



**EXPRESSCLUSTER X 5.1 for Windows
Maintenance Guide**

Release 3

NEC Corporation

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1.1 Who Should Use This Guide

The EXPRESSCLUSTER X Maintenance Guide describes maintenance-related information, intended for administrators. See this guide for information required for operating the cluster.

1.2 How This Guide is Organized

- *2. The system maintenance information:* Provides maintenance information for EXPRESSCLUSTER.

1.3 EXPRESSCLUSTER X Documentation Set

The EXPRESSCLUSTER X manuals consist of the following four guides. The title and purpose of each guide is described below:

Getting Started Guide

This guide is intended for all users. The guide covers topics such as product overview, system requirements, and known problems.

Installation and Configuration Guide

This guide is intended for system engineers and administrators who want to build, operate, and maintain a cluster system. Instructions for designing, installing, and configuring a cluster system with EXPRESSCLUSTER are covered in this guide.

Reference Guide

This guide is intended for system administrators. The guide covers topics such as how to operate EXPRESSCLUSTER, function of each module and troubleshooting. The guide is supplement to the "Installation and Configuration Guide".

Maintenance Guide

This guide is intended for administrators and for system administrators who want to build, operate, and maintain EXPRESSCLUSTER-based cluster systems. The guide describes maintenance-related topics for EXPRESSCLUSTER.

1.4 Conventions

In this guide, **Note**, **Important**, **See also** are used as follows:

Note: Used when the information given is important, but not related to the data loss and damage to the system and machine.

Important: Used when the information given is necessary to avoid the data loss and damage to the system and machine.

See also:

Used to describe the location of the information given at the reference destination.

The following conventions are used in this guide.

Convention	Usage	Example
Bold	Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.	In User Name, type your name. On the File menu, click Open Database.
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	<code>clpstat -s [-h <i>host_name</i>]</code>
Monospace	Indicates path names, commands, system output (message, prompt, etc), directory, file names, functions and parameters.	<code>c:\Program files\ EXPRESSCLUSTER</code>
bold	Indicates the value that a user actually enters from a command line.	Enter the following: clpcl -s -a
<i>italic</i>	Indicates that users should replace italicized part with values that they are actually working with.	<code>clpstat -s [-h <i>host_name</i>]</code>



In the figures of this guide, this icon represents EXPRESSCLUSTER.

1.5 Contacting NEC

For the latest product information, visit our website below:

<https://www.nec.com/global/prod/expresscluster/>

THE SYSTEM MAINTENANCE INFORMATION

This chapter provides information you need for maintenance of your EXPRESSCLUSTER system. Resources to be managed are described in detail.

This chapter covers:

- 2.1. *Directory structure of EXPRESSCLUSTER*
- 2.2. *How to delete EXPRESSCLUSTER logs or alerts*
- 2.3. *Mirror statistics information collection function*
- 2.4. *System resource statistics information collection function*
- 2.5. *Process resource statistics information collection function*
- 2.6. *Cluster statistics information collection function*
- 2.7. *Function for outputting the operation log of Cluster WebUI*
- 2.8. *Communication ports*
- 2.9. *Limit on the band for mirror disk connect communication*
- 2.9.2. *Procedure for suspending or releasing the limit on the band for mirror disk connect communication*
- 2.11. *Configuring the settings to temporarily prevent execution of failover*
- 2.12. *How to execute chkdsk/defrag*
- 2.13. *How to replace a server with a new one*
- 2.14. *Wait time for synchronized cluster startup*
- 2.15. *Changing the server configuration (add/delete)*
- 2.16. *Changing the server IP address*
- 2.17. *Changing the host name*
- 2.18. *Replacing the network card*
- 2.19. *Changing the disk configuration - For a shared disk -*
- 2.20. *Changing the disk configuration - For a mirror disk -*
- 2.21. *Backing up/restoring data*
- 2.22. *Performing a snapshot backup*
- 2.23. *How to back up a mirror/hybrid disk to its disk image*
- 2.24. *How to restore the mirror/hybrid disk from the disk image*
- 2.25. *Restoring the system disk*

- *2.26. Replacing the shared disk*
- *2.27. Replacing the mirror disk*
- *2.28. Replacing the hybrid disk*
- *2.29. Increasing the shared disk size*
- *2.30. Increasing the mirror disk size*
- *2.31. Increasing the hybrid disk size*
- *2.32. Replacing the disk array controller (DAC)/updating the firmware*
- *2.33. Replacing FibreChannel HBA / SCSI / SAS controller*
- *2.34. Updating data encryption key file of mirror/hybrid disk resources*
- *2.35. Information required for inquiry*

2.1 Directory structure of EXPRESSCLUSTER

Note: You will find executable files and script files that are not described in "EXPRESSCLUSTER command reference" in the "Reference Guide" under the installation directory. Run these files only with EXPRESSCLUSTER. Any failures or troubles caused by executing them by using applications other than EXPRESSCLUSTER are not supported.

EXPRESSCLUSTER directories are structured as described below:

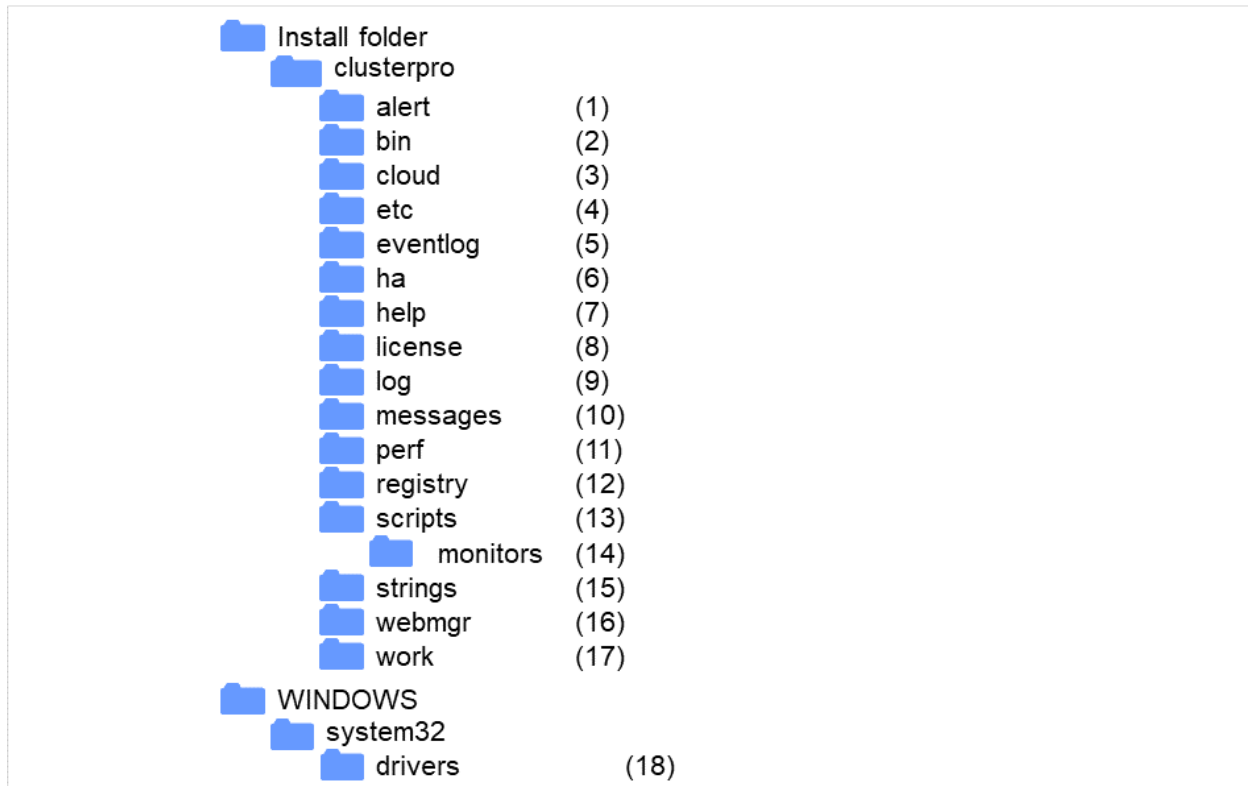


Fig. 2.1: Directory structure

1. Directory for alert synchronization
This directory stores EXPRESSCLUSTER Alert Synchronization's modules and management files.
2. Directory for cluster modules
This directory stores the EXPRESSCLUSTER Server's executable files and libraries.
3. Directory for cloud environment
This directory stores script files for cloud environment.
4. Directory for cluster configuration data
This directory stores the cluster configuration files and policy file of each module.
5. Directory for event logs
This directory stores libraries that are related to the EXPRESSCLUSTER event logs.
6. Directory for HA products
The directory stores binary files and setting files of Java Resource Agent and System Resource Agent.

7. Directory related to Help
Not used now.
8. Directory for licenses
This directory stores licenses for licensed products.
9. Directory for module logs
This directory stores logs produced by each module.
10. Directory for report messages (alert, event log)
This directory stores alert and event log messages reported by each module.
11. Directory for performance log
This directory stores performance log of mirror or hybrid disk resources and system resource of OS.
12. Directory for the registry
Not used now.
13. Directory for script resource scripts of group resources
This directory stores script resource scripts of group resources.
14. Directory for the recovery script executed
This directory stores the script executed when an error is detected in the group resource or monitor resource.
15. Directory for the string table
This directory stores string tables used in EXPRESSCLUSTER.
16. Directory for the WebManager server and Cluster WebUI.
This directory stores the WebManager server modules and management files.
17. Directory for module tasks
This is a work directory for modules.
18. Directory for cluster drivers
This directory stores drivers for kernel mode LAN heartbeat and disk filter.

2.2 How to delete EXPRESSCLUSTER logs or alerts

To delete EXPRESSCLUSTER logs or alerts, perform the following procedure.

1. Disable all cluster services on all servers in a cluster.

```
clpsscctrl.bat --disable -a
```

2. Shut down the cluster with the Cluster WebUI or clpstdn command, and then reboot the cluster.
3. To delete logs, delete the files in the following folder. Perform this operation on the server for which you want to delete the logs.
 - <EXPRESSCLUSTER installation path>\log
4. To delete alerts, delete the files in the following folder. Perform this operation on the server for which you want to delete the alerts.
 - <EXPRESSCLUSTER installation path>\log
5. Enable all cluster services on all servers in a cluster.

```
clpsscctrl.bat --enable -a
```

6. Restart all the servers in the cluster.

2.3 Mirror statistics information collection function

2.3.1 What is the mirror statistics information collection function?

The mirror statistics information collection function collects statistics information related to the mirror function that is obtained from each mirror source in mirror disk and hybrid disk configurations.

Using the Windows OS functions (performance monitor and typeperf command), the mirror statistics information collection function can collect mirror statistics information for EXPRESSCLUSTER X and display the collected information in real time. Moreover, it can continuously output mirror statistics information to a statistic log file from the instant that the mirror is constructed.

As shown below, the collected mirror statistics information can be used during mirror construction and mirror operation.

During mirror construction	To tune the mirror setting items in the current environment, you can adjust the optimum setting by checking how each setting item influences the current environment.
During mirror operation	You can monitor the situation to determine whether a problem is likely to occur. Moreover, analysis performance improves because mirror statistics information can be collected before and after failure occurrence.

2.3.2 Linkage between the mirror statistics information collection function and OS standard functions

- **Using the OS standard functions**

Using the performance monitor and typeperf command, mirror statistics information can be collected and that information displayed in real time. Any counter can be selected from the subsequent "Counter names" list to continuously display and collect information over a fixed period of time. This allows you to visually check whether the mirror-related setting values are suitable for the constructed environment or whether an error has occurred during the collection of the statistics information.

For the procedure for using the performance monitor and typeperf command, see the subsequent items "Displaying mirror statistics information with the performance monitor," "Collecting mirror statistics information from the performance monitor", and "Collecting mirror statistics information from the typeperf command."

- **Specifying an object name**

The object name used with the mirror statistics information collection function is "Cluster Disk Resource Performance" Specifying the "Cluster Disk Resource Performance" object enables the collection of mirror statistics information.

- **Specifying a counter name**

The counter names used by the mirror statistics information collection function are listed below.

Counter name	Meaning	Unit	Description
% Compress Ratio	Compression ratio	%	Compression ratio of the mirror data to be sent to a remote server. The ratio of the compressed data size relative to the original data is used. Therefore, if 100 MB of data is compressed to 80 MB, the compression ratio is 80%.
Async Application Queue Bytes Async Application Queue Bytes, Max	Application queue size (instantaneous value/maximum value)	Byte	Amount of data which is retained in the user space memory and which has yet to be sent during asynchronous mirror communication. The value that appears when the latest data is collected is an instantaneous value while the value that appears when the amount of data to be retained is the greatest is the maximum value.
Async Kernel Queue Bytes Async Kernel Queue Bytes, Max	Kernel queue size (instantaneous value/maximum value)	Byte	Amount of data which is retained in the kernel space memory and which has yet to be sent during asynchronous mirror communication. The value that appears when the latest data is collected is an instantaneous value while the value that appears when the amount of data to be retained is the greatest is the maximum value.
Async Mirror Queue Transfer Time Async Mirror Queue Transfer Time, Max	Time for transfer from the kernel queue to the application queue (average value/maximum value)	msec	Average value/maximum value of the time needed to transfer data from the kernel space memory to the user space memory during asynchronous mirror communication
Async Mirror Send Wait History Files Total Bytes Async Mirror Send Wait History Files Total Bytes, Max	History file usage (instantaneous value/maximum value)	Byte	Total size of the data files accumulated in the history file storage folder and which have yet to be sent during asynchronous mirror communication. The value that appears when the latest data is collected is an instantaneous value while the value that appears when the amount of accumulated data is the greatest is the maximum value.
Async Mirror Send Wait Total Bytes Async Mirror Send Wait Total Bytes, Max	Amount of data yet to be sent (instantaneous value/maximum value)	Byte	Total amount of mirror data which is to be sent to a remote server and which has yet to be sent during asynchronous mirror communication. The value that appears when the latest data is collected is an instantaneous value while the value that appears when the amount of data that has yet to be sent is the greatest is the maximum value.

Continued on next page

Table 2.2 – continued from previous page

Counter name	Meaning	Unit	Description
Mirror Bytes Sent Mirror Bytes Sent/sec	Mirror transmission amount (total value/average value)	Byte (Byte/sec)	Number of bytes of mirror data sent to a remote server. The total number of bytes that appears until the latest data is collected is the total value while the number of bytes to be sent per second is the average value.
Request Queue Bytes Request Queue Bytes, Max	Request queue size (instantaneous value/maximum value)	Byte	Amount of queue used when an IO request is received during mirror communication. The value that appears when the latest data is collected is an instantaneous value while that the value that appears when the queue size is the greatest is the maximum value.
Transfer Time, Avg Transfer Time, Max	Mirror communication time (average value/maximum value)	msec/time	Communication time per mirror communication used during mirror data transmission. The communication time averaged by the number of times of mirror communication used until the latest data is collected is the average value while the communication time per mirror communication which was the greatest is the maximum value.

- **Specifying the instance name**

The instance name to be used by the mirror statistics information collection function is "MD,HD ResourceX." X indicates a mirror disk number/hybrid disk number from 1 to 22.

For example, if the mirror disk number of mirror disk resource "MD" is set to "2", the mirror statistics information relating to resource "MD" can be collected by specifying instance "MD,HD Resource2."

Moreover, if two or more resources are set, specifying instance "_Total" can collect information totalized by mirror statistics information relating to all resources that have been set.

Note: Specify the instance name corresponding to the mirror disk number/hybrid disk number for which a resource is set. An instance for which no resource is set can be specified; however, mirror statistics information cannot be displayed/collected.

- **Using mirror statistics information**

Mirror statistics information that has actually been collected can be used to adjust the mirror-related setting values. If, for example, the communication speed and communication load can be confirmed from the collected mirror statistics information, it may be possible to improve the communication speed by turning the mirror-related setting values.

- **Displaying mirror statistics information with the performance monitor**

Procedure for displaying the mirror statistics information to be collected in real time

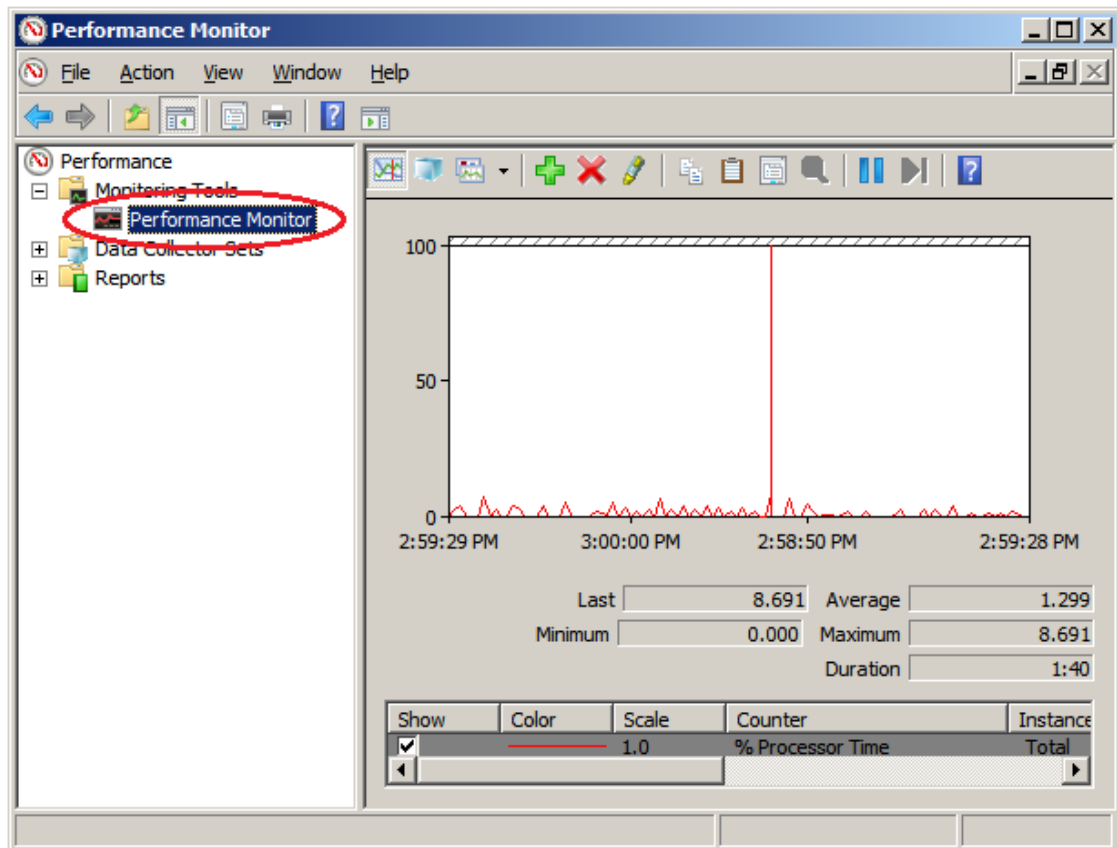
1. From the **Start** menu, start **Administrative Tools - Performance Monitor**.
2. Select the performance monitor.

3. Click the + button or right-click to execute **Add Counters** from the menu.
4. Save the counter setting added with **File - Save as**.
5. Starting from the saved setting, you can repeatedly use the same counter setting.

The procedure is detailed below.

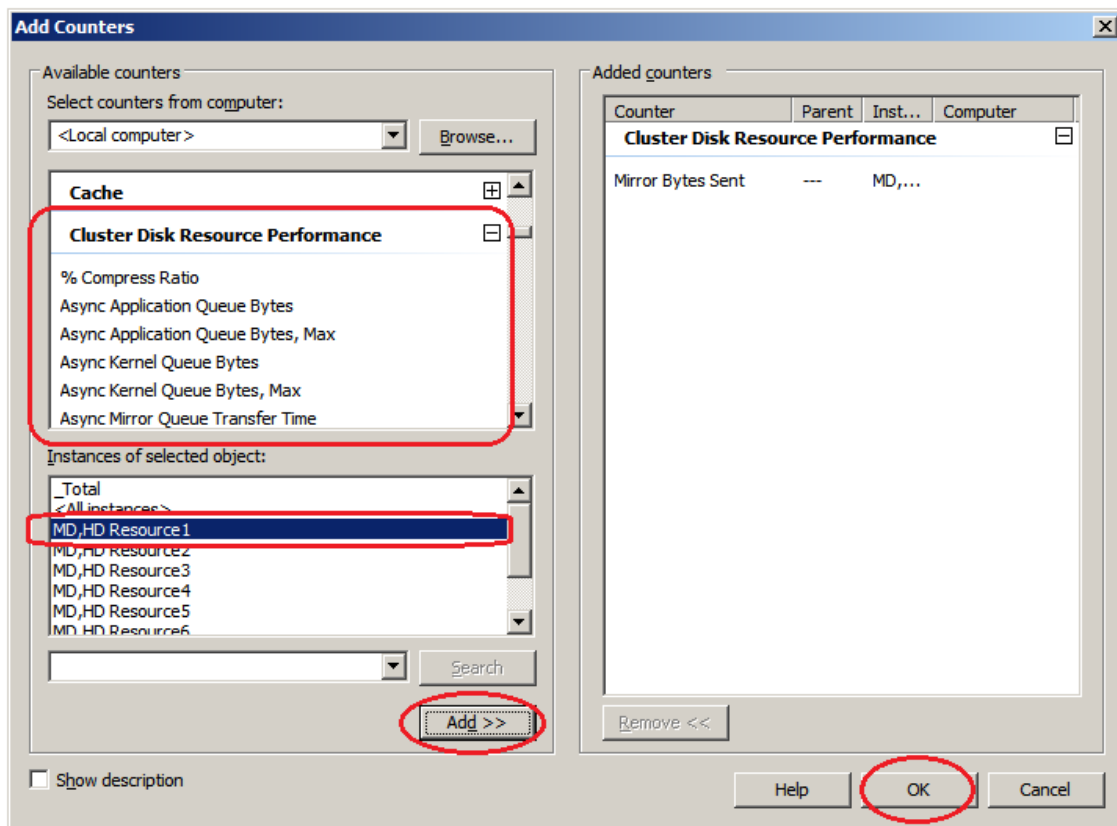
Here, "Mirror Bytes Sent," or one item of mirror statistics information, is collected as an example. The target instance is assumed to be "MD/HD Resource1."

1. From the **Start** menu, start **Administrative Tools - Performance**.
2. From the left-hand menu tree in the window, select **Performance Monitor**.



The performance monitor window appears on the right-hand side of the window.

3. Click the + button or right-click to execute **Add Counters** from the menu.



If the operation conditions are satisfied, the additional counter/instance is displayed.

Select **Cluster Disk Resource Performance**, select counter **Mirror Bytes Sent** and instance **MD,HD Resource1** and then click **Add**.

Note: If **Cluster Disk Resource Performance** is not displayed, the linkage function is disabled. In this case, execute the following command at the command prompt to enable the linkage function, and then retry the procedure from step 1.

```
>lodctr.exe <EXPRESSCLUSTER installation path>\perf\clpdiskperf.ini
```

4. Save the counter setting added with **File - Save as**.
 5. Starting from the saved setting, you can repeatedly use the same counter setting.
- **Collecting mirror statistics information from the performance monitor**

The following explains the procedure for collecting the log file of mirror statistics information from the performance monitor.

Procedure for collecting the log file

1. From the **Start** menu, start **Administrative Tools - Performance Monitor**.
2. Create a new data collector set with **Data Collector Sets - User Defined**.
3. From **Create Data Log**, select **Performance Counter** and then click **Add**.
4. Select **Cluster Disk Resource Performance** and then add the counter and instance to be collected.

5. Start log collection.

The procedure is detailed below.

Here, "Mirror Bytes Sent," or one item of mirror statistics information, is collected as an example. The target instance is assumed to be "MD/HD Resource1."

1. From the **Start** menu, start **Administrative Tools - Performance Monitor**.
2. From **Data Collector Sets - User Defined**, select **Operation - New**, or from **New** of the right-click option, specify **Data Collector Set**.
 - Enter any name as the data collector set name.
 - As the data collector set creation method, select **Create manually (Details) (C)**.
3. From **Create Data Log**, select **Performance Counter** and then click **Add**.
4. Add a counter. Here, after selecting **Mirror Bytes Sent** from **Cluster Disk Resource Performance**, select **MD,HD Resource1** from **Instances of Selected object**, and then click **Add**.
MD,HD Resource1 of **Mirror Bytes Sent** is added to **Added Counter**.
After adding all the counters to be collected, click **OK** and then select **Finish**.

Note: If **Cluster Disk Resource Performance** is not displayed, the linkage function is disabled. In this case, execute the following command at the command prompt to enable the linkage function, and then retry the procedure from step 1.

```
>lodctr.exe <EXPRESSCLUSTER installation path>\perf\clpdiskperf.ini
```

5. Start log collection. Execute **Start** from the menu with **Data Collector Sets - User Defined - (Data Collector Set Name)**.

- **Collecting mirror statistics information from the typeperf command**

The following explains the procedure for collecting the mirror statistics information from the typeperf command.

1. From the **Start** menu, start **Programs - Accessories - Command Prompt**.
2. Execute typeperf.exe.

The following explains the use example in detail.

[Use example 1] Collecting the mirror communication time (specifying all instances **EXPRESSCLUSTER Resource**)

Case in which MD resources: md01 to md04 and HD resources: hd05 to hd08 are already registered
However, each resource is set as follows:

```
The md01 mirror disk number is 1.
The md02 mirror disk number is 2.
:
The hd07 hybrid disk number is 7.
The hd08 hybrid disk number is 8.
```

In line 1 below, the typeperf command is executed to collect the mirror communication time.
Lines 2 through 11 show the column headers of the results.

Here, the column headers are separated into each of the lines for readability, which are actually printed in one line.

From line 12, the actually collected statistics data is displayed.

Columns separated by "," indicate the following values, starting from left to right:

```
"Sampling time", each communication time of "md01", "md02", "md03", "md04  
↪", "hd05", "hd06", "hd07", and "hd08"
```

```
1 C:\>typeperf "\Cluster Disk Resource Performance(*)\Transfer Time, Avg"  
2 "(PDH-CSV 4.0)", "\\v-ralw2012\Cluster Disk Resource Performance(*)\  
↪Transfer Time, Avg",  
3 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource1)\Transfer_  
↪Time, Avg",  
4 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource2)\Transfer_  
↪Time, Avg",  
5 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource3)\Transfer_  
↪Time, Avg",  
6 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource4)\Transfer_  
↪Time, Avg",  
7 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource5)\Transfer_  
↪Time, Avg",  
8 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource6)\Transfer_  
↪Time, Avg",  
9 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource7)\Transfer_  
↪Time, Avg",  
10 "\\v-ralw2012\Cluster Disk Resource Performance(MD/HD Resource8)\Transfer_  
↪Time, Avg",  
11 "\\v-ralw2012\Cluster Disk Resource Performance(_Total)\Transfer Time, Avg  
↪"  
12 "03/03/2010 15:21:24.546", "0.24245658", "0.3588965", "0.488589", "0.24245658  
↪", "0.3588965", "0.488577", "0.3588965", "0.488589"  
13 "03/03/2010 15:21:24.546", "0.21236597", "0.6465466", "0.488589", "0.24245658  
↪", "0.3588965", "0.488589", "0.2588965", "0.288589"  
14 "03/03/2010 15:21:24.546", "0.24465858", "0.7797976", "0.488589", "0.13123213  
↪", "0.4654699", "0.488544", "0.6588965", "0.288589"  
15 "03/03/2010 15:21:24.546", "0.85466658", "0.5555565", "0.488589", "0.24245658  
↪", "0.3588965", "0.485689", "0.7588965", "0.388589"  
16 "03/03/2010 15:21:24.546", "0.46564468", "0.3123213", "0.488589", "0.24245658  
↪", "0.4388965", "0.482289", "0.8888965", "0.338589"  
17 "03/03/2010 15:21:24.546", "0.85858998", "0.3588965", "0.488589", "0.44245658  
↪", "0.2288965", "0.483289", "0.3768965", "0.228589"  
18 "03/03/2010 15:21:24.546", "0.47987964", "0.3588965", "0.488589", "0.64245658  
↪", "0.1288965", "0.488214", "0.3488965", "0.428589"  
19 "03/03/2010 15:21:24.546", "0.88588596", "0.3588965", "0.488589", "0.84245658  
↪", "0.1588965", "0.484449", "0.3668965", "0.422589"
```

[Use example 2] Collecting the amount of mirror data transmission (specifying the hd05 resource for the instance)

Case in which MD resources: md01 to md04 and HD resources: hd05 to hd08 are already registered
However, each resource is set as follows:

```
The md01 mirror disk number is 1.  
The md02 mirror disk number is 2.  
:
```

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```
The hd07 hybrid disk number is 7.
The hd08 hybrid disk number is 8.
```

In line 1 below, the typeperf command is executed to collect the amount of mirror data transmission.
Line 2 shows the column headers of the results.
From line 3, the actually collected statistics data is displayed.
Columns separated by "," indicate the following values, starting from left to right:

"Sampling time", the amount of data transmission of "hd05"

```
1 C:\>typeperf "\Cluster Disk Resource Performance(MD/HD Resource5)\Mirror_
↪Bytes Sent/sec"
2 "(PDH-CSV 4.0)", "\\v-ra1w2012\Cluster Disk Resource Performance(MD/HD_
↪Resource5)\Mirror Bytes Sent/sec"
3 "03/03/2010 15:21:24.546", "52362",
4 "03/03/2010 15:21:24.546", "45564",
5 "03/03/2010 15:21:24.546", "25560",
6 "03/03/2010 15:21:24.546", "25450",
7 "03/03/2010 15:21:24.546", "22560",
8 "03/03/2010 15:21:24.546", "21597",
9 "03/03/2010 15:21:24.546", "35999",
10 "03/03/2010 15:21:24.546", "25668",
```

[Use example 3] Outputting the compression ratio to the log (specifying the hd01 resource for the instance)

Case in which MD resources: md01 to md04 and HD resources: hd05 to hd08 are already registered
However, each resource is set as follows:

```
The md01 mirror disk number is 1.
The md02 mirror disk number is 2.
:
The hd07 hybrid disk number is 7.
The hd08 hybrid disk number is 8.
```

CSV is specified as the log file format and C:\PerfData\hd01.csv as the file output destination path.

```
C:\>typeperf "\Cluster Disk Resource Performance(MD/HD Resource1)\%_
↪Compress Ratio" -f CSV -o C:\PerfData\hd01.csv
```

Use [Ctrl]+[C] to stop the log output after command execution.

[Use example 4] Displaying the counter list (specifying no instance)

Case in which MD resources: md01 to md04 and HD resources: hd05 to hd08 are already registered
However, each resource is set as follows:

```
The md01 mirror disk number is 1.  
The md02 mirror disk number is 2.  
:  
The hd07 hybrid disk number is 7.  
The hd08 hybrid disk number is 8.
```

In line 1 below, the typeperf command is executed to display the counter list.
From line 2, the counters are displayed.

```
1 C:\>typeperf -q "\ Cluster Disk Resource Performance"  
2 \Cluster Disk Resource Performance(*)\% Compress Ratio  
3 \Cluster Disk Resource Performance(*)\Async Application Queue Bytes  
4 \Cluster Disk Resource Performance(*)\Async Application Queue Bytes, Max  
5 \Cluster Disk Resource Performance(*)\Async Kernel Queue Bytes  
6 \Cluster Disk Resource Performance(*)\Async Kernel Queue Bytes, Max  
7 \Cluster Disk Resource Performance(*)\Async Mirror Queue Transfer Time  
8 \Cluster Disk Resource Performance(*)\Async Mirror Queue Transfer Time, ↵  
↵Max  
9 \Cluster Disk Resource Performance(*)\Async Mirror Send Wait History ↵  
↵Files Total Bytes  
10 \Cluster Disk Resource Performance(*)\Async Mirror Send Wait History ↵  
↵Files Total Bytes, Max  
11 \Cluster Disk Resource Performance(*)\Async Mirror Send Wait Total Bytes  
12 \Cluster Disk Resource Performance(*)\Async Mirror Send Wait Total Bytes, ↵  
↵Max  
13 \Cluster Disk Resource Performance(*)\Mirror Bytes Sent  
14 \Cluster Disk Resource Performance(*)\Mirror Bytes Sent/sec  
15 \Cluster Disk Resource Performance(*)\Request Queue Bytes  
16 \Cluster Disk Resource Performance(*)\Request Queue Bytes, Max  
17 \Cluster Disk Resource Performance(*)\Transfer Time, Avg  
18 \Cluster Disk Resource Performance(*)\Transfer Time, Max
```

In addition, sampling interval change, command issuance to a remote server, and the like can all be specified as options.

Use "Typeperf -?" to confirm the details of the options.

2.3.3 Operation of the mirror statistics information collection function

- **Mirror statistics information log output (automatic) during operation**

The mirror statistics information collection function continuously collects statistics information in the environment in which the operation condition is satisfied and then outputs it to the statistic log file. Mirror statistics information collection and log output are performed automatically. Statistic log output is detailed below.

Item	Operation	Description
Output file name	nmp_<n>.cur nmp_<n>.pre<x> nmp_total.cur nmp_total.pre<x>	<n> indicates the mirror disk No. or hybrid disk No. cur is the newest, followed by pre, pre1, pre2, ..., in the newest to oldest order. The larger the number, the older. When the prescribed number of log files is exceeded, existing logs are deleted, starting with the oldest. total indicates the total data of all mirror disk resources/hybrid disk resources.
Output file format	Text file	Data is output to the file in the comma-separated (CSV) text format. One-line data is output for each information collection.
Output destination folder	EXPRESSCLUSTER installation folder\ perf\disk	Data is output within the work folder immediately under the EXPRESSCLUSTER installation folder.
Resource to be output	For each resource + total	Log is output to one file for each mirror disk resource or hybrid disk resource that was set. If no resource is set, no log file is created. If one or more log files are created, the Total log file indicating the total value of all the resources is also created.
Output timing	Per minute	Information is output every minute. No log output occurs if the mirror statistics information output function is disabled. If the mirror statistics information log output operation is disabled, no log output occurs even though the mirror statistics information collection function is operating.

Continued on next page

Table 2.3 – continued from previous page

Item	Operation	Description
Output file size	About 16 MB	The maximum size of one file is about 16 MB. If the upper size limit is exceeded, the log file is automatically rotated and the previous log file is saved. Even if the upper size limit is not exceeded, the log file may be rotated automatically when the output data is changed.
Number of log rotations	12 generations	Up to 12 generations of log files are saved through log file rotations. If the upper rotation limit is exceeded, the oldest generation log file is automatically deleted.

2.3.4 Operation conditions of the mirror statistics information collection function

The mirror statistics information collection function runs when the following conditions are satisfied:

- The EXPRESSCLUSTER Disk Agent service is active normally.
- One or more mirror disk resources or hybrid disk resources are set.
- The mirror statistic information collection function is enabled in cluster properties.

Confirm the EXPRESSCLUSTER Disk Agent service status.

From the **Start** menu, start **Server Management - Service**.

Confirm that the EXPRESSCLUSTER Disk Agent service status is **Start**.

Confirm that **Startup Type** is **Auto**.

The server is required to be restarted if the service status is not **Start**.

Confirm the mirror setting.

Start Cluster WebUI.

Confirm that the mirror disk resource or hybrid disk resource is set.

Confirm the setting of the mirror statistics information collection function.

Start Cluster WebUI.

Change the mode to **Config mode**.

Check the setting of **Mirror Statistics** in the **Statistics** tab in **Cluster Properties**.

For details of Cluster WebUI, see the online manual of Cluster WebUI.

2.3.5 Notes on the mirror statistics information collection function

- To operate the mirror statistics information collection function, the free space (up to about 8.9 GB) is required on disk to record the statistic log file of the mirror statistics information.
- Up to 32 processes can be started for a single server with both the performance monitor and typeperf commands combined. No mirror statistics information can be collected if more than 32 performance monitors or typeperf commands are executed for a single server.
- More than one of statistical information acquisition can't be done in 1 process.
For example the computer which is a target from more than one performance monitor on the other computers, and the occasion from which more than one data collect is extracted by 1 performance monitor, etc.
- The extracted mirror statistics information is included in the logs collected by the clplogcc command or Cluster WebUI.
Specify type5 to collect the log by the clplogcc command; specify Pattern 5 to collect the log by the Cluster WebUI. For details about log collection, see "Collecting logs (clplogcc command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide" or the online manual.

2.4 System resource statistics information collection function

If the **System Resource Statistics** check box is checked on the **Statistics** tab of **Cluster Properties** in the Cluster WebUI config mode, or if system monitor resources or process resource monitor resources are added to the cluster, information on the system resource is collected and saved under `<installation path>/perf/system` according to the following file naming rules. The file format is CSV (text). In the following explanations, this file is referred to as the system resource statistics information file.

system.cur system.pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.

The collected information is saved to the system resource statistics information file. The output interval (sampling interval) of statistics information is 60 seconds. If the size of current log file reached 16MB, log rotation occurs and the information is saved to a new log file (two generation log files can be used). Information saved to the system resource statistics information file can be used as a reference for analyzing the system performance. The collected statistics information contains the following items.

Statistic value name	Unit	Description
CPUCount	Quantity	The number of CPUs
CPUUtilization	%	Utilization of CPU
MemoryTotalSize	KByte	Total memory size
MemoryCurrentSize	KByte	Utilization of memory
SwapTotalSize	KByte	Total swap size
SwapCurrentSize	KByte	Utilization of swap
ThreadCurrentSize	Quantity	The number of threads
FileCurrentSize	Quantity	The number of opened files
ProcessCurrentCount	Quantity	The number of processes
AvgDiskReadQueueLength__Total	Quantity	The number of read requests queued in disk
AvgDiskWriteQueueLength__Total	Quantity	The number of write requests queued in disk
DiskReadBytesPersec__Total	Byte	The number of bytes transferred from disk by read operation
DiskWriteBytesPersec__Total	Byte	The number of bytes transferred to disk by write operation
PercentDiskReadTime__Total	tick	Busy time occurred while disk handles read requests
PercentDiskWriteTime__Total	tick	Busy time occurred while disk handles write requests
PercentIdleTime__Total	tick	Disk idle time
CurrentDiskQueueLength__Total	Quantity	The number of requests remained in disk when performance data are collected

The following output is an example of system resource statistics information file.

- system.cur

```
"Date", "CPUCount", "CPUUtilization", "MemoryTotalSize", "MemoryCurrentSize",  
↪ "SwapTotalSize", "SwapCurrentSize", "ThreadCurrentSize", "FileCurrentSize",  
↪ "ProcessCurrentCount", "AvgDiskReadQueueLength__Total", "AvgDiskWriteQueueLength__  
↪ Total", "DiskReadBytesPersec__Total", "DiskWriteBytesPersec__Total",  
↪ "PercentDiskReadTime__Total", "PercentDiskWriteTime__Total", "PercentIdleTime__Total",  
↪ "CurrentDiskQueueLength__Total"  
"2019/11/14 17:18:57.751", "2", "11", "2096744", "1241876", "393216", "0", "1042", "32672", "79  
↪", "623078737", "241067820", "95590912", "5116928", "623078737", "241067820", "305886514",  
↪ "0"  
"2019/11/14 17:19:57.689", "2", "3", "2096744", "1234892", "393216", "0", "926", "31767", "77",  
↪ "14688814", "138463292", "3898368", "7112192", "14688814", "138463292", "530778498", "0"  
"2019/11/14 17:20:57.782", "2", "2", "2096744", "1194400", "393216", "26012", "890", "30947",  
↪ "74", "8535798", "189735393", "3802624", "34398208", "8535798", "189735393", "523400261", "0  
↪"  
:
```

2.5 Process resource statistics information collection function

If the **System Resource Statistics** check box is checked on the **Statistics** tab of **Cluster Properties** in the Cluster WebUI config mode, or if system monitor resources or process resource monitor resources are added to the cluster, information on the process resource is collected and saved under *<installation path>/perf/system* according to the following file naming rules. The file format is CSV (text). In the following explanations, this file is referred to as the process resource statistics information file.

process.cur process.pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.

The collected information is saved to the process resource statistics information file. The output interval (sampling interval) of statistics information is 60 seconds. If the size of current log file reached 32MB, log rotation occurs and the information is saved to a new log file (two generation log files can be used). Information saved to the process resource statistics information file can be used as a reference for analyzing the process performance. The collected statistics information contains the following items.

Statistic value name	Unit	Description
PID	-	Process ID
CPUUtilization	%	CPU utilization
MemoryPhysicalSize	Byte	Physical memory usage
ThreadCurrentCount	Quantity	Number of running threads
FileCurrentCount	Quantity	Number of opening files
ProcessName	-	Process name * Outputted not in double quotes.

The following output is an example of process resource statistics information file.

- process.cur

```
"Date", "PID", "CPUUtilization", "MemoryPhysicalSize", "ThreadCurrentCount",  
↔ "FileCurrentCount", "ProcessName"  
"2022/09/26 11:39:19.099", "676", "0", "10149888", "8", "641", services.exe  
"2022/09/26 11:39:19.114", "688", "0", "13660160", "7", "940", C:\Windows\system32\lsass.exe  
"2022/09/26 11:39:19.130", "808", "0", "3674112", "2", "85", C:\Windows\system32\svchost.  
↔ exe -k DcomLaunch -p -s PlugPlay  
:
```

2.6 Cluster statistics information collection function

In the Config mode of Cluster WebUI, with the **Cluster Statistics** check box (open **Cluster Properties** -> the **Statistics** tab) checked, CSV text files are created containing information on the processing results and time of, for example, reception interval for heartbeat resources, group failovers, starting group resources, and monitoring processes by monitor resources. These files are hereinafter called cluster statistics information files.

- For heartbeat resources

Information is outputted to the file for each heartbeat resource type. This function is supported by kernel mode LAN heartbeat resources.

[Heartbeat resource type].cur [Heartbeat resource type].pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	<installation path>/perf/cluster/heartbeat/

- For groups

group.cur group.pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	<installation path>/perf/cluster/group/

- For group resources

The information for each type of group resource is output to the same file.

[Group resource type].cur [Group resource type].pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	<installation path>/perf/cluster/group/

- For monitor resources

The information for each type of monitor resources is output to the same file.

[Monitor resource type].cur [Monitor resource type].pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	<installation path>/perf/cluster/monitor/

Note:

The cluster statistics information file is included in the logs collected by the clplogcc command or Cluster WebUI. Specify type 6 to collect the log by the clplogcc command; specify Pattern 6 to collect the log by the Cluster WebUI. For details about log collection, see "Collecting logs (clplogcc command)" in "EXPRESSCLUSTER command reference" of "Reference Guide" or the online manual.

Listed below are the timing to output the statistics information to the cluster statistics information file:

- For heartbeat resources
- Periodical output
- For groups¹
- When the group startup processing is completed
- When the group stop processing is completed
- When the group move processing is completed²
- When the failover processing is completed²
- For group resources
- When the group resource startup processing is completed
- When the group resource stop processing is completed
- For monitor resources
- When the monitor processing is completed
- When the monitor status change processing is completed

The statistics information to be collected includes the following items:

- For heartbeat resources

Statistic value name	Description
Date	Time when the statistics information is output. This is output in the form below (000 indicates millisecond): YYYY/MM/DD HH:MM:SS.000
Name	Name of a heartbeat resource.
Type	Type of the heartbeat resource.
Local	Host name of the local server.

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¹ If a single unit of group resource was started or stopped, the group statistics information is not output.

² If a group was moved or failed over, the statistics information is output to the failover target server

Table 2.12 – continued from previous page

Statistic value name	Description
Remote	Host name of the other server.
RecvCount	Heartbeat reception count during the log output interval.
RecvError	Error reception count during the log output interval.
RecvTime(Min)	Minimum interval (in milliseconds) of heartbeat reception during the log output interval.
RecvTime(Max)	Maximum interval (in milliseconds) of heartbeat reception during the log output interval.
RecvTime(Avg)	Average interval (in milliseconds) of heartbeat reception during the log output interval.
SendCount	Heartbeat transmission count during the log output interval.
SendError	Error transmission count during the log output interval.
SendTime(Min)	Minimum time (in milliseconds) for heartbeat transmission during the log output interval.
SendTime(Max)	Maximum time (in milliseconds) for heartbeat transmission during the log output interval.
SendTime(Avg)	Average time (in milliseconds) for heartbeat transmission during the log output interval.

- For others (except heartbeat resources)

Statistic value name	Description
Date	Time when the statistics information is output. This is output in the form below (000 indicates millisecond): <i>YYYY/MM/DD HH:MM:SS.000</i>
Name	Name of group, group resource or monitor resource.
Action	Name of the executed processing. The following strings are output: For groups: Start (at start), Stop (at stop), Move (at move), Failover (at failover) For group resources: Start (at activation), Stop (at deactivation) For monitor resources: Monitor (at monitor execution)
Result	Name of the results of the executed processing. The following strings are output: When the processing was successful: Success (no errors detected in monitoring or activation/deactivation) When the processing failed: Failure (errors detected in monitoring or activation/deactivation) When a warning occurred: Warning (only for monitoring, in case of warning) When a timeout occurred: Timeout (monitoring timeout) When the processing was canceled: Cancel (canceling processings such as cluster shutdown during group startup)

Continued on next page

Table 2.13 – continued from previous page

Statistic value name	Description
ReturnCode	Return value of the executed processing.
StartTime	Start time of the executed processing. This is output in the form below (000 indicates millisecond): <i>YYYY/MM/DD HH:MM:SS.000</i>
EndTime	End time of the executed processing. This is output in the form below (000 indicates millisecond): <i>YYYY/MM/DD HH:MM:SS.000</i>
ResponseTime(ms)	Time taken for executing the processing (in millisecond). This is output in millisecond.

Here is an example of the statistics information file to be output when a group with the following configuration is started up:

- Server - Host name: server1, server2
- Heartbeat resource
 - Kernel mode LAN heartbeat resource
Resource name: lankhb1, lankhb2
- Group
 - Group name: failoverA
- Group resource which belongs to the group (failoverA)
 - script resource
Resource name: script01, script02, script03
- lankhb.cur

```
"Date", "Name", "Type", "Local", "Remote", "RecvCount", "RecvError", "RecvTime (Min) ",
↪ "RecvTime (Max) ", "RecvTime (Avg) ", "SendCount", "SendError", "SendTime (Min) ",
↪ "SendTime (Max) ", "SendTime (Avg) "
"2018/12/18 09:35:36.237", "lankhb1", "lankhb", "server1", "server1", "20", "0", "3000",
↪ "3000", "3000", "20", "0", "0", "0", "0"
"2018/12/18 09:35:36.237", "lankhb1", "lankhb", "server1", "server2", "20", "0", "3000",
↪ "3000", "3000", "20", "0", "0", "0", "0"
"2018/12/18 09:35:36.237", "lankhb2", "lankhb", "server1", "server1", "20", "0", "3000",
↪ "3000", "3000", "20", "0", "0", "0", "0"
"2018/12/18 09:35:36.237", "lankhb2", "lankhb", "server1", "server2", "20", "0", "3000",
↪ "3000", "3000", "20", "0", "0", "0", "0"
:
```

- group.cur

```
"Date", "Name", "Action", "Result", "ReturnCode", "StartTime", "EndTime",
↪ "ResponseTime (ms) "
"2018/12/19 09:44:16.925", "failoverA", "Start", "Success", , "2018/12/19 09:44:09.785
↪ ", "2018/12/19 09:44:16.925", "7140"
```

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```


```

- script.cur

```
"Date", "Name", "Action", "Result", "ReturnCode", "StartTime", "EndTime",
↪ "ResponseTime (ms) "
"2018/12/19 09:44:14.845", "script01", "Start", "Success", , "2018/12/19 09:44:09.807",
↪ "2018/12/19 09:44:14.845", "5040"
"2018/12/19 09:44:15.877", "script02", "Start", "Success", , "2018/12/19 09:44:14.847",
↪ "2018/12/19 09:44:15.877", "1030"
"2018/12/19 09:44:16.920", "script03", "Start", "Success", , "2018/12/19 09:44:15.880",
↪ "2018/12/19 09:44:16.920", "1040"

```

2.6.1 Notes on the size of the cluster statistics information file

The number of cluster statistics information files to be generated differs depending on their configurations. Some configurations may cause a large number of files to be generated. Therefore, consider setting the size of the cluster statistics information file according to the configuration. The maximum size of the cluster statistics information file is calculated with the following formula:

The size of the cluster statistics information file =

([Heartbeat resource file size] x [number of types of heartbeat resources which are set]) x (number of generations (2)) +

([Group file size] x (number of generations (2)) +

([Group resource file size] x [number of types of group resources which are set]) x (number of generations (2)) +

([Monitor resource file size] x [number of types of monitor resources which are set]) x (number of generations (2))

Example: For the following configuration, the total maximum size of the cluster statistics information files to be saved is 332 MB with this calculation. $((((50\text{MB}) \times 1) \times 2) + (((1\text{MB}) \times 2) + ((3\text{MB} \times 5) \times 2) + ((10\text{MB} \times 10) \times 2) = 332\text{MB})$

- Number of heartbeat resource types: 1 (file size: 50 MB)
- Group (file size: 1 MB)
- Number of group resource types: 5 (file size: 3 MB)
- Number of monitor resource types: 10 (file size: 10 MB)

2.7 Function for outputting the operation log of Cluster WebUI

If the **Output Cluster WebUI Operation Log** check box is already checked on the **WebManager** tab of **Cluster Properties** in the config mode of Cluster WebUI, the information on the operation of Cluster WebUI is outputted to the log file. This file is in CSV format, which is hereinafter called "the operation log file of Cluster WebUI.

webuiope.cur webuiope.pre<x>	
cur	Indicates the last outputted log file.
pre<x>	Indicates a previously outputted but rotated log file. pre, pre1, pre2, ..., in reverse chronological order. When the prescribed number of existing log files is exceeded, the oldest log file is deleted.
Where to save	Directory as Log output path in the config mode of Cluster WebUI

The operation information to be outputted includes the following items:

Item name	Description
Date	Time when the operation information is outputted. This is outputted in the form below (000 in milliseconds): YYYY/MM/DD HH:MM:SS.000
Operation	Name of the executed operation in Cluster WebUI.
Request	Request URL issued from Cluster WebUI to the WebManager server.
IP	IP address of a client that operated Cluster WebUI.
UserName	Name of a user who executed the operation. When a user logged in to Cluster WebUI by using the OS authentication method, the user name is output.
HTTP-Status	HTTP status code. 200: Success Other than 200: Failure
ErrorCode	Return value of the executed operation.
ResponseTime(ms)	Time taken for executing the operation (in milliseconds). This is outputted in milliseconds.

Continued on next page

Table 2.15 – continued from previous page

Item name	Description
ServerName	Name of a server to be operated. Its server name or IP address is outputted. It is outputted when the name of a server to be operated is specified.
GroupName	Name of a group to be operated. It is outputted when the name of a group to be operated is specified.
ResourceName	Name of a resource to be operated. Outputted is the heartbeat resource name, network partition resolution resource name, group resource name, or monitor resource name. It is outputted when the name of a resource to be operated is specified.
ResourceType	Type of a resource to be operated. It is output when the type of a resource to be operated is specified.
Parameters...	Operation-specific parameters.

The following output is an example of the operation log file of Cluster WebUI:

```
"Date", "Operation", "Request", "IP", "UserName", "HTTP-Status", "ErrorCode",
↪ "ResponseTime (ms)", "ServerName", "GroupName", "ResourceName", "ResourceType",
↪ "Parameters..."
"2020/08/14 17:08:39.902", "Cluster properties", "/GetClusterproInfo.js", "10.0.
↪ 0.15", "user1", 200, 0, 141, , , ,
"2020/08/14 17:08:46.659", "Monitor properties", "/GetMonitorResourceProperty.
↪ js", "10.0.0.15", "user1", 200, 0, 47, , , "fipw1", "fipw"
"2020/08/14 17:15:31.093", "Resource properties", "/GetGroupResourceProperty.js
↪ ", "10.0.0.15", "user1", 200, 0, 47, , "failoverA", "fip1", "fip"
"2020/08/14 17:15:45.309", "Start group", "/GroupStart.js", "10.0.0.15", "user1",
↪ 200, 0, 0, "server1", "failoverA", ,
"2020/08/14 17:16:23.862", "Suspend all monitors", "/AllMonitorSuspend.js", "10.
↪ 0.0.15", "user1", 200, 0, 453, "server1", , , , "server2"
:
```

The following is an example of the operation log file of Cluster WebUI outputted when the authentication fails:

- When the cluster password method is used

```
"Date", "Operation", "Request", "IP", "UserName", "HTTP-Status", "ErrorCode",
↪ "ResponseTime (ms)", "ServerName", "GroupName", "ResourceName", "ResourceType",
↪ "Parameters..."
"2020/11/20 09:29:59.710", "Login", "/Login.js", "10.0.0.15", "", 403, , 0, , , ,
```

- When the OS authentication method is used

```
"Date", "Operation", "Request", "IP", "UserName", "HTTP-Status", "ErrorCode",  
↔ "ResponseTime (ms)", "ServerName", "GroupName", "ResourceName", "ResourceType",  
↔ "Parameters..."  
"2020/11/20 09:29:59.710", "Login User", "/LoginUser.js", "10.0.0.15", "user1", 401,,0,  
↔ , , ,
```

2.8 Communication ports

EXPRESSCLUSTER uses the following port numbers by default. You can change these port numbers by using the Cluster WebUI. Make sure that the programs other than EXPRESSCLUSTER do not access these port numbers.

To set up a firewall for the server, make sure that the following port numbers can be accessed.

For a cloud environment, allow access to ports numbered as below, not only in a firewall configuration at the instance side but also in a security configuration at the cloud infrastructure side.

For port numbers EXPRESSCLUSTER uses, refer to "Getting Started Guide" > "Notes and Restrictions" > "Before installing EXPRESSCLUSTER" > "Communication port number".

2.9 Limit on the band for mirror disk connect communication

You can set a limit on the communication band used for mirror disk connect communication by using the standard Windows Local Group Policy Editor (Policy-based QoS). A limit is set for each mirror disk connect. This method is useful for setting a limit on the communication band for all mirror disk resources or hybrid disk resources using the specified mirror disk connect.

2.9.1 Procedure for setting a limit on the band for mirror disk connect communication

To set a limit on the band for mirror disk connect communication, follow the procedure described below.

1. Setting the properties of a network adapter

- Click **Start, Control Panel**, then **Network and Sharing Center**. Then, open **Properties** for a mirror disk connect.
- Check the **Qos Packet Scheduler** check box when it is in **Properties**.
- Click **Install, Services**, and then **Add** buttons to select **QoS Packet Scheduler** when it is not in **Properties**.

2. Starting the Local Group Policy Editor

To set a limit on the band, use the Local Group Policy Editor. From the **Start** menu, click **Run**, and then execute the following command:

```
gpedit.msc
```

3. Creating a policy

Create a policy for a limit on the band. In the left pane, click **Local Computer Policy, Computer Configuration**, then **Windows Settings**, and then right-click **Policy-based QoS** and select **Create New Policy**.

1. **Policy-based QoS - Create a QoS policy** window

Set items as follows.

Policy name

Enter a policy name for identification.

Specify DSCP value

Set the IP priority. This setting is optional. For details, see **Learn more about QoS Policies**.

Specify Outbound Throttle Rate

Check the **Specify Outbound Throttle Rate** check box. Specify an upper limit on the communication band used for the mirror disk connect in units of **KBps** (kilobytes per second) or **MBps** (megabytes per second).

After setting the required items, click the **Next** button.

2. **Policy-based QoS - This QoS policy applies to:** window

Set this item as follows.

This QoS policy applies to: (application specification)

Select **All applications**.

After setting the required items, click the **Next** button.

3. **Policy-based QoS - Specify the source and destination IP addresses.** window

Set these items as follows.

This QoS policy applies to: (source IP address specification)

Select **Only for the following source IP address or prefix** and then enter the source IP address used for the mirror disk connect.

This QoS policy applies to: (destination IP address specification)

Select **Only for the following destination IP address or prefix** and then enter the destination IP address used for the mirror disk connect.

After setting the required items, click the **Next** button.

4. **Policy-based QoS - Specify the protocol and port numbers.** window

Set these items as follows.

Select the protocol this QoS policy applies to (S)

Select **TCP**.

Specify the source port number:

Select **From any source port**.

Specify the destination port number:

Select **To this destination port number or range** and then specify the mirror driver port number (default: 29005).

4. Reflecting the policy

Click the **Finish** button to apply the settings. The set policy is not immediately reflected, but according to the automatic policy update interval (default: within 90 minutes). To reflect the set policy immediately, update the policy manually. From the **Start** menu, click **Run**, and then execute the following command:

```
gpupdate /force
```

This completes the setting of a policy.

2.9.2 Procedure for suspending or releasing the limit on the band for mirror disk connect communication

To suspend or release the limit on the band for mirror disk connect communication, follow the procedure described below.

1. Starting the Local Group Policy Editor

To suspend or release the limit on a band, use the Local Group Policy Editor. From the **Start** menu, click **Run**, and then execute the following command:

```
gpedit.msc
```

2. Suspending a policy by changing its setting or deleting the policy

- To suspend a limit on the band

To suspend a limit on the band, change the setting for the policy for the limit on the band. Right-click the target QoS policy and then choose **Edit Existing Policy**. Then, uncheck the **Specify Outbound Throttle Rate** check box.

After making this setting, click the **OK** button.

- To release a limit on the band

To release a limit on the band, delete the policy for the limit on the band. Right-click the target QoS policy and then choose **Delete Policy**. The pop-up message "Are you sure you want to delete the policy?" appears. Click **Yes**.

3. Reflecting the policy

The modification or deletion of a policy is not immediately reflected, but according to the automatic policy update interval (default: within 90 minutes). To reflect the deletion or modification immediately, update the policy manually. From the **Start** menu, click **Run**, and then execute the following command:

```
gpupdate /force
```

This completes the setting of a policy.

2.10 What causes EXPRESSCLUSTER to shut down servers

When any one of the following errors occurs, EXPRESSCLUSTER shuts down or resets servers to protect resources.

2.10.1 Final action for an error in group resource activation or deactivation

When one of the following is specified as the final action to be taken for errors in resource activation/deactivation:

Final action	Result
The cluster service stops and the OS shuts down.	Causes normal shutdown after the group resources stop.
The cluster service stops and the OS reboots.	Causes normal reboot after the group resources stop.
An intentional stop error is generated	Causes a stop error (Panic) intentionally upon group resource activation/deactivation error.

2.10.2 Action for a stall of resource activation or deactivation

When one of the following is specified as the action to be taken for a stall of resource activation or deactivation, and resource activation or deactivation took longer time than expected:

Action for a stall	Result
Emergency shutdown	Causes the OS to shut down upon the stall of group resource activation or deactivation.
Intended generation of a stop error	Causes a stop error (Panic) upon the stall of group resource activation or deactivation.

The OS shuts down if the resource activation or deactivation takes an unexpectedly long time. The OS shuts down, regardless of the setting of recovery in the event of a resource activation or deactivation error.

If a resource activation stall occurs, the following message is output to the event log and as an alert message.

- Module type: rc
- Event ID: 1032
- Message: Failed to start the resource %1. (99 : command is timeout)
- Description: Resource start failure

If a resource deactivation stall occurs, the following message is output to the event log and as an alert message.

- Module type: rc
- Event ID: 1042
- Message: Failed to stop the resource %1. (99 : command is timeout)
- Description: Resource stop failure

2.10.3 Final action at detection of an error in monitor resource

When the final action for errors in monitor resource monitoring is specified as one of the following:

Final action	Result
Stop cluster service and shut down the OS	Causes normal shutdown after the group resources stop.
Stop cluster service and reboot the OS	Causes normal reboot after the group resources stop.
An intentional stop error is generated	Causes a stop error (Panic) intentionally upon monitor resource error detection.

2.10.4 Forced stop action

When the type of forced stop is configured as **BMC**:

Forced stop action	Result
BMC reset	Causes reset in the failing server where the failover group existed.
BMC power off	Causes power off in the failing server where the failover group existed.
BMC power cycle	Causes power cycle in the failing server where the failover group existed.
BMC NMI	Causes NMI in the failing server where the failover group existed.

When the type of forced stop is configured as **vCenter**:

Forced stop action	Result
Power off	Causes power off in the failing server where the failover group existed.
Reset	Causes reset in the failing server where the failover group existed.

When the type of forced stop is configured as **AWS, Azure or OCI**:

Forced stop action	Result
stop	Stops the instance of the failing server where the failover group existed.
reboot	Reboots the instance of the failing server where the failover group existed.

2.10.5 Emergency server shutdown

When the following processes terminated abnormally, clustering can not work properly. Then EXPRESSCLUSTER shuts down the server on which those processes terminated. This action is called emergency server shutdown.

- clprc.exe

Server shut down method can be configured in **Action When the Cluster Service Process is Abnormal** of **Cluster Properties** from the config mode of Cluster WebUI. Following method can be set.

- Emergency shutdown (default)
- Generate an Intentional Stop Error

- HW Reset³

2.10.6 Resource deactivation error in stopping the EXPRESSCLUSTER Server service

If there is a failure to deactivate the resource during the EXPRESSCLUSTER Server service stop process, the action set in [Action When the Cluster Service Process Is Abnormal] is executed.

2.10.7 Recovery from network partitioning

If all heartbeats are disrupted, network partitioning resolution takes place which results in one or all of the servers to shut down. Unless the automatic recovery mode is set in Cluster Properties, the server is in the Suspension (Isolated) status and is not clustered after reboot.

When you resolve the problem that caused the disruption of heartbeats, recover the cluster.

For details on network partitioning, see "Details on network partition resolution resources" in the "Reference Guide".

For information on the suspended status (restart following a shutdown) and cluster recovery, see the online manual "Functions of the WebManager" in this guide.

2.10.8 Emergency server restart

When an abnormal termination is detected in the following processes, EXPRESSCLUSTER reboots the OS. This action is called Emergency server restart.

- EXPRESSCLUSTER Disk Agent (clpdiskagent.exe)
- EXPRESSCLUSTER Server (clppmsvc.exe)
- EXPRESSCLUSTER Transaction (clptrnsv.exe)

2.10.9 Failure in suspending or resuming the cluster

If suspending or resuming the cluster fails, the server is shutdown.

³ This function does not require ipmiutil, unlike the force stop function.

2.11 Configuring the settings to temporarily prevent execution of failover

Follow the steps below to temporarily prevent failover caused by a failed server from occurring.

- Temporarily adjust timeout

By temporarily adjusting timeout, you can prevent a failover caused by a failed server from occurring.

The `clptoratio` command is used to temporarily adjust timeout. Run the `clptoratio` command on one of the servers in the cluster.

(Example) To (temporarily) extend the heartbeat time-out to 3600 seconds (one hour) from the current time when the heartbeat time-out is set to 90 seconds:

```
clptoratio -r 40 -t 1h
```

- Releasing temporary time-out adjustment

Releases the temporary adjustment of time-out. Execute the `clptoratio` command for any server in the cluster.

```
clptoratio -i
```

Follow the steps below to temporarily prevent failover caused by a monitor error by temporarily stopping monitor resource monitoring.

- Suspending monitoring operation of monitor resources

By suspending monitoring operations, a failover caused by monitoring can be prevented.

The `clpmonctrl` command is used to suspend monitoring. Run the `clpmonctrl` command on all servers in the cluster. Another way is to use the `-h` option on a server in the cluster and run the `clpmonctrl` command for all the servers.

(Example) To suspend all monitoring operations on the server in which the command is run:

```
clpmonctrl -s
```

(Example) To suspend all monitoring operations on the server with `-h` option specified

```
clpmonctrl -s -h <server name>
```

- Restarting monitoring operation of monitor resources

Resumes monitoring. Execute the `clpmonctrl` command for all servers in the cluster. Another way is to use the `-h` option on a server in the cluster and run the `clpmonctrl` command for all the servers.

(Example) Resuming all monitoring operations on the server in which the command is run:

```
clpmonctrl -r
```

(Example) To resume all monitoring operations on the server with `-h` option specified

```
clpmonctrl -r -h <server name>
```

Follow the steps below to temporarily prevent failover caused by a monitor error by disabling recovery action for a monitor resource error.

- Disabling recovery action for a monitor resource error

When you disable recovery action for a monitor resource error, recovery action is not performed even if a monitor resource detects an error. To set this feature, check the **Recovery action when a monitor resource error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in the config mode of Cluster WebUI and update the setting.

- Not disabling recovery action for a monitor resource error
Enable recovery action for a monitor resource error. Uncheck the **Recovery action when a monitor resource error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in the config mode of Cluster WebUI and update the setting.

Follow the steps below to temporarily prevent failover caused by an activation error by disabling recovery action for a group resource activation error.

- Disabling recovery action for a group resource activation error
When you disable recovery action for a group resource activation error, recovery action is not performed even if a group resource detects an activation error. To set this feature, check the **Recovery operation when a group resource activation error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in config mode of Cluster WebUI and update the setting.
- Not disabling recovery action for a group resource activation error
Enable recovery action for a group resource activation error. Uncheck the **Recovery operation when a group resource activation error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in config mode of Cluster WebUI and update the setting.

2.12 How to execute chkdsk/defrag

2.12.1 How to execute chkdsk/defrag on a shared disk

Follow the steps below to execute chkdsk/defrag on a shared disk:

1. Suspend all monitor resources temporarily by using the Cluster WebUI or the clpmonctrl command.

(Example):

```
clpmonctrl -s
```

2. Stop the group in which the target disk resource is registered by using the Cluster WebUI or the clpgrp command.

(Example)

```
clpgrp -t <group name> -h <server name>
```

3. Start only the target disk resource in the group by using the Cluster WebUI or the clprsc command.

(Example)

```
clprsc -s <resource name> -h <server name>
```

4. Execute chkdsk or defrag on the target partition from the command prompt.

Important: When executing chkdsk in recovery mode (/f , /r option), it is necessary to close all processes (including EXPRESSCLUSTER) before executing chkdsk.

Important: If the message "chkdsk cannot run because the volume is being used by another process. Would you like to schedule this volume to be checked the next time the system restarts? (Y/N)" appears, select "N".

5. Stop only the target disk resource in the group by using the Cluster WebUI or the clprsc command.

(Example)

```
clprsc -t <resource name> -h <server name>
```

6. Start the group in which the target disk resource is registered by using the Cluster WebUI or the clpgrp command.

(Example)

```
clpgrp -s <group name> -h <server name>
```

7. Resume all monitor resources by using the Cluster WebUI or the clpmonctrl command.

(Example)

```
clpmonctrl -r
```

2.12.2 How to execute chkdsk/defrag on a mirror/hybrid disk

When executing chkdsk or defrag on a partition configured as a mirror disk resource, the procedure differs depending on whether the server is an active server or a standby server.

How to execute chkdsk/defrag on an active server (mirror/hybrid disk)

Refer to "How to execute chkdsk/defrag on a shared disk"

How to execute chkdsk/defrag on a standby server (mirror disk)

If you perform a chkdsk or defragmentation in restoration mode on the standby server, mirror copy overwrites partitions established as mirror disks on the active disk image, and the file system fails to be restored or optimized. This section describes the procedure for chkdsk in order to check media errors.

1. Suspend the mdw monitor resources temporarily by using the Cluster WebUI or the clpmonctrl command.

(Example)

```
clpmonctrl -s -m <mdw monitor name>
```

2. Isolate the target mirror disk resource.

(Example)

```
clpmdctrl --break <md resource name>
```

3. Enable access to the mirror disk .

(Example)

```
clpmdctrl --active <md resource name> -f
```

4. Execute chkdsk or defrag on the target partition from the command prompt.

Important: If the message "chkdsk cannot run because the volume is being used by another process. Would you like to schedule this volume to be checked the next time the system restarts? (Y/N)" appears, select "N".

5. Disable access to the mirror disk.

(Example)

```
clpmdctrl --deactive <md resource name>
```

6. Resume the mdw monitor resources by using the Cluster WebUI or the clpmonctrl command.

(Example)

```
clpmonctrl -r -m <mdw monitor name>
```

7. If automatic mirror recovery is disabled, perform mirror recovery manually from Mirror Disks.

How to execute chkdsk/defrag on a standby server (hybrid disk)

If you perform a chkdsk or defragmentation in restoration mode on the standby server, mirror copy overwrites partitions established as hybrid disks on the active disk image, and the file system fails to be restored or optimized. This section describes the procedure for chkdsk in order to check media errors.

1. Suspend the hdw monitor resources temporarily by using the Cluster WebUI or the clpmonctrl command.

(Example)

```
clpmonctrl -s -m <hdw monitor name>
```

2. Isolate and enable access to the target hybrid disk resource.

(Example)

```
clphdsnapshot --open <hd resource name>
```

3. Execute `chkdsk` or `defrag` on the target partition from the command prompt.

Important: If the message "chkdsk cannot run because the volume is being used by another process. Would you like to schedule this volume to be checked the next time the system restarts? (Y/N)" appears, select "N".

4. Disable access to the mirror disk ..

(Example)

```
clphdsnapshot --close
```

5. Resume the mdw monitor resources by using the Cluster WebUI or the `clpmonctrl` command.

(Example)

```
clpmonctrl -r -m <hdw monitor name>
```

6. If automatic mirror recovery is disabled, perform mirror recovery manually from Mirror Disks.

2.13 How to replace a server with a new one

When you replace a server in a cluster environment, follow the instructions below:

1. Set up a new server in the same way as the failed server.
 - When using a shared disk, do not connect the new server to the shared disk yet.
 - Set the same computer name and IP address as the failed server.
 - Register the EXPRESSCLUSTER license and apply updates as they have been registered and applied before.
 - If there were cluster partition and/or data partition of a mirror disk or hybrid disk on the local disk of the failing server, allocate these partitions and assign drive letters for them as they were configured in the failing server. When you use the disk of the failing server, configure drive letters for the partitions, though allocating partitions is not necessary.
 - When using a shared disk, set the SCSI controller or the HBA that is connected to the shared disk to be filtered in **Filter Settings of Shared Disk** upon installing the EXPRESSCLUSTER Server.
 - After the setup, shut it down and power it off.

Important: In **Filter Settings of Shared Disk**, set the SCSI controller or the HBA that is connected to the shared disk to be filtered. If the new server is connected to the shared disk when it has not been set to be filtered, data on the shared disk may be corrupted.

2. If the failed server is still running, shut it down and remove it from the shared disk and the LAN, and make sure other servers in the cluster are working properly. (Ignore errors caused by the failed server being stopped.)
3. Start the new server while it is connected to the LAN. When using a shared disk, start the server while it is also connected to the shared disk.
4. When using the shared disk, on the new server, use Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.) to confirm that the shared disk is visible, and set the same drive letter as the failed server.
 - At this point, access to the shared disk is controlled, so the disk data cannot be referred.
5. Connect to a server in normal operation in the cluster by using the Web browser to start the config mode of Cluster WebUI. When using a shared disk, click **Properties**, **HBA** tab and **Connect** on the new server to check or modify the information on HBA and partitions.

Important: On the **HBA** tab of **Properties** of the new server, set the SCSI controller or the HBA that is connected to the shared disk to be filtered. If the shared disk is connected when it has not been set to be filtered, data on the shared disk may be corrupted.

6. When there is any mirror disk resource or hybrid disk resource in the resources used in the new server, stop the failover group containing these resources from the operation mode of Cluster WebUI.
7. Run "clpcl --suspend --force" from the command prompt on the server in normal operation in the cluster and suspend the cluster.
 - A server is recognized to have stopped, so the cluster cannot be suspended from the Cluster WebUI.
8. Select Apply the settings from the File menu in the Builder to apply the cluster configuration data on the cluster.
 - When the message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears, select **Yes**.

- If you use a fixed term license, run the following command:

```
clplcnsd --reregister <a folder path for saved license files>
```

9. Resume the cluster from the operation mode of Cluster WebUI. If you stopped any group in step 6, start it.

Note: If you resume the cluster from the Cluster WebUI, the error message "**Failed to resume the cluster. Click the Refresh data button, or try again later.**" is displayed, but ignore it. This is displayed because the new server has not been suspended.

10. Reboot the OS on the new server.
11. When **Off** is selected for **Auto Return** in **Extension** tab of **Cluster Properties**, click **Recover Server** of the server where EXPRESSCLUSTER has been reinstalled in the operation mode of Cluster WebUI.
12. When a mirror disk resource or hybrid disk resource exists in the resources used in the new server and the **Auto mirror recovery** check box is not selected in **Mirror Disk** tab of **Properties** of the cluster, copy the mirror disk or hybrid disk fully from Mirror Disks.

Important: If the server that operates in another mirror disk type cluster is replaced with a new server, differential copy is executed automatically. After differential copy is completed, perform full copy manually. If you do not perform full copy, a mirror disk data inconsistency will occur.

13. Move group as necessary. When mirror disk or hybrid disk is being fully copied, complete copying before moving.

2.14 Wait time for synchronized cluster startup

Even all servers in a cluster are powered on simultaneously, it does not always mean that EXPRESSCLUSTER will start up simultaneously on all servers. EXPRESSCLUSTER may not start up simultaneously after rebooting the cluster following shutdown. Because of this, one server waits for other servers in the cluster to start.

By default, 5 minutes is set to the startup synchronization time. To change the default value, click **Cluster Properties** in the Cluster WebUI, click the **Timeout** tab, and select **Synchronize Wait Time**.

For more information, see "Timeout tab" in "Parameter details" in the "Reference Guide".

2.15 Changing the server configuration (add/delete)

2.15.1 Adding a server (mirror disk or hybrid disk is not used)

To add a server, follow the steps below:

Important:

- When adding a server in changing the cluster configuration, do not make any other changes such as adding a group resource.
 - The additional server license must be registered.
To register licenses, refer to "Installation and Configuration Guide" > "Registering the license".
-

1. Make sure that the cluster is working properly.
2. Start the server to add. For using the shared disk, make sure the server to add is not connected to the shared disk and then start the server to add.

Important: To use the shared disk, do not connect the server to the shared disk before setting it up and powering it off. Data on the shared disk may be corrupted.

3. Configure the settings that should be done before setting up the EXPRESSCLUSTER Server on the server to add. However, to use the shared disk, do not configure the settings for the disk in this step.

See also:

As for the settings to be configured before the setup, see "Settings after configuring hardware" of "Determining a system configuration" in "Installation and Configuration Guide".

4. Set up the EXPRESSCLUSTER Server to the server to add. Enter the port numbers of the Cluster WebUI and the disk agent. Configure the same settings for the port number as the server that has been already set up. To use the shared disk, set the HBA that is connected to the shared disk to be filtered. Register the license as necessary. After the setup, shut down the server to add and power it off.

Important: If the shared disk is not set to be filtered in Filter Settings of Shared Disk when setting up the EXPRESSCLUSTER Server, do not connect to the shared disk even after the setup completes. Data on the shared disk may be corrupted. Reinstall EXPRESSCLUSTER and set the shared disk to be filtered.

5. Start the server to add. To use the shared disk, connect the disk to the server to add at first, and then start the server.
6. To use the **shared** disk, configure the settings for the disk on the server to add.
 - Use Disk Management (On the **start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.) to confirm that the shared disk is visible.
 - Set the switchable partitions for disk resources and the partitions used as the cluster partition or data partition for hybrid disk resources so that they can be accessed from all the servers by using the same drive letters.
 - On all the servers, set the same drive letter to the disk heartbeat partitions to be used for the disk network partition resolution resources.

- At this point, access to the shared disk is controlled, so the disk data cannot be referred.

Note: Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

- (1) Run the following command by using the command prompt to delete the drive letter.

```
> mountvol <drive_letter(_to_be_changed)>: /P
```

- (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).
 - (3) Assign a new drive letter to the drive by using Disk Management.
-

7. Access to other server in the cluster via the Web browser and click the Add server in the config mode of Cluster WebUI.
8. By using the config mode of Cluster WebUI, configure the following settings of the server to add.
 - Information on the HBA and the partition on the **HBA** tab of **Properties** of the server to add (when using the shared disk).
 - Information on the disk heartbeat partition on the **NP Resolution** tab of **Cluster Properties** (when using the shared disk).
 - Information on the **Source IP Address** of the server to add on the **Details** tab of **Properties** of the virtual IP resource (when using the virtual IP resource).
 - **IP Address** of the server to add on the **Monitor(special)** tab of **Properties** of the NIC Link Up/Down monitor resource (when using the NIC Link Up/Down monitor resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS elastic IP resources (when using an AWS Elastic IP resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS virtual IP resources (when using an AWS virtual IP resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS secondary IP resources (when using an AWS secondary IP resource).
 - Information on the **IP Address** of the server to add on the Details tab of Properties of the Azure DNS resources (when using an Azure DNS resource).

Important: On the **HBA** tab of **Properties** of the server to add, set the SCSI controller and the HBA connected to the shared disk to be filtered. If the shared disk is connected when it has not been set to be filtered, data on the shared disk may be corrupted.

9. Click **Properties** of the failover group in the Cluster WebUI config mode. Add the server in the **Startup Server** tab as a startable server (Note : On each failover group, only required server for failover must be added.).
10. Click **Apply the Configuration File** in the Cluster WebUI config mode to update the cluster configuration.

Note: Apply the configuration when the confirmation message is displayed.
11. Perform **Start server service** of the added server in the Cluster WebUI operation mode.
12. Click **Refresh data** in the Cluster WebUI operation mode and confirm the displayed cluster information is in normal status.
13. If the server recovery is required, recover the server manually in the Cluster WebUI operation mode.

2.15.2 Adding a server (Mirror disk or hybrid disk is used)

To add a server, follow the steps below:

Important:

- When adding a server in changing the cluster configuration, do not make any other changes such as adding a group resource.
 - The additional server license must be registered.
To register licenses, refer to "Installation and Configuration Guide" > "Registering the license".
-

1. Make sure that the cluster is working properly.
2. Start the server to add. For using the shared disk, make sure the server to add is not connected to the shared disk and then start the server to add.

Important: To use the shared disk, do not connect the server to the shared disk before setting it up and powering it off. Data on the shared disk may be corrupted.

3. Configure the settings that should be done before setting up the EXPRESSCLUSTER Server on the server to add. However, to use the shared disk, do not configure the settings for the disk in this step.

See also:

As for the settings to be configured before the setup, see "Settings after configuring hardware" of "Determining a system configuration" in "Installation and Configuration Guide".

4. Set up the EXPRESSCLUSTER Server to the server to add. Enter the port numbers of the Cluster WebUI and the disk agent. Configure the same settings for the port number as the server that has been already set up. To use the shared disk, set the HBA that is connected to the shared disk to be filtered. Register the license as necessary. After the setup, shut down the server to add and power it off.

Important: If the shared disk is not set to be filtered in Filter Settings of Shared Disk when setting up the EXPRESSCLUSTER Server, do not connect to the shared disk even after the setup completes. Data on the shared disk may be corrupted. Reinstall EXPRESSCLUSTER and set the shared disk to be filtered.

5. Start the server to add. To use the shared disk, connect the disk to the server to add at first, and then start the server.
6. To use the **shared** disk, configure the settings for the disk on the server to add.
 - Use Disk Management (On the **start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.) to confirm that the shared disk is visible.
 - Set the switchable partitions for disk resources and the partitions used as the cluster partition or data partition for hybrid disk resources so that they can be accessed from all the servers by using the same drive letters.
 - On all the servers, set the same drive letter to the disk heartbeat partitions to be used for the disk network partition resolution resources.
 - At this point, access to the shared disk is controlled, so the disk data cannot be referred.

Note: Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

- (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter(_to_be_changed)>: /P
```

- (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).
 - (3) Assign a new drive letter to the drive by using Disk Management.
-

7. Access to other server in the cluster via the Web browser and click the Add server in the config mode of Cluster WebUI.
8. By using the config mode of Cluster WebUI, configure the following settings of the server to add.
 - Information on the HBA and the partition on the **HBA** tab of **Properties** of the server to add (when using the shared disk).
 - Information on the disk heartbeat partition on the **NP Resolution** tab of **Cluster Properties** (when using the shared disk).
 - Information on the **Source IP Address** of the server to add on the **Details** tab of **Properties** of the virtual IP resource (when using the virtual IP resource).
 - **IP Address** of the server to add on the **Monitor(special)** tab of **Properties** of the NIC Link Up/Down monitor resource (when using the NIC Link Up/Down monitor resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS elastic IP resources (when using an AWS Elastic IP resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS virtual IP resources (when using an AWS virtual IP resource).
 - Information on the **ENI ID** of the server to add on the Details tab of Properties of the AWS secondary IP resources (when using an AWS secondary IP resource).
 - Information on the **IP Address** of the server to add on the Details tab of Properties of the Azure DNS resources (when using an Azure DNS resource).

Important: On the **HBA** tab of **Properties** of the server to add, set the SCSI controller and the HBA connected to the shared disk to be filtered. If the shared disk is connected when it has not been set to be filtered, data on the shared disk may be corrupted.

9. When using a hybrid disk resource in the added server, click Properties of Servers in the Conf mode of Cluster WebUI. From the Server Group tab, add the server to the servers that can run the Group. Do this for required servers only.
10. Click Properties of the failover group in the config mode of Cluster WebUI. Add the server to the servers that can be started on the Startup Server tab. Add the server that can be started only to the required failover group.
11. Click **Apply the Configuration File** in the Cluster WebUI config mode to update the cluster configuration. OS reboot might be required (proceed accordingly).
12. If the server recovery is required, recover the server manually in the Cluster WebUI operation mode.

2.15.3 Deleting a server (Mirror disk or hybrid disk is not used)

To delete a server, follow the steps below:

Important:

- When deleting a server in changing the cluster configuration, do not make any other changes such as adding a group resource.
 - Refer to the following information for licenses registered in the server you want to delete.
 - No action required for CPU licenses.
 - VM node licenses and other node licenses are discarded when EXPRESSCLUSTER is uninstalled. Back up the serial numbers and keys of licenses if required.
 - No action required for fixed term licenses. Unused licenses are automatically collected and provided to other servers.
-

1. Make sure that the cluster is working normally. If any group is active on the server you are going to delete, move the group to another server.
2. When the server to be deleted is registered in a server group, click **Properties** of **Server** of the config mode of Cluster WebUI. **Delete the server from Servers that can run the Group in the Server Group tab.**
3. Click **Remove Server** of the server to delete in the config mode of Cluster WebUI.
4. Click **Apply the Configuration File** in the Cluster WebUI config mode to update the cluster configuration. Proceed accordingly when the confirmation message is displayed.
5. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.
6. Deleted servers will not belong to clusters. To uninstall EXPRESSCLUSTER servers on the servers you want to delete, refer to "Installation and Configuration Guide" > "Uninstalling and reinstalling EXPRESSCLUSTER" > "Uninstallation".

2.15.4 Deleting a server (Mirror disk or hybrid disk is used)

To delete a server, follow the steps below:

Important:

- When deleting a server in changing the cluster configuration, do not make changes (such as adding a group resource) other than ones given below.
 - Refer to the following information for licenses registered in the server you want to delete.
 - No action required for CPU licenses.
 - VM node licenses and other node licenses are discarded when EXPRESSCLUSTER is uninstalled. Back up the serial numbers and keys of licenses if required.
 - No action required for fixed term licenses. Unused licenses are automatically collected and provided to other servers.
-

1. Stop groups using mirror disk resources or hybrid disk resources with Cluster Web UI operation mode.

2. Make sure that the cluster is working properly. (However, ignore errors in the server to be deleted.)
3. Access to other server in the cluster via the Web browser and start the Cluster WebUI.
4. When the server to be deleted is registered in a server group, click **Properties** of **Server** of the config mode of Cluster WebUI. **Delete the server from Servers that can run the Group in the Server Group tab.**
5. Click **Remove Server** of the server to delete in the config mode of Cluster WebUI.
6. Click **Remove resource** of mirror disk resource or hybrid disk resource in the Cluster WebUI config mode.
7. Click **Apply the Configuration File** in the Cluster WebUI config mode to update the cluster configuration. OS reboot might be required (proceed accordingly).
8. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.
9. Deleted servers will not belong to clusters. To uninstall EXPRESSCLUSTER servers on the servers you want to delete, refer to "Installation and Configuration Guide" > "Uninstalling and reinstalling EXPRESSCLUSTER" > "Uninstallation".

2.16 Changing the server IP address

To change the server IP address after you have started the cluster system operation, follow the instructions below.

2.16.1 When changing the mirror disk connect IP address is not required

1. Make sure that the cluster is working properly.
2. Suspend the cluster by using the operation mode of Cluster WebUI.
3. Change the OS network configuration in the **Properties** of **My Network Places**.
4. Change the IP address on the **Interconnect** tab of the **Cluster Properties** by using the config mode of Cluster WebUI.
5. If the changed IP address is used for the NIC Link Up/Down monitor resource, change the IP address on the **Monitor(special)** tab of the monitor resource properties.
6. Click **Apply the Configuration File** from the config mode of Cluster WebUI and apply the cluster configuration data to the cluster.
7. Resume the cluster by using the operation mode of Cluster WebUI.

2.16.2 When changing the mirror disk connect IP address is required

1. Make sure that the cluster is working properly.
2. Stop the cluster by using the operation mode of Cluster WebUI.
3. Change the OS network configuration in the **Properties** of **My Network Places**.
4. Change the IP address on the **Interconnect** tab and the **MDC** tab of the **Cluster Properties** by using the config mode of Cluster WebUI.
5. If the changed IP address is used for the NIC Link Up/Down monitor resource, change the IP address on the **Monitor(special)** tab of the monitor resource properties.
6. Click **Apply the Configuration File** from the config mode of Cluster WebUI and apply the cluster configuration data to the cluster.
7. Reboot the OS on all the servers.

2.17 Changing the host name

Follow the steps below if you want to change the host name of a server after you have started the cluster system operation.

2.17.1 Environment where the mirror disk / hybrid disk does not exist

1. Make sure that the cluster is working properly.
2. If the group is started on the server whose host name is to be changed, move the group.
3. Suspend the cluster by using the operation mode of Cluster WebUI.
4. Change the host name in the properties of **My Computer**.

Note: Do not restart the OS at this stage. The cluster configuration data will not be able to be applied until the OS is completely restarted.

5. Click **Rename Server** of the server in the config mode of Cluster WebUI.
6. Use the config mode of Cluster WebUI to save the cluster configuration information in which the server name has been changed in a disk area accessible from a cluster server.
 - When the Cluster WebUI is used on a cluster server, save the information in the local disk. When the Cluster WebUI is used in another PC, save the information in the shared disk that can be accessed from the cluster server or save it in an external media or the like and then copy it to the local disk of a cluster server.
7. Run the following command on one of the cluster servers to upload the saved cluster configuration information.

```
clpcfctrl --push -x <path_of_the_cluster_configuration_information>_
↪--nocheck
```

Note: Check cluster configuration information before the distribution if required.

8. Open **Administrative Tools - Services** for all servers to restart the EXPRESSCLUSTER X Node Manager service.
9. Open **Administrative Tools - Services** for all servers to restart the EXPRESSCLUSTER X Information Base service.
10. Shutdown the OS on the server you have changed the host name.
11. Resume the cluster from the operation mode of Cluster WebUI.
12. Restart the manager from the operation mode of Cluster WebUI.
13. Execute the server of which the host name has been changed. When **Off** is selected for **Auto Return** in **Extension** tab of **Cluster Properties**, **recover the cluster by using the operation mode of Cluster WebUI manually**.

2.17.2 Environment where the mirror disk / hybrid disk exists

1. Make sure that the cluster is working properly.
2. Stop the cluster by using the operation mode of Cluster WebUI..
3. Change the host name in the properties of **My Computer**.

Note: Do not restart the OS at this stage. The cluster configuration data will not be able to be applied until the OS is completely restarted.

4. Click **Rename Server** of the server in the config mode of Cluster WebUI.
5. Use Cluster WebUI to save the cluster configuration information in which the server name has been changed in a disk area accessible from a cluster server.
 - When the Cluster WebUI is used on a cluster server, save the information in the local disk. When the Cluster WebUI is used in another PC, save the information in the shared disk that can be accessed from the cluster server or save it in an external media or the like and then copy it to the local disk of a cluster server.
6. Open **Administrative Tools - Services** for all servers to stop the EXPRESSCLUSTER X Disk Agent service.
7. Run the following command on one of the cluster servers to upload the saved cluster configuration information.

```
clpcfctrl --push -x <path_of_the_cluster_configuration_information> --nocheck
```

Note: Check cluster configuration information before the distribution if required.

8. Reboot the OS on all the servers.

2.18 Replacing the network card

To replace the network card, follow the steps below. To replace the network card used for the mirror disk connect, follow the same steps as well.

1. Make sure that the cluster is working properly. (However, ignore errors in the network card to be replaced.)
2. If a group is running on the server whose network card is to be replaced, move the group. If the network card has been used for the mirror disk connect, no groups can be moved until the mirror disk recovers after the replacement. Because of this, stop the group by Cluster WebUI.
3. Change a startup type to manual start on the server where you will replace a network card.

```
clpsscctrl.bat --disable -a
```

4. Click **Server Shut Down** of the server whose network card is to be replaced from Cluster WebUI.
5. After the shutdown completes, replace the network card.
6. Start the server that the network card is replaced.
7. Configure the settings for the OS network in the **Properties of My Network Places**. Configure the same settings for the network as before replacing the network card.
8. Change the startup type for the service to automatic startup on the server with the network card replaced.

```
clpsscctrl.bat --enable -a
```

9. Restart the OS on the server.
10. When **Off** is selected for **Auto Return** in **Extension** tab of **Cluster Properties**, **recover the cluster by using the Cluster WebUI manually**.
11. Move group as necessary.

2.19 Changing the disk configuration - For a shared disk -

2.19.1 Replacing the disk

To replace the shared disk, see "2.26. *Replacing the shared disk*".

2.19.2 Adding a disk

The following shows the procedures to add a disk resource. When you add a hybrid disk, consider "disk resource" as "hybrid disk resource", and "partition used for disk resource" as "data partition". Note that it is necessary to add the disk to both of two server groups when you add a hybrid disk resource. As for cluster partition, an existing cluster partition can be used, but it is necessary to configure it so that the offset index of the cluster partition does not overlap the existing hybrid disk.

1. Make sure that the cluster is working properly.
2. Stop the cluster by using the operation mode of Cluster WebUI.
3. Change **Startup Attribute** to manual on the **Attribute** tab of **Properties** of the group to which the disk resource is added from the config mode of Cluster WebUI.
4. Click **Apply the Configuration File** of the config mode of Cluster WebUI **and apply the cluster configuration data to the cluster**.
5. Shut down all the servers and power them off.
6. Power off the shared disk and add a disk.
7. Power on the share disk and configure its settings.
 - If it is required to build a RAID again or to change the LUN configuration, use the setup tool provided with the shared disk. For details, see the manual attached to the shared disk.
8. Start only one server, and create a partition used for the disk resource using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.) **and set its drive letter**. Even if the drive letter you want to assign is the same as the drive letter automatically assigned by the OS, manually assign the desired drive letter explicitly; for example, by deleting the OS assigned drive letter and then assigning the desired drive letter.

Note: Controlling the access to the created partition is started upon its creation, so it cannot be formatted. Set only the drive letter here.

Note: Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

- (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter(_to_be_changed)>: /P
```

- (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).
 - (3) Assign a new drive letter to the drive by using Disk Management.
-

9. To create a disk heartbeat partition, create it in the same way as the disk resource, and set the drive letter. Do not format the partition.

10. To format the partition to be used as the disk resource, execute the following command to temporarily release the access restriction.

```
clpvolctrl --open <drive_letter_of_the_partition_to_be_used_as_the_disk_
→resource>
```

11. From disk management (**Control Panel > Administrative Tools > Computer Management > Disk Management**), format the partition to be used as the disk resource.

Note: If "RAW" is not displayed for the partition to be formatted in **Disk Management**, the access restriction released in step 10 is not reflected to **Disk Management**. Before formatting the partition, reflect the released access restriction to **Disk Management**.

- (1) From **Disk Management**, execute **Actions > Refresh**.
- (2) Check that "RAW" is displayed for the partition to be formatted.
12. To restore the access restriction temporarily released in 10, above, execute the following command:

```
clpvolctrl --close <drive_letter_of_the_partition_to_be_used_as_the_disk_
→resource>
```
13. Start other servers in the cluster, and by using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.), confirm that the partition created by the first server is visible.
14. Set the drive letter of the partition used as the disk resource in the same way as the first server.
15. If the disk heartbeat partition has been created, set its drive letter in the same way as the first server.
16. Start the Cluster WebUI, and stop the cluster by using the operation mode.
17. Add a disk resource by clicking **Add Resource** of the group to add a disk resource from the Config mode of Cluster WebUI Cluster WebUI. Change **Startup Attribute** to manual on the **Attribute** tab of **Properties** of the group.
18. If the disk heartbeat partition has been added, in all the servers in the cluster, add a disk network partition resolution resource on the **NP Resolution** tab of **Cluster Properties**.
19. Click **Apply the Configuration File** of the config mode of Cluster WebUI **and apply the cluster configuration data to the cluster**.
 - When the message "There is the disk information that is not configured. Are you sure you want automatic configuration?" appears, select **Yes**.
20. Start the cluster by using the operation mode of Cluster WebUI.

2.19.3 Deleting a disk

1. Make sure that the cluster is working properly.
2. Stop the cluster by using the operation mode of Cluster WebUI.
3. Click the group whose disk resource is to be deleted in the config mode of Cluster WebUI. Click **Remove Resources** of the disk resource. When there is a hybrid disk resource using the partition of the disk to be deleted, delete it as well.
4. When having used the partition for disk heartbeat, delete the disk network partition resolution resource in **NP Resolution** tab in **Properties** of the cluster.

5. Click **Apply the Configuration File** of the config mode of Cluster WebUI and apply the cluster configuration data to the cluster.
6. Shut down all the servers, and power them off.
7. Power off the shared disk and remove it.
8. Power on the shared disk, and configure its settings.
 - If it is required to build a RAID again or to change the LUN configuration, use the setup tool provided with the shared disk. For details, see the manual attached to the shared disk.
9. Start all the servers.

2.20 Changing the disk configuration - For a mirror disk -

2.20.1 Replacing the disk

To replace the mirror disk, see "2.27. *Replacing the mirror disk*".

2.20.2 Adding a disk

To add a disk used for the mirror disk, follow the steps below:

1. Make sure that the cluster is working properly.
2. If the group is running on the server to which a disk is added, move the group.
3. Shut down only one server by using the operation mode of Cluster WebUI and power it off.
4. Expand the disk, and start the server.
5. Return the server to the cluster, and rebuild the mirror again.
6. Configure the settings for the disk by the server on which the disk is added.
 - Reserve a data partition and a cluster partition for mirror disk using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.). Set their drive letters so that they will be the same on both of the servers.
7. Perform the steps 2 to 6 on other server.
8. In the operation mode of Cluster WebUI, stop the group to which the mirror disk resource is to be added.
9. Suspend the cluster by using the operation mode of Cluster WebUI.
10. Add the mirror disk resource by clicking **Add Resource** of the group to which the mirror disk resource is added in the config mode of Cluster WebUI.
11. Click **Apply the Configuration File** of the config mode of Cluster WebUI **and apply the cluster configuration data to the cluster**.
12. Resume the cluster by using the operation mode of Cluster WebUI.
13. Start the added mirror disk resource or the group that added the mirror disk resource. If **Auto Mirror Initial Construction** is set to be performed in **Cluster Properties**, the initial mirror construction is started. If **Auto Mirror Initial Construction** is set not to be performed, perform the initial mirror construction manually.
14. Move group as necessary.

2.20.3 Deleting a disk

Follow the steps below to delete the disk used for the mirror disk.

1. Make sure that the cluster is working properly.
2. Stop the group with the mirror disk resource to be deleted by using the operation mode of the Cluster WebUI.
3. Suspend the cluster by using the operation mode of the Cluster WebUI.
4. Click the group from which the mirror disk resource is deleted in the config mode of Cluster WebUI. Click **Remove Resources** of the mirror disk resource.

5. Click **Apply the Configuration File of** the config mode of Cluster WebUI **and apply the cluster configuration data to the cluster.**
6. Resume the cluster by using the operation mode of Cluster WebUI.
7. Start the group with the operation mode of Cluster WebUI.
8. Shut down the server on which the group has not been started with the operation mode of Cluster WebUI and power it off.
9. Remove the disk, and start the server.
10. Move the group, and perform the steps 8 and 9 on other server.
11. Move group as necessary.

2.21 Backing up/restoring data

Data is backed up and restored, as shown in the following image. For details on how to back up data, see the manuals of the backup software.

Data of the Shared Disk and Local Disk is backed up to a device connected to the active server (Server 1).

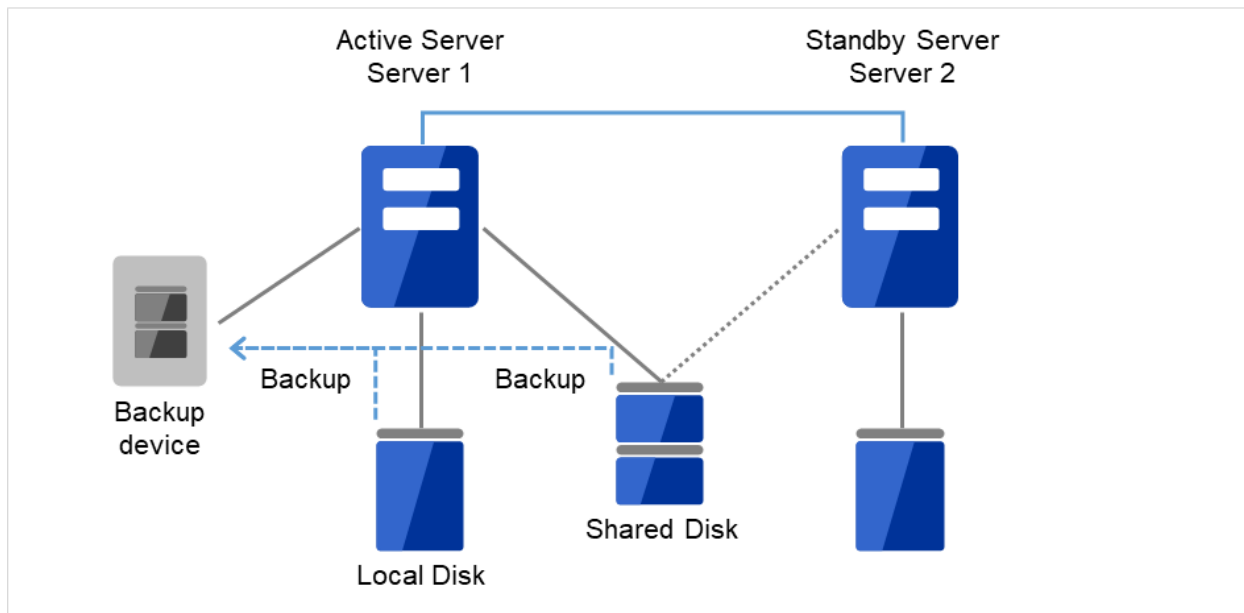


Fig. 2.2: Backup example of active-standby (1)

If an error has occurred on an active server (Server 1), data of the Shared Disk and Local Disk is backed up to a device connected to the standby server (Server 2).

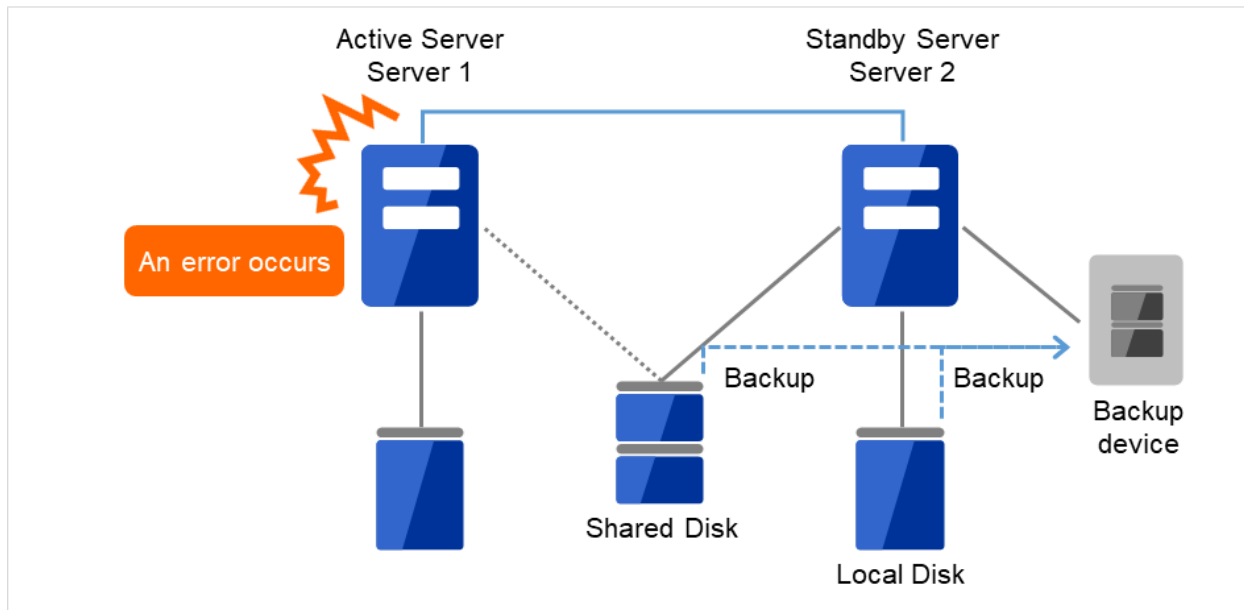


Fig. 2.3: Backup example of active-standby (2)

2.22 Performing a snapshot backup

When a mirror disk or a hybrid disk is used, it is possible to suspend mirroring to back up the stand-by data partition as a snapshot image. This is referred to as snapshot backup.

During executing snapshot backup, failover cannot be performed to the stand-by server or server group of the copying destination because mirroring is temporarily canceled. While in this state, cancel the access restriction to the data partition of the standby server to collect the backup.

To return from the snapshot status, control the disk access and build the mirror again.

For details for how to collect the backup, see the manuals of the backup software.

Note: When mirroring is interrupted, note that the data at the mirroring copy destination does not necessarily have integrity as NTFS or application data, depending on the timing of the mirroring.

2.22.1 Performing a snapshot backup

To execute the snapshot backup for a mirror disk, follow the steps below:

1. Stop the mirror disk monitor resource that monitors the mirror disk that will be backed up on the server to be backed up.

```
clpmonctrl -s -m <mdw(mirror_disk_monitor_resource_name)>
```

2. Disconnect the mirror disk.

```
clpmdctrl --break <md(mirror_disk_resource_name)>
```

3. Allow accesses to the mirror disk.

```
clpmdctrl --active <md(mirror_disk_resource_name)> -f
```

4. Back up necessary files.

5. Forbid accesses to the mirror disk.

```
clpmdctrl --deactive <md(mirror_disk_resource_name)>
```

6. Start the mirror disk monitor resource that monitors the mirror disk.

```
clpmonctrl -r -m <mdw(mirror_disk_resource_monitor_resource_name)>
```

7. If automatic mirror recovery is disabled, perform mirror recovery manually from Mirror Disks.

To execute the snapshot backup for a hybrid disk, collect the backup by following the steps below in a server in the standby server group of the copying destination.

1. Run the following command in the server where the backup is collected.

```
clphdsnapshot --open <hybrid_disk_resource_name>
```

2. When the access restriction in the data partition is canceled, back up the required files.

3. Run the following command in the server where the backup has been collected to restart mirroring.

```
clphdsnapshot --close <hybrid_disk_resource_name>
```

4. When the automatic mirror recovery is disabled, perform mirror recovery manually from Mirror Disks.

For the commands, see "EXPRESSCLUSTER command reference" in the "Reference Guide".

2.23 How to back up a mirror/hybrid disk to its disk image

Perform either of the following procedures when backing up the partition (cluster partition and data partition) for a mirror/hybrid disk, to its disk image:

2.23.1.	<i>Simultaneously backing up both active and standby mirror disks</i>
2.23.2.	<i>Backing up active/standby mirror disks in each server</i>
2.23.3.	<i>Backing up standby mirror disks</i>

Note:

- These procedures are not intended for per-file backup/restoration, but for backup/restoration to the disk image outside the OS.
These procedures are different from that for backing up files from activated mirror disks/hybrid disks or backing up files from standby mirror disks/hybrid disks by canceling the access restriction. For information on the procedure of performing a snapshot backup on a standby server, see "*Performing a snapshot backup*".
- In these procedures, backup/restoration applies to all the mirror disks and hybrid disks on the target server. These procedures are not applicable to separate backup/restoration for each resource.
- Back up/Restore both of the cluster partition and the data partition.
 - * A mirror/hybrid disk consists of a data partition to be the mirroring target, and a cluster partition to record the management information.
For information on the cluster partition and the data partition, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" or "Understanding Hybrid disk resources".
- If hybrid disk resources exist, it should be determined on which server the backup is performed, in each of the server groups.
- Each of the procedures with hybrid disk resources is written as follows: Execute `clpbackup --pre` or `clpbackup --post` on a server of a server group first, then perform `clpbackup --pre --only-shutdown` or `clpbackup --post --only-reboot` on all the other servers of the server group.
Each of the written procedures includes the current server of the server group, as a signpost for the first server of the group on which the command is executed. However, the current server does not have to be the first server.
If the server group has only one server, it is unnecessary to execute `clpbackup --pre --only-shutdown` or `clpbackup --post --only-reboot` on all the other servers of the server group.
 - * In each server group, a current server is responsible for the mirror data to be transmitted/received, and to be written to its disk.
In the active server group, the current server contains the hybrid disk resource being activated.
In the standby server group, the current server receives the mirror data, sent from the current server of the active server group, and writes such data to its mirror disk.
- None of the above three procedures applies to a cluster environment including a server with a version earlier than 4.3 of EXPRESSCLUSTER installed.

- When you execute the `clpbackup` command to shut down a server, an error may occur with such a message as "Some invalid status. Check the status of cluster.", leading to a failure in the shutdown. Then wait a while before performing the `clpbackup` command again.
- On Cluster WebUI, you can go to **Config mode** -> **Cluster Properties** -> the **Extension** tab, and set **Auto Return** to **Off**. Then, through a restart of the server after its backup, the server's status changes to `Suspended (isolated) Suspension (Isolated)`.
In this case, click **Recover server** in the **Status** tab of Cluster WebUI, or execute the `clpcl` command with the `--return` option as follows:

```
clpcl --return
```

After the server recovery, the failover group may not be started. Then start it if necessary.

See also:

For information on the `clpbackup` command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Preparing for backup to a disk image (`clpbackup` command)".

2.23.1 Simultaneously backing up both active and standby mirror disks

This procedure is intended for simultaneously backing up both of active mirror disks and standby mirror disks. Perform the following procedure:

1. Confirm that the mirror is synchronized normally, by using Cluster WebUI or by running the `clpmdstat / clphdstat` command:
 - For mirror disk resources:

```
clpmdstat --mirror <md_resource_name>
```
 - For hybrid disk resources:

```
clphdstat --mirror <hd_resource_name>  
clphdstat --active <hd_resource_name>
```

Note:

If the mirror status is GREEN for both servers or both server groups, the mirror is synchronized normally. For hybrid disk resources, confirm which is a current server in each the active server group and the standby server group.

2. Stop the activated failover group (the operation) by using Cluster WebUI or by running the `clpgrp` command.
3. Switch the mirror disks to backup mode by running the `clpbackup` command.
 - For mirror disk resources:
Execute the following command on both of the active and standby servers:

```
clpbackup --pre --no-shutdown
```

- For hybrid disk resources:

Execute the following command on one server in both server groups:

```
clpbackup --pre
```

Note:

After the execution, the status of mirroring is changed to that for the backup, automatic startup of the cluster service is set to disabled.

For mirror disk resources: After the above actions are completed, the cluster service stops.

For hybrid disk resources: After the above actions are completed, the server shuts down.

4. For hybrid disk resources: After shutting down the server with the clpbackup command, execute the following command on all the other servers:

```
clpbackup --pre --only-shutdown
```

Note: When the command is executed, automatic startup of the cluster service is set to disabled and the server shuts down.

5. Execute backup on both servers.
6. After completing the backup, return the mirror disks from backup mode to normal mode.

- For mirror disk resources:

Execute the following command on both of the active and standby servers:

```
clpbackup --post --no-reboot
```

- For hybrid disk resources:

Start all the servers.

Then, execute the following command on one server in both server groups:

```
clpbackup --post
```

Note:

After the execution, the mirror status returns to normal, automatic startup of the cluster service is set to enabled.

For mirror disk resources: After the above actions are completed, the cluster service starts up.

For hybrid disk resources: After the above actions are completed, the server reboots. The process may take time.

7. For hybrid disk resources: When the server starts rebooting with the clpbackup command, execute the following command on all the other servers:

```
clpbackup --post --only-reboot
```

Note: When the command is executed, automatic startup of the cluster service is set to enabled and the server reboots.

8. After the cluster services start up on all the active and standby servers, confirm that the mirror is synchronized normally by using Cluster WebUI or by running the `clpmdstat / clphdstat` command.

2.23.2 Backing up active/standby mirror disks in each server

Back up the disks in each server alternately according to the following procedure as specified in "*Backing up standby mirror disks*".

1. Back up the disks on the standby server as specified in "*Backing up standby mirror disks*".
2. After the completion of backup, when mirror recovery is completed to synchronize the mirror disks between the active server and the standby server, move the failover group from the active server to the standby server.
3. Back up the disks on the previously active server as specified in "*Backing up standby mirror disks*".
4. After the completion of backup, when mirror recovery is completed to synchronize the mirror disks between the active server and the standby server, move the failover group as required.

2.23.3 Backing up standby mirror disks

This procedure is intended for backing up a mirror/hybrid disk to its disk image on the standby server while the active server is activated.

Perform the following procedure:

1. Confirm that the mirror is synchronized normally by using Cluster WebUI or by running the `clpmdstat / clphdstat` command:
 - For mirror disk resources:

```
clpmdstat --mirror <md_resource_name>
```
 - For hybrid disk resources:

```
clphdstat --mirror <hd_resource_name>  
clphdstat --active <hd_resource_name>
```

Note:

If the mirror status is GREEN for both servers or both server groups, the mirror is synchronized normally. For hybrid disk resources, confirm which is a current server in the standby server group.

2. In order to secure the quiescent point for data being written to the mirror area, stop the failover group including mirror disk resources and hybrid disk resources by using Cluster WebUI or by running the `clpgrp` command.

Note: Stopping the failover group prevents the backup of the data being written, or the failure to be written and backed up to a mirror area due to a cache.

3. In order to prevent the automatic mirror recovery from working, pause all the mirror disk monitor resources/hybrid disk monitor resources on both of the active server and the standby server, by using Cluster WebUI or executing the following clpmonctrl command:

```
clpmonctrl -s -h <server_name> -m <monitor_resource_name>
```

4. Switch the mirror disks to backup mode by running the clpbackup command.

- For mirror disk resources:

Execute the following command on the standby server (i.e., the server to be backed up):

```
clpbackup --pre --no-shutdown
```

- For hybrid disk resources:

Execute the following command on one server in the standby server group:

```
clpbackup --pre
```

Note:

After the execution, the status of mirroring is changed to that for the backup, automatic startup of the cluster service is set to disabled.

For mirror disk resources: After the above actions are completed, the cluster service stops.

For hybrid disk resources: After the above actions are completed, the server shuts down.

5. For a hybrid disk, after shutting down the server with the clpbackup command, execute the following command on all the other servers of the standby server group:

```
clpbackup --pre --only-shutdown
```

Note: When the command is executed, automatic startup of the cluster service is set to disabled and the server shuts down.

6. If you want to restart the operation immediately, start the failover group (operation) on the active server (i.e., the server not to be backed up) by using Cluster WebUI or by running the clpgrp command.

7. Back up the disk to its disk images on the standby server.

8. After the completion of the backup, return the mirror disks from backup mode to normal mode.

- For mirror disk resources:

Execute the following command on the standby server:

```
clpbackup --post --no-reboot
```

- For hybrid disk resources:

Start all the servers in the standby server group.

Then, execute the following command on one server in the standby server group:

```
clpbackup --post
```

Note:

After the execution, the mirror status returns to normal, automatic startup of the cluster service is set to enabled.
For mirror disk resources: After the above actions are completed, the cluster service starts up.
For hybrid disk resources: After the above actions are completed, the server reboots. The process may take time.

9. For a hybrid disk, execute the following command on all the other servers of the standby server group:

```
clpbackup --post --only-reboot
```

Note: When the command is executed, automatic startup of the cluster service is set to enabled and the server reboots.

10. The cluster service starts up on the standby server.

If the mirror disk monitor resources/hybrid disk monitor resources stay paused, resume them through Cluster WebUI or by executing the following clpmonctrl command:

```
clpmonctrl -r -h <server_name> -m <monitor_resource_name>
```

11. The failover group, if remains stopped (if not restarted immediately in the previous step), is executable on the active server.
12. If automatic mirror recovery is enabled, mirroring is automatically recovered to return to normal.

If automatic mirror recovery is not executed and the server is not working normally, execute mirror recovery by using Cluster WebUI or by running the clpmdctrl / clphdctrl command on the active server.

- For mirror disk resources:

```
clpmdctrl --recovery <md_resource_name>
```

- For hybrid disk resources:

```
clphdctrl --recovery <hd_resource_name>
```

Note: For hybrid disk resources, execute this command on the current server of the active server group.

2.24 How to restore the mirror/hybrid disk from the disk image

Perform either of the following procedures when restoring the partition (cluster partition and data partition) from its disk image backed up as specified in "How to back up a mirror/hybrid disk to its disk image":

2.24.1.	<i>Simultaneously restoring the mirror disks on both of the active and standby servers from the same disk image</i>
2.24.2.	<i>Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images</i>
2.24.3.	<i>Restoring the mirror disk on the single server from the disk image</i>

Note:

- This section describes the procedure to be performed before and after the restoration outside the OS, of the disk image backed up according to "How to back up a mirror/hybrid disk to its disk image".
These procedures are different from that for per-file restoration of activated mirror disks/hybrid disks while the OS is running.
- In these procedures, backup/restoration applies to all the mirror disks and hybrid disks on the target server. These procedures are not applicable to separate backup/restoration for each resource.
- Back up/Restore both of the cluster partition and the data partition.
 - * A mirror/hybrid disk consists of a data partition to be the mirroring target, and a cluster partition to record the management information.
For information on the cluster partition and the data partition, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" or "Understanding Hybrid disk resources".
- If hybrid disk resources exist, it should be determined on which server the restoration is performed, in each of the server groups.
- Each of the procedures with hybrid disk resources is written as follows: Execute `clprestore --post` or `clprestore --post --skip-copy` on a server of a server group first, then perform `clprestore --post --only-reboot` on all the other servers of the server group. Each of the written procedures includes the current server of the server group, as a signpost for the first server of the group on which the command is executed. However, the current server does not have to be the first server.
If the server group has only one server, it is unnecessary to execute `clprestore --post --only-reboot` on all the other servers of the server group.
 - * In each server group, a current server is responsible for the mirror data to be transmitted/received, and to be written to its disk.
In the active server group, the current server contains the hybrid disk resource being activated.
In the standby server group, the current server receives the mirror data, sent from the current server of the active server group, and writes such data to its mirror disk.
- None of the above two procedures applies to a cluster environment including a server with a version earlier than 4.3 of EXPRESSCLUSTER installed.
- When you execute the `clprestore` command to shut down a server, an error may occur with such a message as "Some invalid status. Check the status of cluster.", leading to

a failure in the shutdown. Then wait a while before performing the clpbackup command again.

- After the restoration, if an error such as "Invalid configuration file." is displayed and the server is not restarted, check to see if the configuration data is registered, or there are any problems with the installation of EXPRESSCLUSTER or the setting of the firewall.
- On Cluster WebUI, you can go to **Config mode** -> **Cluster Properties** -> the **Extension** tab, and set **Auto Return** to **Off**. Then, through a restart of the server after its restoration, the server's status changes to *Suspended (isolated) Suspension (Isolated)*.

In this case, click **Recover server** in the **Status** tab of Cluster WebUI, or execute the clpcl command with the --return option as follows:

```
clpcl --return
```

After the server recovery, the failover group may not be started. Then start it if necessary.

- Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:
 - (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter_to_be_changed>: /P
```
 - (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel** > **Administrative Tools** > **Computer Management** > **Disk Management**).
 - (3) Assign a new drive letter to the drive by using Disk Management.
- If **Apply the Configuration File** fails with **Config mode** of Cluster WebUI, distribute the configuration information file to all the servers by using the clpcfctrl command.
 - (1) Save the configuration data file (in zip format) to the disk with **Export** of Cluster WebUI.
 - (2) Extract the zip-formatted configuration data file to the disk accessible from either of the servers that belong to the cluster.
 - (3) Forcibly distribute the extracted configuration information file to all the servers by using the clpcfctrl command:

```
clpcfctrl --push -x <path_to_the_directory_containing_the_<br>->extracted_configuration_data_file_clp.conf> --force --nocheck
```
 - (4) After completing the distribution, you can delete the saved zip file and the extracted configuration data file.

If the distribution fails for any server due to its stoppage, remember to perform the distribution to the server later to avoid inconsistency in the configuration data.

See also:

- For information on the clprestore command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Perform the processing after restoring from a disk image (clprestore command)".
- For information on the clpcfctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Creating a cluster and backing up configuration data (clpcfctrl command)".

2.24.1 Simultaneously restoring the mirror disks on both of the active and standby servers from the same disk image

This procedure is intended for simultaneously restoring both of active/standby mirror disks from the same mirror disk image.

This procedure allows the mirror data of the active server and that of the standby server to be the same, thus eliminating the operation of mirror recovery (full copy) after restoration.

Important:

In this procedure, **Execute the initial mirror construction** needs to be set to disabled in advance in the setting of mirror resources/hybrid resources.

If **Execute the initial mirror construction** is enabled, an error occurs. In this case, disable the setting by using Cluster WebUI.

1. Stop the activated failover group by using Cluster WebUI or by running the clpgrp command.
2. Run the following command on all the active/standby servers:
 - * If the OS cannot be started and the OS or EXPRESSCLUSTER needs to be reinstalled or restored, run the following command on the server where the reinstallation or the restoration was performed:

```
clprestore --pre
```

Note: When the command is executed, automatic startup of the cluster service is set to disabled and the server shuts down.

3. Restore the cluster partition and the data partition on both of the active server and standby server.
 - * Restore the active server and the standby server from the same disk images.
4. After the completion of restoring both of the active server and the standby server, start all the servers.
5. On each of the servers, go to **Control Panel -> Administrative Tools -> Computer Management -> Disk Management**, then respecify the drive letters--for example, of the restored data partition and cluster partition.
 - * Explicitly respecify the drive letters even if they have not been changed.

Note:

For a hybrid disk, you may fail to change/delete the drive letter of a shared-disk partition.

In this case, execute the following mountvol command to delete the drive letter first, then respecify it in **Disk Management**:

```
mountvol <drive_letter_to_be_changed>: /P
```

6. Start Cluster WebUI and change the mode to **Config mode**.

In each setting of the mirror disk resource and the hybrid disk resource, confirm or reselect the cluster partition and the data partition for each server.

 - For information on mirror disk resources, select each server from **Servers that can run the group** on the **Details** tab in the Resource Properties and click the **Edit** button.
Click the **Connect** button in **Selection of partition** to confirm that the data partition and the cluster partition are correctly selected. If not, select the correct partition and click the **OK** button.

- For hybrid disk resources, click **Obtain information** for **Server Groups** under **Details** tab of the Resource Properties.

After the GUID for each partition has been updated, click the **OK** button.

See also:

For the details of the setting, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" -> "Details tab" or "Understanding Hybrid disk resources" -> "Details tab".

7. If **Execute the initial mirror construction** is enabled in the setting of mirror disk resources/hybrid disk resources, change it to disabled.

See also:

For the details of the setting, see **Tuning and Execute the initial mirror construction** in "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" -> "Details tab" or "Understanding Hybrid disk resources" -> "Details tab".

8. After confirming or modifying the setting with Cluster WebUI, execute **Apply the Configuration File**.

Note: If the message "**There is a difference between the disk information in the configuration information and the disk information on the server. Do you want to automatically set it up?**" appears upon executing **Apply the Configuration File**, select **Yes**.

9. After completing the application, execute the following command on each of the active server and the standby server.
* For a hybrid disk, perform this command on one server (e.g. the current server) of the active server group and on that of the standby server group:

```
clprestore --post --skip-copy
```

Note:

When the command is executed, the cluster partition is updated, automatic startup of the cluster service is set to enabled, and the server reboots.

This process may take time for a hybrid disk.

10. For hybrid disk resources: When the server starts rebooting with the command in step 9 above, execute the following command on all the other servers of the server group:

```
clprestore --post --only-reboot
```

Note: When the command is executed, automatic startup of the cluster service is set to enabled and the server reboots.

11. After both of the active/standby servers are started, check the status of mirroring by using Cluster WebUI or by running the clpmdstat / clphdstat command.

The status of mirroring for both the active server and the standby server is "Normal" (GREEN).

- For mirror disk resources:

```
clpmdstat --mirror <md_resource_name>
```

- For hybrid disk resources:

```
clphdstat --mirror <hd_resource_name>
```

Note:

If the mirroring status of either the active server or the standby server is "Normal" (GREEN) and that of the other is "Abnormal" (RED), then make a mirror recovery by clicking **Difference copy** icon in the **Mirror disks** tab of Cluster WebUI or by executing the clpmdctrl/clphdctrl command with the --recovery option on the "Normal" (GREEN) status server:

- For mirror disk resources:

```
clpmdctrl --recovery <md_resource_name>
```

- For hybrid disk resources:

(* Perform this command on the current server.)

```
clphdctrl --recovery <hd_resource_name>
```

In addition, check the status of the failover group by using Cluster WebUI or executing the clpstat command. If you find the failover group has failed to start, stop the group by using Cluster WebUI or executing the clpgrp command. Then you can start the failover group (operation).

Note:

If the mirroring statuses of both the active server and the standby server are "Abnormal" (RED), change the status of the mirror side to be copied to "Normal" (GREEN) by clicking **Forced mirror recovery** icon in the **Mirror disks** tab of Cluster WebUI or by executing the clpmdctrl/clphdctrl command with the --force option. Confirm the status of the failover group by using Cluster WebUI or by running the clpstat command. Stop the failover group that failed the startup by using Cluster WebUI or by running the clpgrp command. After that, on the latest server, the failover group can be started (the operation can be started). And then, execute the mirror recovery.

See also:

For information on the clpmdctrl / clphdctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Operating mirror disk resource (clpmdctrl command)" or "Operating hybrid disk resource (clphdctrl command)".

12. If the setting of **Execute the initial mirror construction** is changed, restore the original setting by using Cluster WebUI as required.

2.24.2 Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images

This procedure is intended for simultaneously restoring both of active/standby mirror disks from the respective mirror disk image.

Perform the following procedure:

See also:

For information on the procedure of restoring both of active/standby mirror disks from the same mirror disk image, see "*Simultaneously restoring the mirror disks on both of the active and standby servers from the same disk image*".

1. Stop the activated failover group by using Cluster WebUI or by running the clpgrp command.
2. Run the following command on all the active/standby servers:
 - * If the OS cannot be started and the OS or EXPRESSCLUSTER needs to be reinstalled or restored, run the following command on the server where the reinstallation or the restoration was performed:

```
clprestore --pre
```

Note: When the command is executed, automatic startup of the cluster service is set to disabled and the server shuts down.

3. Restore the cluster partition and the data partition on both of the active server and standby server.
4. After the completion of restoring both of the active server and the standby server, start all the servers.
5. On each of the servers, go to **Control Panel -> Administrative Tools -> Computer Management -> Disk Management**, then respecify the drive letters--for example, of the restored data partition and cluster partition.
 - * Explicitly respecify the drive letters even if they have not been changed.
6. Start Cluster WebUI and change the mode to **Config mode**.
In each setting of the mirror disk resource and the hybrid disk resource, confirm or reselect the cluster partition and the data partition for each server.

- For information on mirror disk resources, select each server from **Servers that can run the group** on the **Details** tab in the Resource Properties and click the **Edit** button.

Click the **Connect** button in **Selection of partition** to confirm that the data partition and the cluster partition are correctly selected. If not, select the correct partition and click the **OK** button.

- For hybrid disk resources, click **Obtain information** for **Server Groups** under **Details** tab of the Resource Properties.

After the GUID for each partition has been updated, click the **OK** button.

See also:

For the details of the setting, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" -> "Details tab" or "Understanding Hybrid disk resources" -> "Details tab".

7. After confirming or modifying the setting with Cluster WebUI, execute **Apply the Configuration File**.

Note: If the message "**There is a difference between the disk information in the configuration information and the disk information on the server. Do you want to automatically set it up?**" appears upon executing **Apply the Configuration File**, select **Yes**.

8. After completing the application, execute the following command on each of the active server and the standby server.
 - * For a hybrid disk, perform this command on one server (e.g. the current server) of the active server group and on that of the standby server group:

```
clprestore --post
```

Note:

When the command is executed, the cluster partition is updated, automatic startup of the cluster service is set to enabled, and the server reboots.

This process may take time for a hybrid disk.

9. For hybrid disk resources: When the server starts rebooting with the command in step 8 above, execute the following command on all the other servers of the server group:

```
clprestore --post --only-reboot
```

Note: When the command is executed, automatic startup of the cluster service is set to enabled and the server reboots.

10. After both of the active/standby servers are started, check the status of mirroring by using Cluster WebUI or by running the `clpmdstat / clphdstat` command.

The status of the mirror for both the active server and the standby server is "Abnormal" (RED).

- For mirror disk resources:

```
clpmdstat --mirror <md_resource_name>
```

- For hybrid disk resources:

```
clphdstat --mirror <hd_resource_name>
```

11. Confirm the status of the failover group by using Cluster WebUI or by running the `clpstat` command.

12. Stop the failover group that failed the startup by using Cluster WebUI or by running the `clpgrp` command.

13. Change the status of the mirror side to be updated to "Normal" (GREEN) by clicking **Forced mirror recovery** icon in the **Mirror disks** tab of Cluster WebUI or by executing the `clpmdctrl/clphdctrl` command with the `--force` option on the server whose status is to be "Normal" (GREEN).

- For mirror disk resources:

```
clpmdctrl --force <md_resource_name>
```

- For hybrid disk resources:

```
clphdctrl --force <hd_resource_name>
```

14. On the latest server, by using Cluster WebUI or by running the `clpgrp` command, the failover group can be started (the operation can be started).

15. Make a mirror recovery (full copy) by clicking **Full copy** icon in the **Mirror disks** tab of Cluster WebUI or by executing the `clpmdctrl/clphdctrl` command on the copy-source server (on the copy-source current server for hybrid disk resources).

- For mirror disk resources:

```
clpmdctrl --recovery <md_resource_name>
```

- For hybrid disk resources:

```
clphdctrl --recovery <hd_resource_name>
```

For information on the `clpmdctrl / clphdctrl` command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Operating mirror disk resource (clpmdctrl command)" or "Operating hybrid disk resource (clphdctrl command)".

2.24.3 Restoring the mirror disk on the single server from the disk image

To restore only the mirror disk of the standby server with the active server operating, see "*Restoring the system disk of a virtual machine (mirror disk)*", read "the server with the system disk to be restored" as " the server with the mirror disk to be restored", and then follow the procedure from step 1 (moving a failover group) through step 12 (confirming that the mirror is synchronized normally). In steps 4 and 5, create only a virtual hard disk for the mirror disk and replace with it the existing disk.

2.25 Restoring the system disk

2.25.1 Restoring the system disk

If an error occurs in the system disk of the server, change the disk following the steps below, and restore the backup data. If EXPRESSCLUSTER has been updated or changes have been made on the configuration after the backup was created, make sure to uninstall EXPRESSCLUSTER after restoration and set this server as a new server by following the steps for server replacement.

1. If any group is running on the server where a system disk is restored (hereafter referred to as target server), move the group. When a mirror disk resource or hybrid disk resource is used, make sure that these resources are running properly after the group is moved.

Important: If the mirror disk resource or hybrid disk resource is not in the latest status, and if the system disk is restored on the server that is not to be restored, the data on the data partition may be corrupted.

2. If the mirror disk resource or hybrid disk resource is used, execute the following procedure.
 - Uncheck **Auto Mirror Recovery** in **Mirror Disk** tab of **Cluster Properties** in the config mode of Cluster WebUI.
 - Click **Apply the Configuration File** of the config mode of Cluster WebUI, and apply the cluster configuration data to the cluster.
3. If the target server is running, shut down the server by selecting **Shut Down** from **Start** menu.
4. When the shared disk is connected to the target server, remove the cable connecting the target server and the shared disk. Remove the cable carefully by following the instructions shown below:
 - When a SCSI disk array is used, remove the cable from the base of the two-way cable.
 - When a Fibre Channel disk array device, remove the cable between the failing server and the Fibre Channel-HUB or the Fibre Channel-Switch.
5. Change the system disk of the server to be restored. For details on how to change the system disk, see the user's guide provided with the device.
6. Follow the normal installation procedure and install the OS.
 - To install the OS, see the user's guide provided with the server.
 - Make sure to configure the network settings when installing the OS. Apply the same OS service pack as the removed disk.
7. Make sure that the OS is running normally, and install the backup software. (For details, see the manual of the backup software.)
8. Use the backup software to restore the system disk from the backup.
 - There is no note cluster dependent note. Restore the system disk with the settings that allow the registry to be recovered and files with the same file names to be overwritten. For details, see the manual of the backup software.
9. When the EXPRESSCLUSTER Server service of the target server is configured as Auto Startup, change the settings to Manual Startup.
10. Reset its drive letter if it has been changed. Also make sure that the date and time on the OS are the same as those of other servers in the same cluster.

11. When the driver of SCSI controller or FC-HBA (Host Bus Adapter) cannot be restored, re-install the above driver. For details, refer to the instruction manual of backup software.
12. Restart the target server. When the shared disk is not connected to the target server, the following steps up to 16 are not required.
13. Connect to the server that has not been restored via the Web browser to start the Cluster WebUI. Open the **Properties** of the target server to configure the filter settings of the HBA connected to the shared disk.
 - Click **Connect** on the **HBA** tab to acquire the disk configuration information for the target server, and then select the check box for the HBA connected to the shared disk.
 - Do not change any settings other than above.
14. Use Cluster WebUI to save the cluster configuration information in which HBA filter settings have been configured in a disk area accessible from a cluster server.
 - When the Cluster WebUI is used on a cluster server, save the information in the local disk. When the Cluster WebUI is used in another PC, save the information in the shared disk that can be accessed from the cluster server or save it in an external media disk or the like and then copy it to the local disk of a cluster server.
15. Run the following command on one of the cluster servers to upload the saved cluster configuration information.

```
clpcfctrl --push -x <path_of_the_cluster_configuration_information>_
↪--nocheck
```
16. Shut down the target server and connect the disk cable, and then reboot the server.
17. If the server configuration (before restoration) meets any of the following conditions, create a partition again with **Disk Management**.
 - A cluster partition of a mirror disk resource/hybrid disk resource was present in the system disk
 - A data partition of a mirror disk resource/hybrid disk resource was present in the system disk.

Note: To re-create a data partition, resize the data partition according to data partition size of another server where you did not perform restoration.

18. Start the target server and check the drive letter of the shared disk and the mirror disk (data partition and cluster partition) in **Disk Management of the target server**. If the drive letter has been changed, re-configure it as it was, restart the server and check that the drive letter is configured correctly.
19. Connect to the server which has not been restored via the Web browser to start the Cluster WebUI. When the shared disk is connected to the target server and the shared disk has a volume that is not for filtering, update the information on the partition that is not for filtering in the **HBA** tab of **Properties** in the target server.
20. Perform the procedures in steps 14 and 15 above to save the cluster configuration information and then upload the information by using the clpcfctrl command from the server.
 - If the message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears upon saving the configuration information, select **Yes**.
21. Restore the setting of the EXPRESSCLUSTER Server service to Auto Startup and reboot the target server.
22. When the Auto Recovery is configured as **Off** in **Extension** tab of **Cluster Properties** of the cluster, click **Recover Server** of the target server in the operation mode of Cluster WebUI. If mirror disk resource or hybrid disk resource is not used on the target server, the following procedure is not required.
23. When a mirror disk resource or hybrid disk resource is created on the system disk, the resource must be recreated before mirror recovery. Perform the following procedure.

- 23-1. From the operation mode of Cluster WebUI, stop the group containing the target mirror disk resource or hybrid disk resource.
 - 23-2. Suspend the cluster.
 - 23-3. From the config mode of Cluster WebUI, execute **Remove Resource** of the target mirror disk resource or hybrid disk resource. Before deleting the resource, make a note of the parameter values required for recreating the resource.
 - 23-4. Click **Apply the Configuration File** from the **File** menu and then apply the cluster configuration data to the cluster.
 - 23-5. Execute **Add Resource** of the failover group. For each parameter, specify the same value as that specified for the resource that was deleted.
 - 23-6. Click **Apply the Configuration File** from the **File** menu again and then apply the cluster configuration data to the cluster.
 - 23-7. Resume the cluster.
24. Open Cluster WebUI -> **Mirror disks**, then make a mirror recovery (full copy) of all the mirror disk resources and hybrid disk resources.

Note:

Data on the server on which restore is performed (the disk is replaced) may not be up to date. A server where **restoring is not performed** must be **the source of the copy**.

In addition, Recover the mirror by **fully copying**, not partially copying because the data difference may be invalid in the process of restoring.

25. When you have unchecked **Auto Mirror Recovery** in step 2, select **Mirror disk tab** and check **Auto Mirror Recovery** in the **Cluster Properties** of the config mode of Cluster WebUI.
26. Click **Apply the Configuration File** of the config mode of Cluster WebUI, **to upload the cluster configuration data to the cluster**.
27. Start the group.

2.25.2 Restoring the system disk of a virtual machine (mirror disk)

If a failure occurs in the system disk of a server in a virtual environment, follow the steps below to replace the disk and to restore the contents from a backup.

Note:

- This procedure is not intended for backup/restoration by the file; but for backing up as or restoring from a disk image, outside the OS.
- This procedure requires backing up the disk as a disk image beforehand.
For information on how to create the disk image, refer to "2.23.1. *Simultaneously backing up both active and standby mirror disks*" and "2.23.3. *Backing up standby mirror disks*". These sections instruct you to execute `clpbackup --pre --no-shutdown` as a step for mirror disk resources. Instead, however, execute `clpbackup --pre` to shut down the server, and then create the backup. This is because, when you back up the system disk, it is recommended to make the system disk static.
- This procedure is for restoring the system disk and mirror disk resources on the server, but not for separately restoring each of the resources.

1. Move a group which has started up on the server with the system disk to be restored (hereafter referred to as the target server), if any. After moving the group, check that each group resource is normally started up.
2. In order to prevent the automatic mirror recovery, pause all the mirror disk monitor resources on servers other than the target server, by using Cluster WebUI or executing the following clpmonctrl command:

```
clpmonctrl -s -h <server name> -m <monitor resource name>
```

3. Shut down the target server by executing the following the clprestore command:

```
clprestore --pre
```

4. Use the backup image of the target server to create a new virtual hard disk.
 - If the target server currently has separate virtual hard disks (one for the system disk and the other[s] for the mirror disk resource[s]), use their backup images to create their respective new virtual hard disks.
5. Replace the existing virtual hard disk of the target server, with the new one.
For more information on the replacement procedure, refer to the manuals or guides of virtual platforms and cloud environments.
6. Start up the target server.

Note:

Starting up the target server does not automatically start up the cluster service. Since you executed `clpbackup --pre` in creating the backup, automatic startup of the cluster service is disabled.

7. On the target server, check that the drive letter after the restoration is the same as that before the restoration. If the drive letter is different, set it as before. Also make sure that the date and time on the OS are the same as those of other servers in the same cluster.
 8. On the target server, check that the disk GUID after the restoration is the same as that before the restoration. If the disk GUID is different, set it as before (for example, by using the `uniqueid` command of `diskpart`). Then restart the server.
 9. Execute the following `clprestore` command to reboot the target server.
- ```
clprestore --post
```
10. Open Cluster WebUI -> **Mirror disks**, then make a mirror recovery (full copy) of all the mirror disk resources.

---

**Note:**

The copy source must be a server on which data to be updated exists.

Make a full copy instead of a differential copy, because the data difference may have become invalid during the restoration process.

---

11. Resume the mirror disk monitor resources on the servers other than the target server, by using Cluster WebUI or executing the following `clpmonctrl` command:

```
clpmonctrl -r -h <server_name> -m <monitor_resource_name>
```

12. Confirm that the mirror is synchronized normally, by using Cluster WebUI or by running the `clpmdstat` command:

```
clpmdstat --mirror <md_resource_name>
```

---

**Note:**

If the mirror status is GREEN for both servers, the mirror is synchronized normally.

---

## 2.26 Replacing the shared disk

---

**Important:** Before step 16, it is not possible to access to the partitions under HBAs to be managed by cluster, even if the partition is not access restricted.

---

1. Make sure that the cluster is working properly. (However, ignore errors in the disk to be replaced.)
2. Stop the cluster by using the Cluster WebUI. When the shared disk to be replaced is connected to some of the servers but not all, stop those servers only.
3. On all servers connected to the shared disk to be replaced, set **Startup Type** to **Manual** from **Properties** of the **EXPRESSCLUSTER Server** service.
4. Shut down all the servers connected to the shared disk to be replaced, and power them off.
5. Power off the shared disk, and change the disk.
6. Power on the shared disk, and configure its settings.
  - If it is required to build a RAID again or to change the LAN configuration, use the setup tool provided with the shared disk. For details, see the manual provided with the shared disk.
7. Start only one server, create a partition by using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.), and set the drive letter as before replacing the disk. Even if the drive letter you want to assign is the same as the drive letter automatically assigned by the OS, manually assign the desired drive letter explicitly; for example, by deleting the OS assigned drive letter and then assigning the desired drive letter.

---

**Note:** Controlling the access to the created partition is started upon its creation, so it cannot be formatted. Set only the drive letter here.

---

---

**Note:** The size of the switchable partition used for disk resource can be changed in this occasion. The size of the data partitions of hybrid disk resource need to be the same in both server groups. Because of this, to change the size it is necessary to delete the resource, change the partition size in both server groups and then create the resource again.

---

---

**Note:** Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

---

- (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter(_to_be_changed)>: /P
```
  - (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).
  - (3) Assign a new drive letter to the drive by using Disk Management.
8. To format the partition to be used as the disk resource, execute the following command to temporarily release the access restriction.

```
clpvolctrl --open <drive_letter_of_the_partition_to_be_used_as_the_disk_
->resource>
```

9. From disk management (**Control Panel > Administrative Tools > Computer Management > Disk Management**), format the partition to be used as the disk resource.
10. To restore the access restriction temporarily released in 8, above, execute the following command:  

```
clpvolctrl --close <drive_letter_of_the_partition_to_be_used_as_the_disk_
→resource>
```
11. Start other servers connected to the replaced shared disk in the cluster, by using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.), and check that the partition created by the first server is visible.
12. Set the drive letter of the partition used for the disk resource in the same way as the first server.
13. Start the Cluster WebUI.
14. When there are partitions with no access restriction on the replaced shared disk, add these partitions in **Partition excluded from cluster management** by selecting the **HBA** tab of **Properties** and then clicking **Connect** in each server connected to the shared disk.

---

**Note:** When **Partition excluded from cluster management** is set for the shared disk before replacement, delete the setting, and then make the setting again. Perform the following procedure.

---

- 14-1. Open the **HBA** tab of **Properties** of the server that is connected to the replaced disk from the config mode of Cluster WebUI, and then click **Connect**.
- 14-2. Select an HBA for which filtering is checked and then execute **Remove** for all the partitions that are displayed in **Partition excluded from cluster management**.
- 14-3. Click **Add** again to add all the partitions deleted in step 14-2.
- 14-4. Make sure that **Volume**, **Disk No.**, **Partition No.**, **Size**, and **GUID** are displayed for each partition that is excluded from cluster management.
15. When some servers are operating as cluster, stop the cluster from the operation mode of Cluster WebUI.
16. Click **Apply the Configuration File of** the config mode of Cluster WebUI and apply the cluster configuration data to the cluster.
  - When the message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears, select **Yes**.
17. On all servers connected to the replaced shared disk, re-configure **Startup Type** to **Automatic** from **Properties** of the **EXPRESSCLUSTER Server** service.
18. Start the Cluster WebUI, and start the cluster from the operation mode.
19. When there is a partition of the hybrid disk resource on the replaced shared disk, rebuilding of mirroring (full copy) is automatically performed if the **Auto mirror recovery** is configured in the **Mirror disk** tab of **Cluster Properties**. If the settings are configured not to perform **Auto mirror recovery**, reconfigure mirror manually.

## 2.27 Replacing the mirror disk

If an error occurs in a disk that forms a mirror set, follow the steps below to replace the disk. When using a disk array, the procedure below also needs to be performed if the array configuration is changed or a disk is recognized as a new one due to DAC replacement or some other reason.

You can replace a local disk mirrored by a hybrid disk resource by following the steps below. In that case, consider "mirror disk resource" in the description below as "hybrid disk resource". To replace a shared disk that is mirrored by a hybrid disk resource consisting of three or more servers, see the procedure described in "Replacing the hybrid disk".

1. Make sure that the cluster is working properly. (However, ignore errors in the disk to be replaced.)
2. If the group is running on the server, which contains the disk to be replaced, move the group.
3. When the **Auto Mirror Recovery** check box is selected in **Properties** of the cluster, in the config mode of Cluster WebUI, select **Properties** of the cluster and the **Mirror disk** tab, clear the **Auto Mirror Recovery** check box, click **Apply the Configuration File in the File menu to apply the cluster configuration data to the cluster**.
4. Shutdown the server whose disk is to be replaced from the operation mode of Cluster WebUI and power it off.
5. Replace the disk and start the server.
6. Configure the settings for the disk by the server with the replaced disk.
  - Reserve the data partition and the cluster partition for the mirror disk by using Disk Management (On the **Start** menu, point to **Settings**, and click **Control Panel**. Double-click **Administrative Tools** and then **Computer Management**, and click **Disk Management**.) Set the drive letters of the data partition and the cluster partition so that the drive letters of data partition and cluster partition and the size of data partitions are the same in both servers.
7. When the **Auto Mirror Recovery** is configured as **Off** in the **Extension** tab in **Cluster properties**, return the replaced server to the cluster from the operation mode of Cluster WebUI.
8. Suspend the cluster.
9. Start Cluster WebUI. If you have unchecked the **Auto Mirror Recovery** check box in procedure 3, check the **Auto Mirror Recovery** check box again.
10. Click **Apply the Configuration File of the config mode of Cluster WebUI to upload the cluster configuration data to the cluster**.
  - When the message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears, select **Yes**.
11. Resume the cluster from the operation mode of Cluster WebUI.
12. If the **Auto Mirror Recovery** check box is selected in cluster properties, full reconstruction of mirror will be performed. If not, it is required to perform the reconstruction manually.
13. Move the group as necessary.

## 2.28 Replacing the hybrid disk

In a hybrid disk resource environment consisting of three or more servers, if an error occurs in a shared disk that forms a mirror set, replace that disk by applying the procedure described below. When a disk array is used, the procedure below also needs to be performed if the configuration of the array is changed or a disk is recognized as being a new one due to DAC replacement or some other reason.

To replace a local disk that is mirrored by a hybrid disk resource, see the procedure in "Replacing the mirror disk".

1. Check that the cluster is working properly. (Ignore errors with the disk that is to be replaced.)
2. If the group is running on the server, which contains the disk to be replaced, move the group.
3. When the Auto Mirror Recovery check box is selected in Properties of the cluster, in the config mode of Cluster WebUI, select Properties of the cluster and the Mirror disk tab, clear the Auto Mirror Recovery check box, click Apply the Configuration File in the File menu to apply the cluster configuration data to the cluster.
4. Select **Stop Server Service** from the operation mode of Cluster WebUI to execute cluster stop for all the servers connected to the shared disk to be replaced.
5. On all the servers connected to the shared disk to be replaced, set **Startup Type** to **Manual** for **EXPRESS-CLUSTER Server service**.
6. Shut down all the servers connected to the shared disk to be replaced, and power them off.
7. Power off and replace the shared disk.
8. Power on the shared disk, and configure its settings.
  - If the RAID is to be built again or if the LUN configuration is to be changed, use the setup tool provided with the shared disk. For details, refer to the manual provided with the shared disk.
9. Start only one server, create a partition by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**) and set the drive letter as before replacing the disk. **Even if the drive letter you want to assign is the same as the drive letter automatically assigned by the OS, manually assign the desired drive letter explicitly; for example, by deleting the OS assigned drive letter and then assigning the desired drive letter.**

---

**Note:** Controlling the access to the created partition is started upon its creation, so it cannot be formatted. Set only the drive letter here.

---

---

**Note:** The size of the switchable partition used for a disk resource can be changed in this occasion. The sizes of the data partitions of a hybrid disk resource need to be the same in both server groups. For this reason, to change the size, it is necessary to delete the resource, change the partition size in both server groups and then create the resource again.

---

---

**Note:** Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

- (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter(_to_be_changed)>: /P
```

- (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).
- (3) Assign a new drive letter to the drive by using Disk Management.

10. To format the partition to be used as a disk resource, execute the following command to temporarily release the access restriction:

```
clpvolctrl --open <drive_letter_of_partition_to_be_used_as_disk_resource>
```

11. From Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**), format the partition to be used as a disk resource.

12. To restore the access restriction temporarily released in step **10** above, execute the following command:

```
clpvolctrl --close <drive_letter_of_partition_to_be_used_as_disk_resource>
```

13. Start the other servers connected to the replaced shared disk, and check that the partition created on the first server is visible from Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**).

14. Set the drive letter for each partition on the shared disk in the same way as for the first server as before replacing the disk.

15. On all the servers connected to the replaced shared disk, restore **Startup Type** to **Automatic** for **EXPRESS-CLUSTER Server** service.

16. Start the Cluster WebUI and select **Service**, then click **Start server service** to execute cluster start for all the servers connected to the replaced shared disk.

---

**Note:** An hdw or hdtw warning message may be displayed at this time. Ignore the message and proceed to the next step.

---

17. Suspend the cluster.

18. When there are partitions with no access restrictions on the replaced shared disk, add these partitions to **Partition excluded from cluster management** by selecting the **HBA** tab of **Properties** and then clicking **Connect** for each server connected to the shared disk.

---

**Note:** When **Partition excluded from cluster management** is set for the shared disk before replacement, delete the setting, and then make the setting again. Perform the following procedure.

---

1. Open the **HBA** tab of **Properties** of the server that is connected to the replaced disk from the config mode of Cluster WebUI and then click **Connect**.
  2. Select an HBA for which filtering is checked and then execute **Remove** for all the partitions that are displayed in **Partition excluded from cluster management**.
  3. Click **Add** again to add all the partitions deleted in step **18-2**.
  4. Make sure that **Volume**, **Disk No.**, **Partition No.**, **Size**, and **GUID** are displayed for each partition that is excluded from cluster management.
19. Start the Cluster WebUI. If you have unchecked **Auto Mirror Recovery** in step **3**, check it again.
  20. Click **Apply the Configuration File of** the config mode of Cluster WebUI **to apply the cluster configuration data to the cluster**.
    - When the pop-up message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears, select **Yes**.
  21. Resume the cluster from the operation mode of Cluster WebUI.

22. If **Auto Mirror Recovery** is checked, full reconstruction (full copying) of the mirror set is performed automatically. Otherwise, manually reconstruct the mirror set.
23. Move the group as required.



## 2.29 Increasing the shared disk size

First, expand the logical disk volume in the shared disk settings so that you can allocate enough free space for increasing the disk size immediately after the partition that is used by the disk resource.

The disk size can not be increased by using the free space of a disk other than the disk that includes the partition that you want to expand.

1. Make sure that the cluster is working properly.
2. Suspend all monitor resources by the using the operation mode of Cluster WebUI.
3. Shut down and power off all servers connected to the shared disk by using the operation mode of Cluster WebUI, excluding the server on which the group is running.
4. Perform **Extend Volume** by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management**) for the target drive on the server on which the group is running.
5. Start all servers that were shut down in step 3.
6. Check whether the drive letter of the expanded volume has been changed on all servers. If the drive letter has been changed, assign the previous drive letter.

---

**Note:** Changing or deleting the drive letter assigned to a partition of a shared disk may fail. To avoid this, specify the drive letter according to the procedure below:

- (1) Run the following command by using the command prompt to delete the drive letter.

```
mountvol <drive_letter(_to_be_changed)>: /P
```

- (2) Confirm that the drive letter has been deleted from the target drive by using Disk Management (**Control Panel > Administrative Tools > Computer Management > Disk Management\***).
- (3) Assign a new drive letter to the drive by using Disk Management.

- 
7. Stop the group that includes the disk resource by using the operation mode of Cluster WebUI.
  8. Suspend the cluster by using the operation mode of Cluster WebUI.
  9. Click **Apply the Configuration File** of the config mode of Cluster WebUI to apply the cluster configuration data to the cluster.

---

**Note:** When the pop-up message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears, select **Yes**.

---

10. Resume the cluster by using the operation mode of Cluster WebUI.
11. Start the group by using the operation mode of Cluster WebUI.
12. Move the group as required.

## 2.30 Increasing the mirror disk size

---

**Note:**

Sufficient disk space must be present right after a data partition area.

The disk size can not be increased by using the free space of a disk other than the disk that includes the partition that you want to expand.

---

1. Make sure that the cluster is working properly.
2. Make sure mirror disk resource you will extend is in normal status.
3. Suspend all the mirror disk monitor resources in the operation mode of Cluster WebUI to prevent automatic mirror recovery.
4. Run the following clpmdctrl command on the server an inactive mirror disk resource belongs to. If the resource is not activated on either server, run the command on either of the servers. The following is an example for extending an md01 data partition to 500 gibibytes.

```
clpmdctrl --resize md01 500G
```

5. Run the clpmdctrl command on the other server. The following example is to extend to 500 gibibytes for a md01 data partition.

---

**Important:** If a mirror disk resource is activated on either of the servers, make sure to run the command on the server that a deactivated mirror disk belongs to. Execution on an activated server results in a mirror break.

```
clpmdctrl --resize md01 500G
```

---

6. Run the following command to confirm the volume sizes of the both servers are the same.

```
clpvolsz <Partition drive letter for mirror disk resource >:
```

7. Run the diskpart command on the server an active mirror resource belongs to.

```
diskpart
```

8. Run the list volume command at DISKPART prompt to confirm the volume number (### column) of the target data partition. The example is as follows:

```
DISKPART> list volume
```

| Volume ### | Ltr | Label | Fs    | Type      | Size   | Status   | Info   |
|------------|-----|-------|-------|-----------|--------|----------|--------|
| Volume 0   | E   |       |       | DVD-ROM   | 0 B    | No Media |        |
| Volume 1   | C   |       | NTFS  | Partition | 99 GB  | Healthy  | Boot   |
| Volume 2   | D   |       | NTFS  | Partition | 500 GB | Healthy  |        |
| Volume 3   |     |       | FAT32 | Partition | 100 MB | Healthy  | System |

9. Run the select volume command at DISKPART prompt to choose the target volume.

```
DISKPART> select volume 2
```

10. Run the extend filesystem command at DISKPART prompt to extend the target file system of the volume.

```
DISKPART> extend filesystem
```

11. Run the exit command at DISKPART prompt to end diskpart prompt.

```
DISKPART> exit
```

12. In the operation mode of Cluster WebUI, restart all the mirror disk monitor resources that were suspended in step 3.

---

**Important:**

The `clpmdctrl --resize` command is effective only when mirror disk resources are in the normal status.

If the mirror becomes inconsistent (mirror break) between step 4 and 5, you can not extend a data partition at step 5. In this case, use the `-force` option to forcibly extend the data partition in step 5 and complete all the steps. Then recover the mirror disk.

If you use the `-force` option for extension, full copy is performed to rebuild the mirror first time.

```
clpmdctrl --resize md01 500G -force
```

## 2.31 Increasing the hybrid disk size

---

**Note:**

Sufficient free space must be present right after a data partition area.

The size of the disk cannot be increased by using the free space of a disk other than the disk that includes the partition to be expanded.

---

1. Make sure that the cluster is working properly.
2. Make sure that the hybrid disk resource to be expanded is in a normal status.
3. Suspend all the hybrid disk monitor resources in the operation mode of Cluster WebUI to prevent automatic mirror recovery.
4. Keeping in operation the current server of each server group, shut down all the other servers. You can check the status of the current server by executing the `clphdstat` with the `-a` option. The following shows an example of checking the status of the current server in the `hd01` resource:

```
clphdstat -a hd01
```

5. Execute the following `clphdctrl` command on the current server of the server group where the hybrid disk resource is deactivated.  
If the resource is not activated on either server group, run the command on either of the servers. The following is an example for extending an `hd01` data partition to 500 gibibytes.

```
clphdctrl --resize hd01 500G
```

6. Likewise, perform the following `clphdctrl` command on the current server of the other server group.  
The following is an example for extending an `hd01` data partition to 500 gibibytes.

```
clphdctrl --resize hd01 500G
```

---

**Important:** If the hybrid disk resource is activated on either of the servers, make sure to run the command on the server where the hybrid disk resource is deactivated. Execution on an active server group results in a mirror break.

---

7. Run the following command to confirm that the size of the volume is the same between both the server groups:  
`clpvolsz <Partition drive letter for hybrid disk resource>:`
8. Run the `diskpart` command on the active server.

```
diskpart
```

9. Run the `list volume` command at DISKPART prompt to confirm the volume number (### column) of the target data partition. The example is as follows:

```
DISKPART> list volume
```

| Volume ### | Ltr | Label | Fs    | Type      | Size   | Status   | Info   |
|------------|-----|-------|-------|-----------|--------|----------|--------|
| Volume 0   | E   |       |       | DVD-ROM   | 0 B    | No media |        |
| Volume 1   | C   |       | NTFS  | Partition | 99 GB  | Normal   | Boot   |
| Volume 2   | D   |       | NTFS  | Partition | 500 GB | Normal   |        |
| Volume 3   |     |       | FAT32 | Partition | 100 MB | Normal   | System |

10. Run the select volume command at DISKPART prompt to choose the target volume.

```
DISKPART> select volume 2
```

11. Run the extend filesystem command at DISKPART prompt to extend the target file system of the volume.

```
DISKPART> extend filesystem
```

12. Run the exit command at DISKPART prompt to end diskpart prompt.

```
DISKPART> exit
```

13. In the operation mode of Cluster WebUI, restart all the hybrid disk monitor resources that were suspended in step 3.

14. Start up all the servers that you shut down in step 4.

---

**Important:**

The [clpmdctrl --resize] command is effective only when hybrid disk resources are in the normal status.

If the mirror becomes inconsistent (mirror break) between step 5 and 6, the data partition cannot be extended at step 6. In this case, use the -force option to forcibly extend the data partition in step 6 and complete all the steps. Then recover the mirror disk.

If the [-force] option is used for extension, full copy is performed to rebuild the mirror first time.

```
clphdctrl --resize hd01 500G -force
```

## 2.32 Replacing the disk array controller (DAC)/updating the firmware

After the disk array controller (DAC) is replaced or the firmware is updated, the OS may recognize an existing disk as a new disk even if the disk has not been replaced actually. The required procedure varies depending on how the OS recognizes the disk. Therefore, be sure to perform the following procedure when replacing the DAC or updating the firmware.

1. Make sure that the cluster is working properly.
2. If a group is active on a server on which DAC is to be replaced or on which the firmware is to be updated (hereafter referred to as target server), move the group.
3. Before replacing the DAC or updating the firmware, execute the following command to check the combinations of "drive letter" and "GUID" for the partitions of all the mirror disk resources and hybrid disk resources.

```
mountvol
```

Output example:

The following are output examples.

The drive letter is applied to "C:\".

The GUID is applied to "123da03b-e7e0-11e0-a2aa-806d6172696f".

```
C:> mountvol

Possible values for the current mount point and volume name:

 \\?\Volume{123da03a-e7e0-11e0-a2aa-806d6172696f}\
 C:\

 \\?\Volume{123da03b-e7e0-11e0-a2aa-806d6172696f}\
 Z:\

 \\?\Volume{123da03c-e7e0-11e0-a2aa-806d6172696f}\
 P:\
```

4. When replacing the DAC, shut down the target server from the operation mode of Cluster WebUI to power off.
5. Replace the DAC or update the firmware.  
When replacing the DAC, power on the target server to start the OS.
6. After the completion of DAC replacement or firmware update, perform the following procedure to check that the OS recognizes the disk used by the mirror disk resources and hybrid disk resources as an existing disk.  
Execute the following command on the target server to check whether the combinations of "drive letter" and "GUID" for the mirror disk resources and hybrid disk resources have changed from those checked in step 3.

```
mountvol
```

7. When the combinations of "drive letter" and "GUID" for all mirror disk resources and hybrid disk resources have not changed from those checked in step 3, the disk is recognized as an existing disk by the OS. In this case, execute step 10 and subsequent steps. (Steps 8 and 9 are not required.)  
When the combination has changed from that checked in step 3, the disk is recognized as a new disk by the OS. In this case, execute step 8 and subsequent steps.
8. Check the disk setting on the target server.

- Check the drive letters of the data and cluster partitions using Disk Management (**Control Panel -> Administrative Tools -> Computer Management -> Disk Management**). If the drive letter has been changed, re-configure it as it was, restart the server and check that the drive letter is configured correctly.
9. Restart the target server from the operation mode of Cluster WebUI.
    - If the drive letters are corrected in step 8 above, reconfigure the cluster information according to the procedures in steps 7 to 11 of "Replacing the mirror disk". In this case, read "server on which disks were replaced" as "target server".
  10. Recover the target server to the cluster.
    - In automatic recovery mode, the server is automatically recovered to the cluster.
  11. If **Cluster Properties -> Mirror Disk** tab -> **Auto Mirror Recovery** is set, the mirror is automatically reconstructed (partially copy or full copy). If the settings are configured not to perform **Auto Mirror Recovery**, reconstruct the mirror manually.
    - If mirror reconstruction ends abnormally, reconfigure the cluster information according to the procedures in steps 8 to 12 of "[2.27. Replacing the mirror disk](#)". In this case, read "server on which disks were replaced" as "target server".
  12. Move the group as required.

## 2.33 Replacing FibreChannel HBA / SCSI / SAS controller

Follow the procedures below to replace HBA connecting the shared disk.

1. If the group is operating in the server where HBA is to be replaced (hereafter referred to as target server), move the group to another server.
2. Change the settings for the EXPRESSCLUSTER Server service of the target server to manual start.
3. Shut down the target server to replace HBA.
4. Start the target server with the disk cable disconnected.
5. From the config mode of Cluster WebUI, open the properties of the target server and configure filter settings on the replaced HBA.
  - Click **Connect** on the **HBA** tab to acquire the disk configuration data for the target server, and then select the replaced HBA.
  - Do not change the settings other than above.
6. Save the cluster configuration data in which HBA filter setting has been configured in Cluster WebUI temporarily in the disk area accessible from the cluster server.
  - If the Cluster WebUI is used on the cluster server, save the cluster configuration data in the local disk. Also, if the Cluster WebUI is used on another PC, save it in the shared folder accessible from the cluster server, or save it temporarily in an external media disk etc. and then copy it to the local disk of the cluster server.

7. Execute the following command on one of the cluster servers to upload the saved cluster configuration data.

```
clpcfctrl --push -x < path_of_the_cluster_configuration_information>_
→--nocheck
```

8. Shut down the target server and connect the disk cable.
9. Start the target server to check the drive letter in **Disk Management**.  
If the drive letter has been changed, set it as it was before. Restart the server to check that the drive letter is correctly configured.
10. From the config mode of Cluster WebUI, open the properties of the target server to check the settings for the **HBA** tab. If there is a partition which does not restrict access on the shared disk, check that the partition data is registered in **Partition excluded from cluster management**.
11. As with the steps 6 and 7 above, save the cluster configuration data temporarily and upload it from the cluster server with the following command:

```
clpcfctrl --push -x < path_of_the_cluster_configuration_information>_
→--nocheck
```

- If the message "There is difference between the disk information in the configuration information and the disk information in the server. Are you sure you want automatic modification?" appears upon saving the configuration information, select **Yes**.
12. Set the configuration for the EXPRESSCLUSTER Server service of the target server back to automatic start, and reboot the target server.
13. When **Auto Recovery** is configured as **Off** in **Extension** tab of **Cluster Properties** of the cluster, select **Recover server** the target server in the operation mode of Cluster WebUI.
14. Migrate the group if necessary.



## 2.34 Updating data encryption key file of mirror/hybrid disk resources

Perform the following procedure to update the encryption key used for the mirror communication encryption of mirror disk resources/hybrid disk resources.

---

**Note:** The following procedure is executable while mirror disk resources and hybrid disk resources are activated. At this time, however, mirroring in progress is suspended. In this case, execute mirror recovery after the completion of the procedure.

---

1. Run the `clpkeygen` command to create a new encryption key file. For more information on the `clpkeygen` command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Creating a key file for encrypting communication data (`clpkeygen` command)".

```
clpkeygen 256 newkeyfile.bin
```

2. Overwrite the encryption key files for all the servers of which mirror disk resources/hybrid disk resources can be activated, by using the file created at step 1. Keep the original file then.
3. Execute the `--updatekey` option for the `clpmdctrl` or `clphdctrl` command.

- for mirror disk resources

```
clpmdctrl --updatekey md01
```

- for hybrid disk resources

```
clphdctrl --updatekey hd01
```

Once you execute the option on either server on which resources can be activated, the key information is updated for all servers necessary for update.

At this time, mirroring in progress is suspended.

4. Updating of the encryption key information is completed. From now on, the mirror communication encryption/decryption is executed by using the new encryption key.
5. If necessary, perform mirror recovery to resume the suspended mirroring.

## 2.35 Information required for inquiry

The following information is required for inquiring about the failure.

1. Failure

Describe the failure.

Example) Failover group (failover1) failed to fail over from server1 to server2.

2. Time that the failure occurred

Example) 2018/01/01 00:00

3. Name of the server with the failure

Example) server2

4. Version of EXPRESSCLUSTER

Example) EXPRESSCLUSTER X 5.1

5. EXPRESSCLUSTER log and event log of when the failure occurred

Logs can be collected by using the Cluster WebUI or by running the log collection command. To use Cluster WebUI, see the online manual. To use the log collection commands, see "Collecting logs (clplogcc command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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