td>
</tr>
<tr>
<td>6</td>
<td>Ld No</td>
<td>Source logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Source logical disk number</td>
</tr>
<tr>
<td>7</td>
<td>Pd Group No (work disk)</td>
<td>Group number of the destination logical disk</td>
<td>‘Hexadecimal’</td>
<td>Physical disk group number of the RANK for which the destination logical disk has been bound</td>
</tr>
<tr>
<td>8</td>
<td>Rank No (work disk)</td>
<td>RANK number of the destination logical disk</td>
<td>‘Hexadecimal’</td>
<td>RANK number of the RANK for which the destination logical disk has been bound</td>
</tr>
<tr>
<td>9</td>
<td>Ld No (work disk)</td>
<td>Destination logical disk number</td>
<td>‘Hexadecimal’</td>
<td>Destination logical disk number</td>
</tr>
</tbody>
</table>
Appendix C  Report Format of Performance Report Editor

The following explains the contents of the statistic information edit report created by the performance report editor (iSMprfedit command).

(1) Performance summary report

Displays the statistic information on the entire disk array and each component of the disk array throughout the period of summarizing. Below is shown a display image (file name: 20010529NECStorage4100_psl_sum.txt)

```
<< PERFORMANCE REPORT (SUMMARY) >>
disk array name: NECStorage4100

DISK ARRAY PERFORMANCE

<table>
<thead>
<tr>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
<th>r.hit(%)</th>
<th>pref.hit(%)</th>
<th>w.hit(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>128.29</td>
<td>5.67</td>
<td>45.30</td>
<td>9.30</td>
<td>26.74</td>
<td>97.96</td>
<td>87.73</td>
<td>0.00</td>
</tr>
</tbody>
</table>

HOST DIRECTOR PORT PERFORMANCE

<table>
<thead>
<tr>
<th>no</th>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h-00h</td>
<td>128.29</td>
<td>5.67</td>
<td>45.30</td>
<td>9.30</td>
<td>26.74</td>
</tr>
<tr>
<td>01h-00h</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

DISK DIRECTOR PORT PERFORMANCE

<table>
<thead>
<tr>
<th>no</th>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h-00h</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>00h-01h</td>
<td>228.28</td>
<td>10.78</td>
<td>48.34</td>
<td>8.33</td>
<td>44.63</td>
</tr>
</tbody>
</table>

LOGICAL DISK PERFORMANCE

<table>
<thead>
<tr>
<th>no</th>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
<th>r.hit(%)</th>
<th>pref.hit(%)</th>
<th>w.hit(%)</th>
<th>busy(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000h</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>0001h</td>
<td>128.34</td>
<td>5.68</td>
<td>45.32</td>
<td>9.30</td>
<td>26.73</td>
<td>97.96</td>
<td>87.73</td>
<td>0.00</td>
<td>50.00</td>
</tr>
</tbody>
</table>

PHYSICAL DISK PERFORMANCE

<table>
<thead>
<tr>
<th>no</th>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
<th>busy(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h-00h</td>
<td>47.45</td>
<td>2.17</td>
<td>46.73</td>
<td>7.64</td>
<td>44.87</td>
<td>80.00</td>
</tr>
<tr>
<td>00h-01h</td>
<td>44.87</td>
<td>2.15</td>
<td>49.15</td>
<td>7.46</td>
<td>44.56</td>
<td>80.00</td>
</tr>
</tbody>
</table>

RANK PERFORMANCE

<table>
<thead>
<tr>
<th>no</th>
<th>iops</th>
<th>trrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
<th>busy(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h-00h</td>
<td>95.05</td>
<td>4.20</td>
<td>48.91</td>
<td>7.64</td>
<td>42.11</td>
<td>81.00</td>
</tr>
<tr>
<td>00h-01h</td>
<td>5.58</td>
<td>1.76</td>
<td>10.09</td>
<td>2.57</td>
<td>80.33</td>
<td>7.74</td>
</tr>
</tbody>
</table>

PERFORMANCE REPORT SUCCESSFUL.
```
• Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>sampling term</td>
<td>Period of accumulation of statistic information</td>
</tr>
<tr>
<td>sampling time unit</td>
<td>Unit of accumulation of statistic information</td>
</tr>
<tr>
<td></td>
<td>“S”: In seconds</td>
</tr>
<tr>
<td></td>
<td>“H”: in hours</td>
</tr>
<tr>
<td></td>
<td>“D”: In days</td>
</tr>
<tr>
<td>no</td>
<td>Device number of each component</td>
</tr>
<tr>
<td>iops</td>
<td>External I/O density (count/second) in the</td>
</tr>
<tr>
<td></td>
<td>accumulation period</td>
</tr>
<tr>
<td>ttrate</td>
<td>External transfer rate (megabyte/second) in the</td>
</tr>
<tr>
<td></td>
<td>accumulation period</td>
</tr>
<tr>
<td>av.len</td>
<td>External average transfer length (kilobyte) in</td>
</tr>
<tr>
<td></td>
<td>the accumulation period</td>
</tr>
<tr>
<td>av.resp</td>
<td>External average response time (millisecond) in</td>
</tr>
<tr>
<td></td>
<td>the accumulation period</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio (percent) of write I/O in the</td>
</tr>
<tr>
<td></td>
<td>accumulation period</td>
</tr>
<tr>
<td>r.hit</td>
<td>Ratio (percent) of cache-hit read I/O in the</td>
</tr>
<tr>
<td></td>
<td>accumulation period</td>
</tr>
<tr>
<td>pref.hit</td>
<td>Ratio (percent) of prefetch-hit read I/O among</td>
</tr>
<tr>
<td></td>
<td>cache-hit read I/O in the accumulation period</td>
</tr>
<tr>
<td>w.hit</td>
<td>Ratio (percent) of cache-hit write I/O in the</td>
</tr>
<tr>
<td></td>
<td>accumulation period</td>
</tr>
<tr>
<td>busy</td>
<td>Average busy ratio (percent) in the accumulation</td>
</tr>
<tr>
<td></td>
<td>period. <strong>###.</strong> is displayed if the information</td>
</tr>
<tr>
<td></td>
<td>of the busy ratio does not exist.</td>
</tr>
</tbody>
</table>

(2) Entire Disk Array Subsystem Performance Detail Report

Chronologically displays statistic information on the entire disk array. Below is shown a display image (file name: 20010529NECStorage4100_psl_array.txt).

<< DISK ARRAY PERFORMANCE REPORT >>

<table>
<thead>
<tr>
<th>disk array name</th>
<th>NECStorage4100</th>
</tr>
</thead>
<tbody>
<tr>
<td>sampling time unit</td>
<td>300 S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>date</th>
<th>time</th>
<th>iops</th>
<th>ttrate(MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
<th>r.hit(%)</th>
<th>pref.hit(%)</th>
<th>w.hit(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-05-29 18:17</td>
<td>99.57</td>
<td>4.18</td>
<td>42.99</td>
<td>8.69</td>
<td>25.86</td>
<td>99.37</td>
<td>89.28</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>01-05-29 18:22</td>
<td>147.30</td>
<td>6.67</td>
<td>46.36</td>
<td>9.75</td>
<td>27.61</td>
<td>98.94</td>
<td>86.95</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>01-05-29 18:27</td>
<td>156.41</td>
<td>7.00</td>
<td>45.85</td>
<td>8.50</td>
<td>25.81</td>
<td>99.45</td>
<td>87.87</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>01-05-29 18:32</td>
<td>138.86</td>
<td>6.36</td>
<td>46.88</td>
<td>10.16</td>
<td>28.12</td>
<td>93.08</td>
<td>85.94</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

PERFORMANCE REPORT SUCCESSFUL.
**Appendix C  Report Format of Performance Report Editor**

- Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>Leftmost position (configuration change mark)</td>
<td>An asterisk is displayed immediately after change in the disk array configuration or restart of accumulation of statistic information.</td>
</tr>
<tr>
<td>date, time</td>
<td>Date and time statistic information was collected</td>
</tr>
<tr>
<td>iops</td>
<td>I/O density (count/second) in the accumulation period</td>
</tr>
<tr>
<td>trrate</td>
<td>External transfer rate (megabyte/second) in the accumulation period</td>
</tr>
<tr>
<td>av.len</td>
<td>External average transfer length (kilobyte) in the accumulation period</td>
</tr>
<tr>
<td>av.resp</td>
<td>External average response time (millisecond) in the accumulation period</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio (percent) of write I/O in the accumulation period</td>
</tr>
<tr>
<td>r.hit</td>
<td>Ratio (percent) of cache-hit read I/O in the accumulation period</td>
</tr>
<tr>
<td>pref.hit</td>
<td>Ratio (percent) of prefetch-hit read I/O among cache-hit read I/O in the accumulation period</td>
</tr>
<tr>
<td>w.hit</td>
<td>Ratio (percent) of cache-hit write I/O in the accumulation period</td>
</tr>
</tbody>
</table>

(3) Host director port performance detail report

Chronologically displays port-based statistic information on the host director port extracted from the statistic information file. Below is shown a display image (file name: 20010529NECStorage4100_psl_hp.txt).
• Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>port no</td>
<td>Number of the host director port</td>
</tr>
<tr>
<td>Leftmost position (configuration change mark)</td>
<td>An asterisk is displayed immediately after change in the disk array configuration or restart of accumulation of statistic information.</td>
</tr>
<tr>
<td>date, time</td>
<td>Date and time statistic information was collected</td>
</tr>
<tr>
<td>iops</td>
<td>I/O density (count/second) in the accumulation period</td>
</tr>
<tr>
<td></td>
<td>total: External I/O density for all I/O</td>
</tr>
<tr>
<td></td>
<td>read: External I/O density for read I/O</td>
</tr>
<tr>
<td></td>
<td>write: External I/O density for write I/O</td>
</tr>
<tr>
<td>trrate</td>
<td>External transfer rate (megabyte/second) in the accumulation period</td>
</tr>
<tr>
<td></td>
<td>total: External transfer rate for all I/O</td>
</tr>
<tr>
<td></td>
<td>read: External transfer rate for read I/O</td>
</tr>
<tr>
<td></td>
<td>write: External transfer rate for write I/O</td>
</tr>
<tr>
<td>av.len</td>
<td>External average transfer length (kilobyte) in the accumulation period</td>
</tr>
<tr>
<td></td>
<td>total: External average transfer length for all I/O</td>
</tr>
<tr>
<td></td>
<td>read: External average transfer length for read I/O</td>
</tr>
<tr>
<td></td>
<td>write: External average transfer length for write I/O</td>
</tr>
<tr>
<td>av.resp</td>
<td>External average response time (millisecond) in the accumulation period</td>
</tr>
<tr>
<td></td>
<td>total: External average response time for all I/O</td>
</tr>
<tr>
<td></td>
<td>read: External average response time for read I/O</td>
</tr>
<tr>
<td></td>
<td>write: External average response time for write I/O</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio (percent) of write I/O in the accumulation period</td>
</tr>
</tbody>
</table>
## Appendix C  Report Format of Performance Report Editor

### (4) Disk director port performance detail report

Chronologically displays port-based statistic information on the disk director port extracted from the statistic information file. Below is shown a display image (file name: 20010529NECStorage4100_psl_dp.txt).

```
<< DISK DIRECTOR PORT PERFORMANCE REPORT >>

disk array name  NECStorage4100

port no = 00h-00h

<table>
<thead>
<tr>
<th>date</th>
<th>time</th>
<th>iops</th>
<th>trrate (MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>total</td>
<td>read</td>
<td>write</td>
<td>total</td>
<td>read</td>
</tr>
<tr>
<td>01-05-29 18:17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>01-05-29 18:22</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>* 01-05-29 18:27</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>01-05-29 18:32</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

port no = 00h-01h

<table>
<thead>
<tr>
<th>date</th>
<th>time</th>
<th>iops</th>
<th>trrate (MB/s)</th>
<th>av.len(KB)</th>
<th>av.resp(ms)</th>
<th>w.ratio(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>total</td>
<td>read</td>
<td>write</td>
<td>total</td>
<td>read</td>
</tr>
<tr>
<td>01-05-29 18:17</td>
<td>267.99</td>
<td>147.42</td>
<td>120.57</td>
<td>12.63</td>
<td>7.92</td>
<td>4.71</td>
</tr>
<tr>
<td>01-05-29 18:22</td>
<td>268.41</td>
<td>148.41</td>
<td>120.00</td>
<td>12.86</td>
<td>8.18</td>
<td>4.70</td>
</tr>
<tr>
<td>* 01-05-29 18:27</td>
<td>264.82</td>
<td>148.90</td>
<td>105.92</td>
<td>12.29</td>
<td>7.77</td>
<td>4.62</td>
</tr>
</tbody>
</table>

port no = xxh-xxh

PERFORMANCE REPORT SUCCESSFUL.

- Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>port no</td>
<td>Number of the disk director port</td>
</tr>
<tr>
<td>Leftmost position (configuration change mark)</td>
<td>An asterisk is displayed immediately after change in the disk array configuration or restart of accumulation of statistic information.</td>
</tr>
<tr>
<td>date, time</td>
<td>Date and time statistic information was collected</td>
</tr>
<tr>
<td>iops</td>
<td>Internal I/O density (count/second) in the accumulation period</td>
</tr>
<tr>
<td>trrate</td>
<td>Internal transfer rate (megabyte/second) in the accumulation period</td>
</tr>
<tr>
<td>av.len</td>
<td>Internal average transfer length (kilobyte) in the accumulation period</td>
</tr>
<tr>
<td>av.resp</td>
<td>Internal average response time (millisecond) in the accumulation period</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio (percent) of write I/O in the accumulation period</td>
</tr>
</tbody>
</table>
(5) Logical disk performance detail report

Chronologically displays disk-based statistic information on the logical disk extracted from the statistic information file. Below is shown a display image (file name: 20010529NECStorage4100_psl_ld.txt).

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Total Read</th>
<th>Total Write</th>
<th>Read</th>
<th>Write</th>
<th>Total Read</th>
<th>Total Write</th>
<th>Read</th>
<th>Write</th>
<th>Total Read</th>
<th>Total Write</th>
<th>Read</th>
<th>Write</th>
<th>Read</th>
<th>Write</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-05-29 18:17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>01-05-29 18:22</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>01-05-29 18:27</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>01-05-29 18:32</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Total Read</th>
<th>Total Write</th>
<th>Read</th>
<th>Write</th>
<th>Total Read</th>
<th>Total Write</th>
<th>Read</th>
<th>Write</th>
<th>Read</th>
<th>Write</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-05-29 18:17</td>
<td>99.82</td>
<td>73.84</td>
<td>25.98</td>
<td>4.20</td>
<td>2.70</td>
<td>1.50</td>
<td>43.12</td>
<td>37.43</td>
<td>59.28</td>
<td>50.53</td>
</tr>
<tr>
<td>01-05-29 18:22</td>
<td>147.48</td>
<td>107.18</td>
<td>40.31</td>
<td>6.65</td>
<td>4.31</td>
<td>2.34</td>
<td>46.16</td>
<td>41.18</td>
<td>59.39</td>
<td>50.73</td>
</tr>
<tr>
<td>01-05-29 18:27</td>
<td>156.12</td>
<td>115.62</td>
<td>40.50</td>
<td>7.01</td>
<td>4.65</td>
<td>2.36</td>
<td>45.99</td>
<td>41.21</td>
<td>59.63</td>
<td>50.98</td>
</tr>
<tr>
<td>01-05-29 18:32</td>
<td>138.98</td>
<td>100.06</td>
<td>38.92</td>
<td>6.34</td>
<td>4.10</td>
<td>2.25</td>
<td>46.75</td>
<td>41.91</td>
<td>59.17</td>
<td>50.44</td>
</tr>
</tbody>
</table>

**Explanation of display items**

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>disk no</td>
<td>Number of the logical disk</td>
</tr>
<tr>
<td>evn</td>
<td>Nickname of the logical disk</td>
</tr>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>disk no</td>
<td>Number of the logical disk</td>
</tr>
<tr>
<td>evn</td>
<td>Nickname of the logical disk</td>
</tr>
<tr>
<td>Date/time</td>
<td>Date and time statistic information was collected</td>
</tr>
<tr>
<td>iops</td>
<td>External I/O density (count/second) in the accumulation period</td>
</tr>
<tr>
<td>read</td>
<td>External I/O density for read I/O</td>
</tr>
<tr>
<td>write</td>
<td>External I/O density for write I/O</td>
</tr>
<tr>
<td>trrate</td>
<td>External transfer rate (megabyte/second) in the accumulation period</td>
</tr>
<tr>
<td>read</td>
<td>External transfer rate for read I/O</td>
</tr>
<tr>
<td>write</td>
<td>External transfer rate for write I/O</td>
</tr>
<tr>
<td>av.len</td>
<td>External average transfer length (kilobyte) in the accumulation period</td>
</tr>
<tr>
<td>read</td>
<td>External average transfer length for read I/O</td>
</tr>
<tr>
<td>write</td>
<td>External average transfer length for write I/O</td>
</tr>
<tr>
<td>av.resp</td>
<td>External average response time (millisecond) in the accumulation period</td>
</tr>
<tr>
<td>read</td>
<td>External average response time for read I/O</td>
</tr>
<tr>
<td>write</td>
<td>External average response time for write I/O</td>
</tr>
</tbody>
</table>
### Physical disk performance detail report

Chronologically displays disk-based statistic information on the physical disk extracted from the statistic information file. Below is shown a display image (file name: 20020927NECStorages4200_psa_pd.txt).

```
<< PHYSICAL DISK PERFORMANCE REPORT >>

disk array name NECStorage4100

disk no = 00h-00h

date time ---------- iops ---------- ------ trrate(MB/s) ------ ------- av.len(KB) ------- ------ av.resp(ms) ------- w.ratio(%)
total read write total read write total read write total read write total read write
01-05-29 18:17 36.75 20.37 16.68 1.64 1.04 0.63 46.37 52.96 38.44 7.76 8.04 7.43 45.38
01-05-29 18:22 54.24 29.89 24.35 2.50 1.58 0.92 47.27 54.27 38.68 7.66 7.86 7.43 44.90
* 01-05-29 18:27 56.62 31.06 25.56 2.59 1.63 0.96 46.87 53.81 38.45 7.56 7.80 7.26 45.15
01-05-29 18:32 53.87 30.28 23.59 2.42 1.54 0.96 46.87 53.81 38.45 7.56 7.80 7.26 45.15

: ::::::::::::::: :

disk no = 00h-01h

date time ---------- iops ---------- ------ trrate(MB/s) ------ ------- av.len(KB) ------- ------ av.resp(ms) ------- w.ratio(%)
total read write total read write total read write total read write total read write
01-05-29 18:17 34.64 19.03 15.61 1.66 1.04 0.62 48.96 55.76 40.68 7.60 7.91 7.22 45.06
01-05-29 18:22 51.48 28.52 22.97 2.48 1.57 0.91 49.32 56.45 40.45 7.45 7.67 7.18 44.61
* 01-05-29 18:27 53.77 29.63 24.15 2.58 1.62 0.95 49.10 56.13 40.46 7.40 7.57 7.19 44.90
01-05-29 18:32 50.76 28.74 22.02 2.41 1.54 0.87 48.64 54.77 40.45 7.32 7.34 7.30 43.38

: ::::::::::::::: :

disk no = xxh-xxh

date time ---------- iops ---------- ------ trrate(MB/s) ------ ------- av.len(KB) ------- ------ av.resp(ms) ------- w.ratio(%)
total read write total read write total read write total read write total read write
01-05-29 18:17 34.64 19.03 15.61 1.66 1.04 0.62 48.96 55.76 40.68 7.60 7.91 7.22 45.06
01-05-29 18:22 51.48 28.52 22.97 2.48 1.57 0.91 49.32 56.45 40.45 7.45 7.67 7.18 44.61
* 01-05-29 18:27 53.77 29.63 24.15 2.58 1.62 0.95 49.10 56.13 40.46 7.40 7.57 7.19 44.90
01-05-29 18:32 50.76 28.74 22.02 2.41 1.54 0.87 48.64 54.77 40.45 7.32 7.34 7.30 43.38

: ::::::::::::::: :

PERFORMANCE REPORT SUCCESSFUL.
```
- Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>disk name</td>
<td>Number of the physical disk</td>
</tr>
<tr>
<td>Leftmost position (configuration change mark)</td>
<td>An asterisk is displayed immediately after change in the disk array configuration or restart of accumulation of statistic information.</td>
</tr>
<tr>
<td>date, time</td>
<td>Date and time statistic information was collected</td>
</tr>
<tr>
<td>iops</td>
<td>Internal I/O density (count/second) in the accumulation period</td>
</tr>
<tr>
<td>total:</td>
<td>Internal I/O density for all I/O</td>
</tr>
<tr>
<td>read:</td>
<td>Internal I/O density for read I/O</td>
</tr>
<tr>
<td>write:</td>
<td>Internal I/O density for write I/O</td>
</tr>
<tr>
<td>trrate</td>
<td>Internal transfer rate (megabyte/second) in the accumulation period</td>
</tr>
<tr>
<td>total:</td>
<td>Internal transfer rate for all I/O</td>
</tr>
<tr>
<td>read:</td>
<td>Internal transfer rate for read I/O</td>
</tr>
<tr>
<td>write:</td>
<td>Internal transfer rate for write I/O</td>
</tr>
<tr>
<td>av.len</td>
<td>Internal average transfer length (kilobyte) in the accumulation period</td>
</tr>
<tr>
<td>total:</td>
<td>Internal average transfer length for all I/O</td>
</tr>
<tr>
<td>read:</td>
<td>Internal average transfer length for read I/O</td>
</tr>
<tr>
<td>write:</td>
<td>Internal average transfer length for write I/O</td>
</tr>
<tr>
<td>av.resp</td>
<td>Internal average response time (millisecond) in the accumulation period</td>
</tr>
<tr>
<td>total:</td>
<td>Internal average response time for all I/O</td>
</tr>
<tr>
<td>read:</td>
<td>Internal average response time for read I/O</td>
</tr>
<tr>
<td>write:</td>
<td>External average response time for write I/O</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio (percent) of write I/O in the accumulation period</td>
</tr>
<tr>
<td>busy</td>
<td>Average busy ratio (percent) in the accumulation period. If there is no information, busy ratio is displayed as “<em><strong>.</strong></em>”.</td>
</tr>
</tbody>
</table>
### (7) RANK performance detail report

Chronologically displays RANK-based statistic information on the RANK retrieved from the statistic information file. A display image (file name: 20020927NECStorage4200_psa_rank.txt) is shown below.

```
<< RANK PERFORMANCE REPORT >>

disk array name               NECStorage4100

rank no = 00h-00h

<table>
<thead>
<tr>
<th>date</th>
<th>time</th>
<th>iops</th>
<th>tmarl(MB/s)</th>
<th>av.len(KB)</th>
<th>avresp(ms)</th>
<th>w.ratio(%)</th>
<th>busy(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02-09-27</td>
<td>11:42</td>
<td>0.69</td>
<td>0.00</td>
<td>0.69</td>
<td>0.00</td>
<td>0.69</td>
<td>100.00</td>
</tr>
<tr>
<td>*</td>
<td>02-09-27</td>
<td>11:57</td>
<td>68.43</td>
<td>16.90</td>
<td>0.00</td>
<td>16.90</td>
<td>99.97</td>
</tr>
<tr>
<td>&gt; 02-09-27</td>
<td>12:57</td>
<td>47.69</td>
<td>27.38</td>
<td>253.31</td>
<td>251.65</td>
<td>25.39</td>
<td>53.56</td>
</tr>
</tbody>
</table>

rank no = 00h-01h

<table>
<thead>
<tr>
<th>date</th>
<th>time</th>
<th>iops</th>
<th>tmarl(MB/s)</th>
<th>av.len(KB)</th>
<th>avresp(ms)</th>
<th>w.ratio(%)</th>
<th>busy(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02-09-27</td>
<td>11:42</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>*</td>
<td>02-09-27</td>
<td>11:57</td>
<td>43.34</td>
<td>10.81</td>
<td>0.00</td>
<td>10.81</td>
<td>17.19</td>
</tr>
<tr>
<td>&gt; 02-09-27</td>
<td>12:57</td>
<td>43.34</td>
<td>10.81</td>
<td>255.36</td>
<td>255.36</td>
<td>7.78</td>
<td>0.82</td>
</tr>
</tbody>
</table>

rank no = xxh-xxh

PERFORMANCE REPORT SUCCESSFUL.
```
### Explanation of display items

<table>
<thead>
<tr>
<th>Display item</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk array name</td>
<td>Nickname of the disk array</td>
</tr>
<tr>
<td>rank no</td>
<td>RANK number</td>
</tr>
<tr>
<td>First column</td>
<td>An asterisk is displayed immediately after changes have been made to the disk array configuration or the accumulation of statistic information has been restarted.</td>
</tr>
<tr>
<td>Second column</td>
<td>A greater-than sign ‘&gt;’ is displayed when a logical disk has been transferred to the RANK from another RANK by the performance optimization function.</td>
</tr>
<tr>
<td>date, time</td>
<td>Date and time when statistic information was collected.</td>
</tr>
<tr>
<td>iops</td>
<td>I/O density (number of times/second) in the calculating period</td>
</tr>
<tr>
<td>ttrate</td>
<td>External transfer rate (megabytes/second) in the calculating period</td>
</tr>
<tr>
<td>av.len</td>
<td>External average transfer length (kilobytes) in the calculating period</td>
</tr>
<tr>
<td>av.resp</td>
<td>External average response (millisecond) in the calculating period</td>
</tr>
<tr>
<td>w.ratio</td>
<td>Ratio of Write I/O (percent) in the calculating period</td>
</tr>
<tr>
<td>busy</td>
<td>Busy Ratio of the RANK</td>
</tr>
<tr>
<td></td>
<td>‘*<strong>.</strong>’ is displayed if the information of the busy ratio does not exist.</td>
</tr>
</tbody>
</table>
Appendix D  Estimation of NEC Storage Performance Monitor File Size

The size of a statistic information history file and a statistic information summarized file can be estimated by applying the number of disk array components (the number of host ports (HPs), disk ports (DPs), logical disks (LDs), physical disks (PDs), replication directors (RDs) number of cache (CACHE), and RANKs), the storage period of statistic information, and logging Interval time to the following equations:

The size of the statistic information history file (byte) = \( A + (B \times \frac{\text{Statistic information storage period (second)}}{\text{Logging Interval time (second)}}) \)

\[ A = 272 + (\text{Number of HPs} \times 4) + (\text{Number of DPs} \times 4) + (\text{Number of LDs} \times 48) + (\text{Number of PDs} \times 48) + (\text{Number of RDs} \times 16) + (\text{Number of CACHE} \times 16) + m \]

\( m: \) A value obtained by calculating \( h \) by each RANK according to the following equations and summing up the individual values of all the RANKs

\[ h = 32 + i + j \]

- When the quotient of \((\text{Number of LDs in a RANK} \times 2) \div 16\) is \( a \) and the remainder is \( b \),
  - \( b \neq 0 \): \( i = (a + 1) \times 16 \)
  - \( b = 0 \): \( i = a \times 16 \)

- When the quotient of \((\text{Number of PDs in a RANK} \times 1) \div 16\) is \( c \) and the remainder is \( d \),
  - \( d \neq 0 \): \( j = (c + 1) \times 16 \)
  - \( d = 0 \): \( j = c \times 16 \)

\[ B = 80 + (\text{Number of HPs} \times 112) + (\text{Number of DPs} \times 48) + (\text{Number of LDs} \times 96) + (\text{Number of PDs} \times 64) + (\text{Number of RDs} \times 272) + (\text{Number of CACHE} \times 272) + (\text{Number of RANKs} \times 64) \]

The size of the statistic information primary summarized file (byte) = \( C + (D \times \text{Hours for a day (24)}) \)

The size of the statistic information secondary summarized file (byte) = \( C + (D \times \text{Days for a month (28 - 31)}) \)

\[ C = 272 + (\text{Number of HPs} \times 4) + (\text{Number of DPs} \times 4) + (\text{Number of LDs} \times 48) + (\text{Number of PDs} \times 48) + n \]

\( n: \) A value calculated in the same manner as for \( m \) to determine the size of the statistic information history file

\[ D = 80 + (\text{Number of HPs} \times 192) + (\text{Number of DPs} \times 80) + (\text{Number of LDs} \times 176) + (\text{Number of PDs} \times 112) + (\text{Number of RANKs} \times 112) \]

Moreover, the file size calculated by the equations above assumes a general case. If the configuration or logical disk name is changed or a logical disk is transferred during the statistic information accumulation period, the actual file size becomes larger than the calculated size.
Furthermore, if there is a period in which there is no input or output during the statistic information storage period, the actual file size may become smaller than the calculated size.

Example: With regard to the disk array with the number of HPs:2, DPs:2, LDs:8, PDs:8, no RDs, the number of CACHE:1, and the number of RANKs:2 (the number of LDs and PDs is 4), the size of the statistic information history file obtained by accumulating statistic information for one day based on the logging Interval time of 5 minutes

\[
A = 272 + (2 \times 4) + (2 \times 4) + (8 \times 48) + (8 \times 48) + (0 \times 16) + (1 \times 16) + ((32 + 16 + 16) + (32 + 16 + 16)) = 1,200
\]

\[
B = 80 + (2 \times 112) + (2 \times 48) + (8 \times 96) + (8 \times 64) + (0 \times 272) + (1 \times 272) + (2 \times 64)
\]

\[= 2,080\]

The size of the statistic information history file (byte) = 1,200 + 2,080 × ((24 × 60 × 60) ÷ (5 × 60)) = 678,304 (byte)
Appendix E  Estimating Size of NEC Storage PerformanceOptimizer Files

The size of a performance optimizing log file can be estimated by applying the number of disk array components (the number of RANKs and logical disks (LDs)), the storage period of statistic information, and logging Interval time to the following equations:

The size of the log file (byte) = 80 + A × (Statistic information storage period (minute) ÷ Logging Interval (minute))

A = 80 + Number of RANKs × 16 + Number of LDs × 4 + m

m: A value obtained by calculating h by each RANK according to the following equations and summing up the individual values of all the RANKs

h = 4 × i

• When the quotient of (Number of LDs in a RANK × ÷ 4) is a and the remainder is b,
  
b ≠ 0; i = 4 - b
  
b = 0; i = 0

Moreover, the file size calculated by the equations above assumes a general case. If the configuration is changed or a logical disk is transferred during the statistic information accumulation period, the actual file size becomes larger than the calculated size.

Example: With regard to the disk array with the number of RANKs:10 and LDs:160, the size of the performance optimizing log file obtained by accumulating statistic information for thirty days based on the logging Interval time of 30 minutes

A = 80 + 10 × 16 + 160 × 4 = 880

The size of the log file (byte) = 80 + 880 × ((30 × 24 × 60) ÷ 30) = 1,267,280 (byte)

Furthermore, an index file (file name :OPTDFASTF) that manages the performance optimizing log file is also created in the same directory as the performance optimizing log file.

File name = OPTDFASTF

The size of the index file (byte) = 80 + (240 + Number of RANKs × 16) × Number of target disk arrays × 2

Example: Number of RANKs:10, disk arrays: the size of 3 cabinets

The size of the index file (byte) = 80 + (240 + 10 × 16) × 3 × 2 = 2,480 (byte)
Appendix F Example of Performance Improvement

This section presents a case study of building a 10-thousand user scale mail-server system using the NEC Storage series disk devices. The case shows an example of analyzing the causes of failing in achieving performance capabilities, using the performance monitoring function.

By converting statistic information history files/summarized files into CSV format files and using tools like Microsoft® Excel2000, graphs shown in the following figure are created (Note 1).

(Note 1)
The disk capacities and RAID configuration of disks are examples for reference. Note that they does not necessarily indicate actual processing capabilities or feasible RAID configurations.
On the basis of study of the graph, the system is analyzed and possible actions are suggested as follows:

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of writing access is greater than reading accesses.</td>
<td>Change RAID configuration into RAID10.</td>
</tr>
<tr>
<td>Accesses exceeding disk performance limit are occurring.</td>
<td>Add extra disk devices to distribute the loads.</td>
</tr>
</tbody>
</table>
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