EXPRESSCLUSTER® X 4.1
for Linux

Maintenance Guide

EXPRESSCLUSTER X

Revision History

Edition	Revised Date	Description
1st	Apr 10, 2019	New manual.

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Table of Contents

Preface

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.

How This Guide is Organized

Chapter 1   **The system maintenance information**
Provides maintenance information for EXPRESSCLUSTER.

Appendix A   **Index**

EXPRESSCLUSTER X Documentation Set

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

Getting Started with EXPRESSCLUSTER
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.

Hardware Feature Guide
This guide is intended for administrators and for system engineers who want to build EXPRESSCLUSTER-based cluster systems. The guide describes features to work with specific hardware, serving as a supplement to the *Installation and Configuration Guide*.

Legacy Feature Guide
This guide is intended for administrators and for system engineers who want to build EXPRESSCLUSTER-based cluster systems. The guide describes EXPRESSCLUSTER X 4.0 WebManager, Builder, and EXPRESSCLUSTER Ver 8.0 compatible commands.

Conventions

In this guide, **Note**, **Important**, **Related Information** 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.

Related Information:

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.	`clpstat -s[-h host_name]`
#	Prompt to indicate that a Linux user has logged on as root user.	`# clpcl -s -a`
Monospace (courier)	Indicates path names, commands, system output (message, prompt, etc.), directory, file names, functions and parameters.	`/Linux/4.1/en/server/`
Monospace bold (courier)	Indicates the value that a user actually enters from a command line.	Enter the following: `# clpcl -s -a`
Monospace italic (courier)	Indicates that users should replace italicized part with values that they are actually working with.	`rpm -i expresscls-<version_number>-<release_number>.x86_64.rpm`

Contacting NEC

For the latest product information, visit our website below:

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Chapter 1 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:

Directory structure of EXPRESSCLUSTER

Note:

Executable files and script files that are not described in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide* can be found under the installation directory. Run these files only with EXPRESSCLUSTER. Any failure or trouble caused by executing them by applications other than EXPRESSCLUSTER is not supported.

EXPRESSCLUSTER directories are structured as described below:
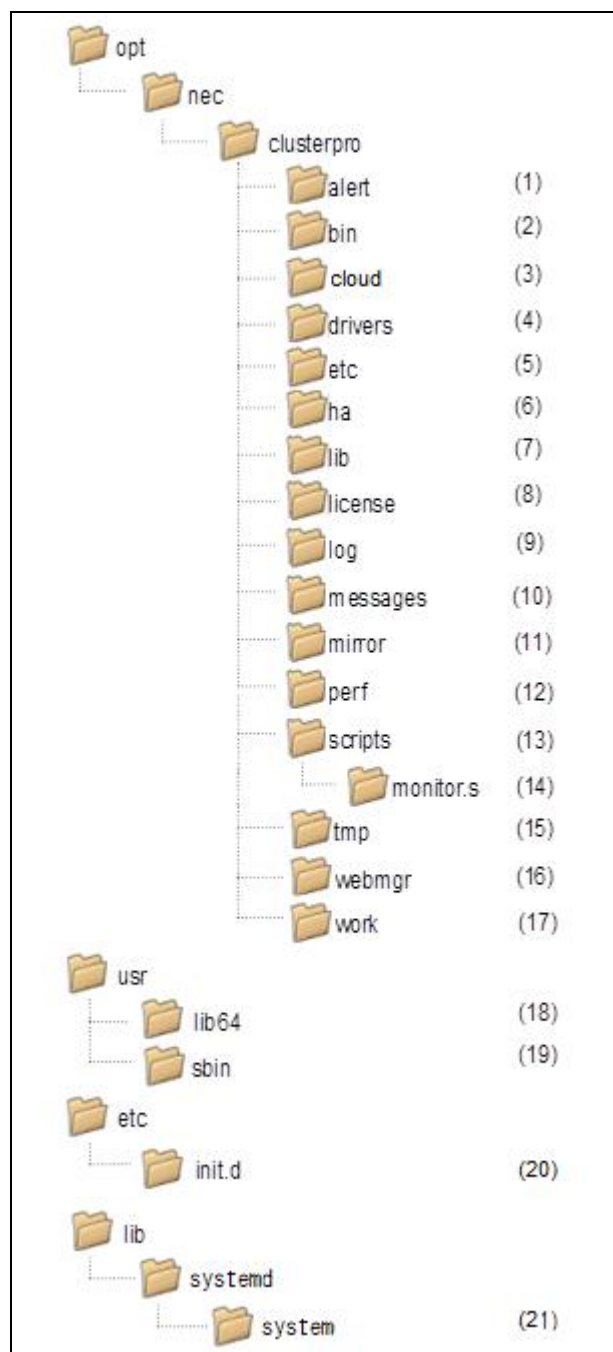
(1) Directory for alert synchronization

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.

(3) Directory for cloud environment

This directory stores script files for cloud environment.

(4) Directory for cluster drivers

- Mirror driver
  This directory stores the executable files of the data mirror driver.

- Kernel mode LAN heartbeat, keepalive driver
  This directory stores the executable files of the kernel mode LAN heartbeat and keepalive driver.

(5) Directory for cluster configuration data

This directory stores the cluster configuration files and policy file of each module.

(6) Directory for HA products linkage

This directory stores binaries and configuration files for the Java Resource Agent and System Resource Agent.

(7) Directory for cluster libraries

This directory stores the EXPRESSCLUSTER Server's library.

(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, syslog, mail)

This directory stores alert, syslog and mail messages reported by each module.

(11) Directory for mirror disk and hybrid disk

This directory stores the executable files and policy files etc. of the modules for mirror disk and hybrid disk.

(12) Directory for the performance logs

This directory stores the information of performance about disk and system.

(13) Directory for EXEC resource script of group resources

This directory stores EXEC resource scripts of group resources.

(14) Directory for the recovery script

This directory stores the script executed by this function when an error is detected in the monitor resource if execution of a recovery script is in effect.

(15) Directory for temporary files

This directory stores archive files created when logs are collected.

(16) Directory for the WebManager server and Cluster WebUI.

This directory stores the WebManager's server modules and management files.

(17) Directory for module tasks

This is a work directory for modules.

(18) usr/lib64

This directory stores the symbolic links to the EXPRESSCLUSTER Server's library.

(19) /usr/sbin

This directory stores the symbolic links to the EXPRESSCLUSTER Server's executable files.

(20) /etc/init.d

For init.d environment, this directory stores the EXPRESSCLUSTER Service's Start/Stop scripts.

(21) /lib/systemd/system (for SUSE Linux, the path will be /usr/lib/ systemd/system.)

For systemd environment, the setting file of EXPRESSCLUSTER service is stored in this directory.

Log structure of EXPRESSCLUSTER

The log directory in the EXPRESSCLUSTER installation directory has the following structure:

(1) EXPRESSCLUSTER service logs

The EXPRESSCLUSTER service logs include the following types and generations.

init_*.start.cur:	Log collected when the current service started
init_*.start.pre:	Log collected when the service one generation older started
init_*.stop.cur:	Log collected when the current service stopped
init_*.stop.pre:	Log collected when the service one generation older stopped

- * represents a character string specific to each service.
  evt: clusterpro_evt
  trn: clusterpro_trn
  md: clusterpro_md
  main: clusterpro
  webmgr: clusterpro_webmgr
  alert: clusterpro_alertsync

- The log level and size cannot be changed.

- Two generations are automatically rotated. Generations older than the second are removed, starting with the oldest data.

(2) Internal logs for each module

The EXPRESSCLUSTER internal logs include the following types and generations for each module.

*.log.cur:	Current internal log
*.log.pre:	Internal log one generation older
*.err.cur:	Current error log
*.err.pre:	rror log one generation older

- * represents the module name. For the module list, see "Modifying the log level and size (clplogcf command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

- Two generations are automatically rotated. Generations older than the second are removed, starting with the oldest data.

(3) Logs for error occurrence

These logs are used to collect emergency information when an error occurs during EXPRESSCLUSTER processing.

For details on collection, see "Collecting logs (clplogcc command) Collecting in formation when a failure occurs" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

elog_*0.tar.gz:	Current log collected when errors occurred
elog_*1.tar.gz:	Previous-generation error log
:	
elog_*4.tar.gz:	Four generations old error log

- * represents the module name.
  pm: When an EXPRESSCLUSTER service starts or stops
  rc: When an a group resource activation or deactivation error occurred
  rm: When a monitor resource error is detected

- Error occurrence information is saved for five generations (10 generations for rm only). For the fifth and older generations, information is discarded, starting from the oldest.

- The log level and size cannot be changed.

How to delete EXPRESSCLUSTER logs or alerts

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

(1) Run **chkconfig --del** *name* (for init.d environment) or **systemctl disable** *name* (for systemd environment) on all the servers in the cluster to disable the following services in the order shown.

- `clusterpro_alertsync`

- `clusterpro_webmgr`

- `clusterpro`

- `clusterpro_md`

- `clusterpro_trn`

- `clusterpro_evt`

(2) Shut down the cluster with the Cluster WebUI or clpstdn command, and then reboot the cluster.

(3) To delete logs, delete the files and directories in the following directory. Perform this operation on the server for which you want to delete the logs.

- `/opt/nec/clusterpro/log/`

(4) To delete alerts, delete the files in the following directory. Perform this operation on the server for which you want to delete the alerts.

- `/opt/nec/clusterpro/alert/log/`

(5) Run **chkconfig --add** *name* (for init.d environment) or **systemctl enable** *name* (for systemd environment) on all the servers in the cluster to enable the following services in the order shown.

- `clusterpro_evt`

- `clusterpro_trn`

- `clusterpro_md`

- `clusterpro`

- `clusterpro_webmgr`

- `clusterpro_alertsync`

(6) Run the `reboot` command on all the servers in the cluster to reboot the cluster.

Mirror statistics information collection function

If the **Collect Mirror Statistics** check box is already checked on the **Mirror Agent** tab of **Cluster Properties** in the config mode of Cluster WebUI, information on the mirror performance is collected and saved to *install_path/*perf/disk according to the following file naming rules. In the following explanations, this file is represented as the mirror statistics information file.

nmpN.cur	
nmpN.pre[X]	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
N	Indicates the target NMP number.
[X]	Indicates the generation number.
	For a file that is one generation older, the generation number is omitted.
	For a file that is m generations older, X is assumed to be m-1.
	If the total number of generations is n, X of the oldest file is assumed to be n-2.

The collected information is saved to the mirror statistics information file. The time during which statistics information is output to this file (=sampling interval) is 60 seconds. .If the size of current log file reached 16MB, it is rotated to new log file. And two generation log files can be saved. Information recorded to the mirror statistics information file can be used as a reference for the tuning related to the mirror function. The collected statistics information contains the following items.

Note:

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 "Chapter 7 EXPRESSCLUSTER command reference" in the Reference Guide or the online manual.

Statistic value name	Unit (*1)	Description	Output (*2)
Write, Total (Write amount)	Byte (MB)	Total amount of data written to the mirror partition. The value to be output is the amount of data written by every sampling.	LOG, CMD (A)
Write, Avg (Write amount, average value)	Byte/s (MB/s)	Amount of data written to the mirror partition per unit time	LOG, CMD (A)
Read, Total (Read amount)	Byte (MB)	Total amount of data read from the mirror partition. The value to be output is the amount of data read by every sampling.	LOG, CMD (A)
Read, Avg (Read amount, average value)	Byte/s (MB/s)	Amount of data read from the mirror partition per unit time	LOG, CMD (A)
Local Disk Write, Total (Local disk write amount)	Byte	Total amount of data written to the local disk (data partition). The value to be output is the amount of data written by every sampling.	LOG (B)
Local Disk Write, Avg (Local disk average write amount)	Byte/s	Amount of data written to the local disk (data partition) per unit time	LOG (B)
Local Disk Read, Total (Local disk read amount)	Byte	Total amount of data read from the local disk (data partition). The value to be output is the amount of data read by every sampling.	LOG (B)
Local Disk Read, Avg (Local disk average read amount)	Byte/s	Amount of data read from the local disk (data partition) per unit time	LOG (B)
Send, Total (Mirror communication amount, total value)	Byte (KB)	Total amount of mirror communication sent up until mirror disk connect. The value to be output is the communication amount by every sampling. TCP control information and the like are excluded.	LOG, CMD (B)
Send, Avg (Mirror communication amount, average value)	Byte/s (KB/s)	Mirror communication amount sent by up until mirror disk connect per unit time	LOG, CMD (B)
Compress Ratio (Compression ratio)	%	Mirror data compression ratio (Post-compression size) / (pre-compression size) x 100. 100 for noncompression. The value to be output is calculated based on the communication data for every sampling.	LOG (A)

Statistic value name	Unit (*1)	Description	Output (*2)
Sync Time, Max (Mirror communication time, maximum value)	Second/time	Time needed until the first piece of mirror synchronization data is synchronized.(*3) The value to be output is the longest mirror synchronization data time. Mirror synchronization data that failed to be synchronized due to non-communication or the like (resulting in a mirror break) is excluded. Moreover, the value to be output is obtained for communication for every sampling.	LOG, CMD (A)
Sync Time, Avg (Mirror communication time, average value)	Second/time	Time needed until the first piece of mirror synchronization data is synchronized. (*3) The value to be output is the average for all the communications. Mirror synchronization data that failed to be synchronized due to non-communication or the like (resulting in a mirror break) is excluded. Moreover, the value to be output is obtained for communication for every sampling.	LOG, CMD (A)
Sync Ack Time, Max (Mirror synchronization ACK response time, maximum value)	Millisecond	Time that elapses between mirror synchronization data being sent to the other server and ACK being received from the other server. (*3) The maximum value of all such times is output. This value is used as a reference to determine **Ack Timeout** of the **Mirror Driver** tab that is set with the mirror disk resource or hybrid disk resource. However, mirror synchronization data that results in an ACK timeout is excluded from the measurement. The value to be output is the time after the mirror daemon (mirror agent) starts.	LOG (A)
Sync Ack Time, Cur (Mirror synchronization ACK response time, latest value)	Millisecond	Of the lengths of time needed for mirror synchronization data ACK reception, this value is the time that needed for the most recent ACK reception. (*3) However, mirror synchronization data that results in an ACK timeout is excluded from the measurement.	LOG (A)

Statistic value name	Unit (*1)	Description	Output (*2)
Recovery Ack Time, Max (Mirror recovery ACK response time, maximum value)	Millisecond	Time that elapses between mirror recovery data being sent to the other server and ACK being received from the other server The maximum value of all such times is output. This value is used as a reference to determine **Ack Timeout** of the **Mirror Driver** tab that is set with the mirror disk resource or hybrid disk resource. However, mirror synchronization data that results in an ACK timeout is excluded from the measurement. The value to be output is the time after the mirror daemon (mirror agent) starts.	LOG (A)
Recovery Ack Time, Max2 (Mirror recovery ACK response time, maximum value during a certain period)	Millisecond	Maximum value of the time that elapses between mirror recovery data being sent to the other server and ACK being received from the other server. The maximum value during one sampling period is output. However, mirror synchronization data that results in an ACK timeout is excluded from the measurement.	LOG (A)
Recovery Ack Time, Cur (Mirror recovery ACK response time, latest value)	Millisecond	Time that elapses between the mirror recovery data being sent to the other server and ACK being received from the other server The value to be output is the time needed for the most recent ACK reception. However, mirror synchronization data that results in an ACK timeout is excluded from the measurement.	LOG (A)
Sync Diff, Max (Difference amount, maximum value)	Byte (MB)	Amount of mirror synchronization data that has not yet been synchronized with the other server. The value to be output is the maximum from among all the samplings. Mirror synchronization data that failed to be synchronized due to non-communication or the like (resulting in a mirror break) is excluded.	LOG, CMD (A)
Sync Diff, Cur (Difference amount, latest value)	Byte (MB)	Amount of mirror synchronization data that has not yet been synchronized with the other server. The value to be output is that which was used most recently for collection. Mirror synchronization data that failed to be synchronized due to non-communication or the like (resulting in a mirror break) is excluded.	LOG, CMD (A)

Statistic value name	Unit (*1)	Description	Output (*2)
Send Queue, Max (Number of send queues, maximum value)	Quantity	Number of queues used when mirror synchronization data is sent. The value to be output is the maximum used after the mirror daemon (mirror agent) starts. This value is used as a reference to determine **Number of Queues** in **Asynchronous** mode that is set with the mirror disk resource or hybrid disk resource.	LOG (A)
Send Queue, Max2 (Number of send queues, maximum value during a certain period)	Quantity	Number of queues used when mirror synchronization data is sent. The maximum value during one sampling period is output.	LOG (A)
Send Queue, Cur (Number of send queues, latest value)	Quantity	Number of queues used when mirror synchronization data is sent. The value to be output is that which was used most recently for collection.	LOG (A)
Request Queue, Max (Number of request queues, maximum value)	Quantity	Number of I/O requests being processed that were sent to the mirror partition. The value to be output is the maximum used after the mirror daemon (mirror agent) starts. This value is used as a reference to determine **Request Queue Maximum Number** of the **Mirror Driver** tab of cluster properties.	LOG (A)
Request Queue, Max2 (Number of request queues, maximum value during a certain period)	Quantity	Number of I/O requests being processed that were sent to the mirror partition. The maximum value during one sampling period is output.	LOG (A)
Request Queue, Cur (Number of request queues, latest value)	Quantity	Number of I/O requests being processed that were sent to the mirror partition. The value to be output is that which was used most recently for collection.	LOG (A)
MDC HB Time Max (Mirror disconnect heartbeat time, maximum value)	Second	Time that elapses between ICMP ECHO being sent to the other server through mirror disconnect and ICMP ECHO REPLY being received from the other server. The value to be output is the maximum used after the mirror daemon (mirror agent) starts.	LOG (B)
MDC HB Time, Max2 (Mirror disconnect heartbeat time, maximum value during a certain period)	Second	Time that elapses between ICMP ECHO being sent to the other server through mirror disconnect and ICMP ECHO REPLY being received from the other server. The maximum value during one sampling period is output.	LOG (B)
MDC HB Time Cur (Mirror disconnect heartbeat time, latest value)	Second	Time that elapses between ICMP ECHO being sent to the other server through mirror disconnect and ICMP ECHO REPLY being received from the other server. The value to be output is that which was used most recently for collection.	LOG (B)

Statistic value name	Unit (*1)	Description	Output (*2)
Local-Write Waiting Recovery-Read Time, Total (Mirror synchronization I/O exclusion time, total value)	Second	If writing to the same area of the disk occurs during mirror recovery, writing is held until the mirror recovery for that area is complete. The value to be output is the cumulative value of the hold time, from when the mirror daemon (mirror agent) starts. That hold time may be long if **Recovery Data Size** of the **Mirror Agent** tab of the cluster properties is made large. This value is used as a reference to determine this size.	LOG (A)
Local-Write Watiting Recovery-Read Time, Total2 (Mirror synchronization I/O exclusion time, total value during a certain period)	Second	If writing to the same area of the disk occurs during mirror recovery, writing is held until the mirror recovery for that area is complete. The value to be output is the cumulative value of the hold time during one sampling period.	LOG (A)
Recovery-Read Waiting Local-Write Time, Total (Mirror recovery I/O exclusion time, total value)	Second	If reading of mirror recovery data from the same area of the disk occurs during writing to the mirror partition, reading of the mirror recovery data is held until writing to that area is complete. The value to be output is the cumulative value of the hold time, from when the mirror daemon (mirror agent) starts. That hold time may be long if **Recovery Data Size** of the **Mirror Agent** tab of the cluster properties is made large. This value is used as a reference to determine this size.	LOG (A)
Recovery-Read Waiting Local-Write Time, Total2 X(Mirror recovery I/O exclusion time, total value during a certain period)	Second	If reading of mirror recovery data from the same area of the disk occurs during writing to the mirror partition, reading of the mirror recovery data is held until writing to that area is complete. The value to be output is the cumulative value of the hold time during one sampling period.	LOG (A)
Unmount Time, Max (Unmount time, maximum value)	Second	Time needed for unmount to be executed when the mirror disk resource or hybrid disk resource is deactivated This value is used as a reference to determine **Timeout** of the **Unmount** tab that is set with the mirror disk resource or hybrid disk resource.	LOG (A)
Unmount Time, Last (Unmount time, latest value)	Second	Time needed for unmount to be executed when the mirror disk resource or hybrid disk resource is deactivated The value to be output is the time needed when unmount was most recently executed.	LOG (A)

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Statistic value name	Unit (*1)	Description	Output (*2)
Fsck Time, Max (fsck time, maximum value)	Second	Time needed for fsck to be executed when the mirror disk resource or hybrid disk resource is activated This value is used as a reference to determine **fsck Timeout** of the **Fsck** tab that is set with the mirror disk resource or hybrid disk resource.	LOG (A)
Fsck Time, Last (fsck time, latest value)	Second	Time needed for fsck to be executed when the mirror disk resource or hybrid disk resource is activated The value to be output is the time needed when fsck was most recently executed.	LOG (A)

*1   The unit in parentheses is used for command display. During output, a value of up to two decimal places is output. The third decimal place is truncated.
The conversion rules are as follows:
  1 KB = 1024 bytes, 1 MB = 1048576 bytes
If a value is truncated to 0, "0.00" is output. If the value is 0 without truncation, "None" is displayed for commands, or "0" for the mirror statistics information file.

*2   CMD   … Information that is visible with commands (clpmdstat, clphdstat)
   LOG   … Information that is output to the mirror statistics information file
   (A)   … In case of Active, the valid value is output.
   (B)   … In both cases of Active/Standby, the valid value is output.

Further, only mirror statistics information on a local server is recorded, information on other servers is not recorded.

*3   If the mode is "synchronous", "time taken from sending a mirror synchronous data to receiving ACK from the other server".
If the mode is "asynchronous", "time taken from placing mirror synchronous data on the synchronization queue to receiving ACK from the other server".

◆   If **Collect Mirror Statistics** is already checked, part of information (information with CMD in the Output column in the above table) can be collected and displayed with the clpmdstat/clphdstat command. For information on how to use this command, see "Displaying the mirror status (clpmdstat command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

Display with commands can be used only when **Gather Statistical information** is already enabled in the **Mirror Agent** tab of **Cluster Properties** in Cluster WebUI.

System resource statistics information collection function

If the **Collect Mirror Statistics** check box is already checked on the **Monitor** tab of **Cluster Properties** in the Cluster WebUI config mode and if system monitor resources or process resource monitor resources are already added to the cluster, information on the system resource is collected and saved under *install_path*/log/system according to the following file naming rules.

This file is in CSV-format. In the following explanations, this file is represented 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 time during which statistics information is output to this file (=sampling interval) is 60 seconds. .If the size of current log file reached 16MB, it is rotated to new log file. And two generation log files can be saved. Information recorded 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	Number of CPUs
CPUUtilization	%	CPU utilization
CPUTotal	10 Millisecond	Total CPU time
CPUUser	10 Millisecond	CPU usage time in the user mode
CPUNice	10 Millisecond	CPU usage time in the user mode with low priority
CPUSystem	10 Millisecond	CPU usage time in the system mode
CPUIdle	10 Millisecond	CPU idle time
CPUIOWait	10 Millisecond	I/O wait time
CPUIntr	10 Millisecond	Interrupt processing time
CPUSoftIntr	10 Millisecond	Software interrupt processing time
CPUSteal	10 Millisecond	Time when CPU was consumed by the OS on another virtual machine for virtual environment
MemoryTotalSize	Byte (KB)	Total memory capacity
MemoryCurrentSize	Byte (KB)	Memory usage
MemoryBufSize	Byte (KB)	Buffer size
MemoryCached	Byte (KB)	Cache memory size
MemoryMemFree	Byte (KB)	Available memory capacity
MemoryDirty	Byte (KB)	Mamory data waiting to be written on hard disk
MemoryActive(file)	Byte (KB)	Buffer or page cache memory
MemoryInactive(file)	Byte (KB)	Available buffer or available page cache memory

Statistic value name	Unit	Description
MemoryShmem	Byte (KB)	Shared memory size
SwapTotalSize	Byte (KB)	Available swap size
SwapCurrentSize	Byte (KB)	Currently used swap size
ThreadLimitSize	Quantity	Maximum number of threads
ThreadCurrentSize	Quantity	Current number of threads
FileLimitSize	Quantity	Maximum number of opened files
FileCurrentSize	Quantity	Current number of opened files
FileLimitinode	Quantity	Number of inodes in the whole system
FileCurrentinode	Quantity	Current number of inodes
ProcessCurrentCount	Quantity	Current total number of processings

Cluster statistics information collection function

If the **Cluster Statistics** check box is already checked on the **Extension** tab of **Cluster Properties** in the Cluster WebUI config mode, it collects the information of the results and the time spent for each of the processings such as group failover, group resource activation and monitor resource monitoring. This file is in CSV format. In the following explanations, this file is represented as the cluster statistics information file.

◆ For groups

group.cur	
group.pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	*install_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	*install_path/perf/cluster/group/*

◆ For monitor resources

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

cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.
File location	*install_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 Chapter 7, "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 groups (*1)

- When the group startup processing is completed

- When the group stop processing is completed

- When the group move processing is completed (*2)

- When the failover processing is completed (*2)

◆ 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

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

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

The statistics information to be collected includes the following items:

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 YYYY/MM/DD HH:MM:SS.000
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) 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 cancelled: Cancel (cancelling processings such as cluster shutdown during group startup)
ReturnCode	Return value of the executed processing.
StartTime	Start time of the executed processing. This is output in the form below (000 indicates millisecond): YYYY/MM/DD HH:MM:SS.000 YYYY/MM/DD HH:MM:SS.000
EndTime	End time of the executed processing. This is output in the form below (000 indicates millisecond): YYYY/MM/DD HH:MM:SS.000 YYYY/MM/DD HH:MM:SS.000

Statistic value name	Description
ElapsedTime(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:

◆ Group

- Group name: failoverA

◆ Group resource which belongs to the group (failoverA)

- exec resource
  Resource name: exec01, exec02, exec03

◆ group.cur

```
"Date","Name","Action","Result","ReturnCode","StartTime","EndTime","ElapsedTime(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"
                                                                :
```

◆ exec.cur

```
"Date","Name","Action","Result","ReturnCode","StartTime","EndTime","ElapsedTime(ms)"
"2018/12/19 09:44:14.845","exec01","Start","Success",,"2018/12/19 09:44:09.807","2018/12/19 09:44:14.845","5040"
"2018/12/19 09:44:15.877","exec02","Start","Success",,"2018/12/19 09:44:14.847","2018/12/19 09:44:15.877","1030"
"2018/12/19 09:44:16.920","exec03","Start","Success",,"2018/12/19 09:44:15.880","2018/12/19 09:44:16.920","1040"
                                                                :
```

Notes on the size of the cluster statistics information file

The size of the cluster statistics information file can be set between 1 and 99 MB. 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 =

([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 232 MB with this calculation. (((1MB) x 2) + ((3MB x 5) x 2) + ((10MB x 10) x 2) = 232MB)

◆ 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)

Communication ports

EXPRESSCLUSTER uses several port numbers. Change the firewall settings so that EXPRESSCLUSTER can use some port numbers.

For an AWS environment, configure to able to access the following port numbers in the security group setting in addition to the firewall setting.

The following is the list of port numbers used in EXPRESSCLUSTER.

Server to Server (Loopback in Server)					
From			**To**		**Used for**
Server	Automatic allocation [1]	→	Server	29001/TCP	Internal communication
Server	Automatic allocation	→	Server	29002/TCP	Data transfer
Server	Automatic allocation	→	Server	29002/UDP	Heartbeat
Server	Automatic allocation	→	Server	29003/UDP	Alert synchronization
Server	Automatic allocation	→	Server	29004/TCP	Communication between mirror agents
Server	Automatic allocation	→	Server	29006/UDP	Heartbeat (kernel mode)
Server	Automatic allocation	→	Server	XXXX [2]/TCP	Mirror disk resource data synchronization
Server	Automatic allocation	→	Server	XXXX [3]/TCP	Communication between mirror drivers
Server	Automatic allocation	→	Server	XXXX [4]/TCP	Communication between mirror drivers
Server	icmp	→	Server	Icmp	keepalive between mirror drivers
					Duplication check of FIP/VIP resource
					Mirror agent
Server	Automatic allocation	→	Server	XXXX [5]/UDP	Internal communication for log

Cluster WebUI to Server					
From			**To**		**Used for**
Cluster WebUI	Automatic allocation	→	Server	29003/TCP	http communication

Others					
From			**To**		**Used for**
Server	Automatic allocation	→	Network warning light	514/TCP	Network warning light control
Server	Automatic allocation	→	BMC Management LAN of the server	623/UDP	BMC control (Forced stop/chassis identify)

BMC Management LAN of the server	Automatic allocation	→	Server	162/UDP	Monitoring target of the external linkage monitor set for BMC identify
BMC Management LAN of the server	Automatic allocation	→	BMC Management LAN of the server	5570/UDP	BMC HB communication
Server	Automatic allocation	→	Witness server	Communication port number specified with Cluster WebUI	Connection destination host of the Witness heartbeat resource
Server	icmp	→	Monitor target	icmp	IP monitor
Server	icmp	→	NFS Server	icmp	Monitoring if NFS server of NAS resource is active
Server	icmp	→	Monitor target	icmp	Monitoring target of PING method of network partition resolution resource
Server	Automatic allocation	→	Monitor target	Management port number set by the Cluster WebUI	Monitoring target of HTTP method of network partition resolution resource
Server	Automatic allocation	→	Server	Management port number [6] set by Cluster WebUI	JVM monitor
Server	Automatic allocation	→	Monitor target	Connection port number [7] set by Cluster WebUI	JVM monitor
Server	Automatic allocation	→	Server	Load balancer linkage management port number [8] set by Cluster WebUI	JVM monitor
Server	Automatic allocation	→	BIG-IP LTM	Communication port number [9] set by Cluster WebUI	JVM monitor
Server	Automatic allocation	→	Server	Probe port set by the Cluster WebUI [10]	Azure probe port resource

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Server	Automatic allocation	→	AWS Region Endpoint	443/tcp[11]	AWS Elastic IP resource AWS Virtual IP resource AWS DNS resource AWS Elastic IP monitor resource AWS Virtual IP monitor resource AWS AZ monitor resource AWS DNS monitor resource
Server	Automatic allocation	→	Azure Endpoint	443/tcp[12]	Azure DNS resource
Server	Automatic allocation	→	Azure authoritative name server	53/udp	Azure DNS monitor resource

1. In automatic allocation, a port number not being used at a given time is allocated.

2. This is a port number used per mirror disk resource or hybrid disk resource and is set when creating mirror disk resource or hybrid disk resource. A port number 29051 is set by default. When you add a mirror disk resource or hybrid disk resource, this value is automatically incremented by 1. To change the value, click **Details** tab in the **[md] Resource Properties** or the **[hd] Resource Properties** dialog box of the Cluster WebUI. For more information, refer to Chapter 2, "Group resource details" in the *Reference Guide*.

3. This is a port number used per mirror disk resource or hybrid disk resource and is set when creating mirror disk resource or hybrid disk resource. A port number 29031 is set by default. When you add a mirror disk resource or a hybrid disk resource, this value is automatically incremented by 1. To change the value, click **Details** tab in the **[md] Resource Properties** or the **[hd] Resource Properties** dialog box of the Cluster WebUI. For more information, refer to Chapter 2, "Group resource details" in the *Reference Guide*.

4. This is a port number used per mirror disk resource or hybrid disk resource and is set when creating mirror disk resource or hybrid disk resource. A port number 29071 is set by default. When you add a mirror disk resource or hybrid disk resource this value is automatically incremented by 1. To change the value, click **Details** tab in the **[md] Resource Properties** or the **[hd] Resource Properties** dialog box of the Cluster WebUI. For more information, refer to Chapter 2, "Group resource details" in the *Reference Guide*.

5. Select **UDP** for the **Communication Method for Internal Logs** in the **Port No. (Log)** tab in **Cluster Properties**. Use the port number configured in Port No. Communication port is not used for the default log communication method **UNIX Domain**.

6. The JVM monitor resource uses the following four port numbers.

    *   A management port number is a port number that the JVM monitor resource internally uses. To set this number, use the **Connection Setting** dialog box opened from the **JVM monitor** tab in **Cluster Properties** of the Cluster WebUI. For details, refer to Chapter 1, "Parameter details" in the *Reference Guide*.

    *   A connection port number is used to establish a connection to the target Java VM (WebLogic Server or WebOTX). To set this number, use the Monitor (special) tab in Properties of the Cluster WebUI for the corresponding JVM monitor resource. For details, refer to Chapter 3, "Monitor resource details" in the Reference Guide.

    *   A load balancer linkage management port number is used for load balancer linkage. When load balancer linkage is not used, this number does not need to be set. To set the number, use opened from the **JVM monitor** tab in **Cluster Properties** of the Cluster WebUI. For details, refer to Chapter 1, "Function of the Builder" in the *Reference Guide*.

- A communication port number is used to accomplish load balancer linkage with BIG-IP LTM. When load balancer linkage is not used, this number does not need to be set. To set the number, use the **Load Balancer Linkage Settings** dialog box opened from the **JVM monitor** tab in **Cluster Properties** of the Cluster WebUI. For details, refer to Chapter 2, "Parameter details" in the *Reference Guide*.

7. Port number used by the Microsoft Azure load balancer for the alive monitoring of each server.

8. The AWS elastic ip resource, AWS virtual ip resource, AWS DNS resource, AWS elastic ip monitor resource, AWS virtual ip monitor resource, AWS AZ monitor resource, and AWS DNS monitor resource run the AWS CLI. The above port numbers are used by the AWS CLI.

9. The Azure DNS resource runs the Azure CLI. The above port numbers are used by the Azure CLI.

Cluster driver device information

- The mirror driver mainly uses 218 as the major number. Make sure that no other driver uses this major number. However, this major number can be changed to avoid using 218 due to system restrictions.

- The kernel mode LAN heartbeat driver uses 10 as the major number, and mainly uses 240 as the minor number. Make sure that no other driver uses these major and minor numbers.

- The keepalive driver uses 10 as the major number, and mainly uses 241 as the minor number. Make sure that no other driver uses these major and minor numbers.

What causes servers to shut down

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

Final action for an error in resource activation or deactivation

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

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.
Sysrq Panic	Performs a panic upon group resource activation/deactivation error.
Keepalive Reset	Performs a reset upon group resource activation/deactivation error.
Keepalive Panic	Performs a panic upon group resource activation/deactivation error.
BMC Reset	Performs a reset upon group resource activation/deactivation error.
BMC Power Off	Performs a power off upon group resource activation/deactivation error.
BMC power Cycle	Performs a power cycle upon group resource activation/deactivation error.
BMC NMI	Causes NMI upon group resource activation/deactivation error.
I/O Fencing(High-End Server Option)	Causes I/O fencing upon group resource activation/deactivation error.

Action for resource activation or deactivation stall generation

When one of the following is specified as the final action to be applied upon the occurrence of an error in resource activation/deactivation, and if resource activation/deactivation takes more time than expected:

Action performed when a stall occurs	Result
The cluster service stops and the OS shuts down.	When a group resource activation/deactivation stall occurs, performs normal shutdown after the group resources stop.
The cluster service stops and the OS reboots.	When a group resource activation/deactivation stall occurs, performs normal reboot after the group resources stop.
Sysrq Panic	When a group resource activation/deactivation stall occurs, performs a panic.
Keepalive Reset	When a group resource activation/deactivation stall occurs, performs a reset.
Keepalive Panic	When a group resource activation/deactivation stall occurs, performs a panic.
BMC Reset	When a group resource activation/deactivation stall occurs, performs a reset.
BMC Power Off	When a group resource activation/deactivation stall occurs, performs a power off.
BMC power Cycle	When a group resource activation/deactivation stall occurs, performs a power cycle.
BMC NMI	When a group resource activation/deactivation stall occurs, performs an NMI.
I/O fencing(High-End Server Option)	When a group resource activation/deactivation stall occurs, performs an I/O fencing.

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, alert occurs and the following message is output to syslog.

Module type: rc

Event ID: 32

Message: Activating %1 resource has failed.(99 : command is timeout)

Description: Failed to activate 1 resource.

If a resource deactivation stall occurs, alert occurs and the following message is output to syslog.

Module type: rc

Event ID: 42

Message: Stopping %1 resource has failed.(99 : command is timeout)

Description: Failed to stop the %1 resource.

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 shutdown after the group resources stop.
Stop cluster service and reboot the OS	Causes reboot after the group resources stop.
Sysrq Panic	Causes panic when an error is detected in monitor resource.
Keepalive Reset	Causes reset when an error is detected in monitor resource.
Keepalive Panic	Causes panic when an error is detected in monitor resource.
BMC Reset	Causes reset when an error is detected in monitor resource.
BMC Power Off	Causes power off when an error is detected in monitor resource.
BMC Power Cycle	Causes power cycle when an error is detected in monitor resource.
BMC NMI	Causes NMI when an error is detected in monitor resource.
I/O Fencing(High-End Server Option)	Causes I/O fencing when an error is detected in monitor resource.

Forced stop action

When forced stop is configured as "Used".

◆   Physical machine

Final action	Result
BMC reset	Causes reset in the failing server in which a failover group existed.
BMC power off	Causes power off in the failing server in which a failover group existed.
BMC power cycle	Causes power cycle in the failing server in which a failover group existed.
BMC NMI	Causes NMI in the failing server in which a failover group existed.

◆   Virtual machine (guest OS)

Final action	Result
VMware vSphere CLI power off	Causes power off in the failing server in which a failover group existed.

Emergency server shutdown, emergency server reboot

When an abnormal termination is detected in any of the following processes, a shutdown or reboot is generated after the group resource stops. Shutdown or reboot generation depends on the setting of **Action When the Cluster Service Process Is Abnormal**.

◆ `clprc`

◆ `clprm`

◆ `clpnm`

Resource deactivation error in stopping the EXPRESSCLUSTER daemon

When deactivating a resource by running clpcl -t, which stops the EXPRESSCLUSTER daemon fails, EXPRESSCLUSTER causes a emergency shutdown. An action for emergency shutdown depends on the settings in [Action When the Cluster Service Process Is Abnormal].

Stall detection in user space

When a server stalls longer than the heartbeat time-out, an OS hardware reset, panic, or I/O fencing is generated. Hardware reset or panic generation depends on the setting of **Operation at Timeout Detection** of the user-mode monitor resource.

Stall detection during shutdown process

When a server stalls during the OS shutdown process, an OS hardware reset, panic, or I/O fencing is generated. Hardware reset or panic generation depends on the setting of **Operation at Timeout Detection** of the shutdown monitor.

Recovery from network partitioning

When any network partition resolution resources are not set, if all heartbeats are disrupted (network partitioning), both servers failover to each other. As a result, groups are activated on both servers. Even when network partition resolution resources are set, groups may be activated on both servers.

If interconnections are recovered from this condition, EXPRESSCLUSTER causes shutdown on both or one of the servers.

For details of network partitioning, see "When network partitioning occurs" in Chapter 8, "Troubleshooting" in the *Reference Guide*.

Network partition resolution

In a cluster system where network partition resolution resources are configured, the network partition resolution is performed when all heartbeats are interrupted (network partition). If this is determined to be caused by the network partitions, some or all of the servers are shut down or stop their services. Shutdown or service stop generation depends on the setting of **Action at NP Occurrence**.

For details on the network partition resolution, see Chapter 5, "Network partition resolution resources details" in the *Reference Guide*.

Mirror disk error ~For Replicator~

When an error occurs in a mirror disk, the mirror agent causes reset.

Hybrid disk error ~For Replicator DR~

When an error occurs in a hybrid disk, the mirror agent causes reset.

Failure in suspending or resuming the cluster

If suspending or resuming the cluster fails, the server is shut down.

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 time-out

By temporarily adjusting time-out, you can prevent a failover caused by a failed server from occurring.
The clptoratio command is used to temporarily adjust time-out. Run the clptoratio command on one of the servers in the cluster.

(Example) To extend the heartbeat time-out to an hour, or 3600 seconds, when the heartbeat time-out is set to 90 seconds:

`clptoratio -r 40 -t 1h`

For more information on the clptoratio command, see "Adjusting time-out temporarily (clptoratio command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

◆ Releasing temporary time-out adjustment

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

`clptoratio -i`

For more information on the clptoratio command, see "Adjusting time-out temporarily (clptoratio command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

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>`

For more information on the clpmonctrl command, see "Controlling monitor resources (clpmonctrl command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

◆ 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>
```

For more information on the clpmonctrl command, see "Controlling monitor resources (clpmonctrl command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

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

◆ Suppressing recovery operation upon a monitor resource error

If suppression of recovery operation upon a monitor resource error is set, the monitor resource does not perform recovery even if it detects an error. To set this function, check **Disable Recovery Action Caused by Monitor Resource Failure** on the **Recovery** tab in **Cluster Properties** from the config mode of Cluster WebUI. The setting is applied.

◆ Suppressing no recovery operation upon a monitor resource error

The setting specifying suppression of the recovery operation upon a monitor resource error is released. To set this function, uncheck **Disable Recovery Action Caused by Monitor Resource Failure** on the **Recovery** tab in **Cluster Properties** from the config mode of Cluster WebUI. The setting is applied.

How to replace a mirror disk with a new one

When the replacement of mirror disks is necessary due to mirror disk breakdown or some reasons after starting operation, run the following steps:

Related Information:
For details on how to stop and start daemons, see "Suspending EXPRESSCLUSTER" in Chapter 9, "Preparing to operate a cluster system" in the *Installation and Configuration Guide*.

In case of replacing a mirror disk constructed with a single disk(non-RAID)

1. Stop the server of which the mirror disk is going to be replaced.

Note:
Before shutting down the server, it is recommended that the steps in "Disabling the EXPRESSCLUSTER daemon" in the *Installation and Configuration Guide* be executed.
On the server on which to disable the daemon, execute the command in the order below to disable the daemon.

```
For init.d environment:
    chkconfig --del clusterpro_alertsync
    chkconfig --del clusterpro_webmgr
    chkconfig --del clusterpro
    chkconfig --del clusterpro_md

For systemd environment:
    systemctl disable clusterpro_alertsync
    systemctl disable clusterpro_webmgr
    systemctl disable clusterpro
    systemctl disable clusterpro_md
```

If a hybrid disk failure occurs, terminate all servers connected to the disk to be replaced.

2. Install a new disk in the server.

3. Start up the server in which the new disk was installed. At this time, change the setting so that the EXPRESSCLUSTER services will not be executed. In case of not having disabled the EXPRESSCLUSTER daemon in the step 1, the daemons start up on run level 1 at OS startup.

4. Construct the same partition as the original disk to the new disk by fdisk command.

Note:
• To replace shared storage with the hybrid disk, create a partition and file system with any server connected to that shared storage.

• Initialize the cluster partition when using the disk used as an EXPRESSCLUSTER mirror disk or hybrid disk with data discarded.

• For more information on initializing the cluster partition (CLUSTER partition), see the related items ("Shared disk settings for hybrid disk resource", "Partition settings for hybrid disk resource", and "Partition settings for mirror disk resource") in "Settings after configuring hardware" in Chapter 1, "Determining a system configuration" in the *Installation and Configuration Guide*.

5. Prevent initial mirror construction from being performed automatically.

◆ **(A)** In the **state in which the operation is being performed** on the server on which a mirror disk **is not replaced** (state in which the group containing mirror disk resources is active), you want to concurrently perform disk copy (initial mirror construction), there is no particular need to make sure that initial mirror construction is not automatically performed.

◆ **(B)** If the operation could be stopped until disk copy is completed (the group may be deactivated), deactivate the group containing the mirror disk resource.

Note:

• With procedure (A), copy is performed by the amount equal to that of disk space used, depending on the type of file system, so the copy time may depend on the amount of disk space used.
  Also, because the operation and copy are performed concurrently, the load may become high and copy may take time depending on the case.

• With procedure (B) whereby disk copy is performed while the operation is stopped (the group is deactivated), copy is performed by the amount equal to that of disk space used, depending on the file system, so the copy time may depend on the amount of disk space used. The operation (group activation) can be started after the completion of copy.

6. On the server on which a new disk has been installed, enable the EXPRESSCLUSTER daemon, and restart the server.

Note:

• In case that the steps in "Disabling the EXPRESSCLUSTER daemon" in the Installation and Configuration Guide were executed before shutting down the server, enable the EXPRESSCLUSTER daemons at this time.
  On the server on which to enable the daemon, execute the command in the order below to enable the daemon.

```
For init.d environment:
   chkconfig --add clusterpro_md
   chkconfig --add clusterpro
   chkconfig --add clusterpro_webmgr
   chkconfig --add clusterpro_alertsync

For systemd environment:
   systemctl enable clusterpro_md
   systemctl enable clusterpro
   systemctl enable clusterpro_webmgr
   systemctl enable clusterpro_alertsync
```

7. Start the initial mirror construction (disk copy) by executing the command described below.

◆ **(A)** When performing an operation on a server on which the mirror disk has not been replaced

The initial mirror construction (disk copy) is automatically started.
If you set **Execute the initial mirror construction** to Off, construction is not started automatically; use Mirror Disks or either of the following commands to start it manually

[For a mirror disk]

```
clpmdctrl --force copy_source_server_name>
<mirror_disk_resource_name>
```

[For a hybrid disk]

```
clphdctrl --force copy_source_server_name>
<hybrid_disk_resource_name>
```

◆ **(B)** If the operation is stopped, and the operation is to be started after the completion of disk copy
(When performing copy when the group containing the mirror disk resource is deactivated)

   [For a mirror disk]

```
clpmdctrl --force <copy_source_server_name>
<mirror_disk_resource_name>
```

   [For a hybrid disk]

```
clphdctrl --force <copy_source_server_name>
<hybrid_disk_resource_name>
```

8. If initial mirror construction is started while the operation is stopped (deactivated) (B), you can start the operation (activate the group) after the completion of the initial mirror construction (after the completion of disk copy).
If mirror recovery is interrupted, start initial mirror construction without activating the group.

In case of replacing a mirror disk constructed with a number of disks(RAID)

1. Stop the server of which the mirror disks are going to be replaced.

Note:

• Before shutting down the server, it is recommended that the steps in "Disabling the EXPRESSCLUSTER daemon" in the Installation and Configuration Guide be executed. On the server on which to disable the daemon, execute the command in the order below to disable the daemon.

```
For init.d environment:
   chkconfig --del clusterpro_alertsync
   chkconfig --del clusterpro_webmgr
   chkconfig --del clusterpro
   chkconfig --del clusterpro_md

For systemd environment:
   systemctl disable clusterpro_alertsync
   systemctl disable clusterpro_webmgr
   systemctl disable clusterpro
   systemctl disable clusterpro_md
```

   If a hybrid disk failure occurs, terminate all servers connected to the disk to be replaced.

2. Install the new disks in the server.

3. Start up the server.

4. Reconstruct the RAID before OS startup.

5. Change the setting so that the EXPRESSCLUSTER services will not be executed at OS startup. In case of not having disabled the EXPRESSCLUSTER daemon in the step 1, startup the daemons on run level 1 at OS startup, then startup the daemons on run level 3 after disabling the daemons.
Back up data from the data partition as required.

6. If LUN is initialized, use the fdisk command to create cluster and data partitions on a new disk.

Note:

• If a hybrid disk failure occurs, terminate all servers connected to the disk to be replaced.

7. Login as the root and initialize the cluster partition using one of the following methods.

◆ Method (1) Without using the dd command

For the mirror disk

```
clpmdinit --create force <mirror disk resource name>
```

For the hybrid disk

```
clphdinit --create force <hybrid disk resource name>
```

Note:

- For the mirror disk, if **Execute initial mkfs** is set to "on" when the mirror disk resource is set up, mkfs is executed upon execution of this command to initialize the file system. However, mkfs may take a long time to complete in the case of a large-capacity disk. (once mkfs is executed, any data saved in the data partition will be erased. Back up the data in the data partition as required, therefore, before executing this command.) Mirror data is copied from the destination server by means of the entire recovery described later.

- If a hybrid disk failure occurs, terminate all servers connected to the disk to be replaced.

◆ Method (2) Using the dd command

For the mirror disk

```
dd if=/dev/zero of=<cluster partition device name
(Example: /dev/sdb1)>
```

```
clpmdinit --create quick <mirror disk resource name>
```

For the hybrid disk

```
dd if=/dev/zero of=<cluster partition device name
(Example: /dev/sdb1)>
```

```
clphdinit --create quick <hybrid disk resource name>
```

Note:

- When the dd command is executed, data in the partition specified by of= is initialized. Confirm whether the partition device name is correct, and then execute the dd command.

- When the dd command is executed, the following message may appear. This does not, however, indicate an error.
  ```
  dd: writing to <CLUSTER partition device name>: No space left
  on device
  ```

- Mirror data is copied from the destination server by means of the entire recovery described later. Back up the data in the data partition as required, therefore, before executing this command.

- If a hybrid disk failure occurs, terminate all servers connected to the disk to be replaced.

8. Prevent initial mirror construction from being performed automatically.

◆ **(A)** In the **state in which the operation is being performed** on the server on which a mirror disk **is not replaced** (state in which the group containing mirror disk resources is active), you want to concurrently perform disk copy (initial mirror construction), there is no particular need to make sure that initial mirror construction is not automatically performed.

◆ **(B)** If the operation could be stopped until disk copy is completed (the group may be deactivated), deactivate the group containing the mirror disk resource.

Note:

- With **procedure (A)**, copy is performed by the amount equal to that of disk space used, depending on the type of file system, so the copy time may depend on the amount of disk space used.
  Also, because the operation and copy are performed concurrently, the load may become high and copy may take time depending on the case.

- With **procedure (B)** whereby disk copy is performed while the operation is stopped (the group is deactivated), copy is performed by the amount equal to that of disk space used, depending on the file system, so the copy time may depend on the amount of disk space used. The start of the operation (group activation) can be performed after the completion of copy.

9. On a server on which a disk has been replaced, enable the EXPRESSCLUSTER daemon, and then restart the server.

Note:

- In the case that the steps in "Disabling the EXPRESSCLUSTER daemon" in the *Installation and Configuration Guide* were executed before shutting down the server, enable the EXPRESSCLUSTER daemons at this time.
  On the server on which to enable the daemon, execute the command in the order below to enable the daemon.

```
For init.d environment:
    chkconfig --add clusterpro_md
    chkconfig --add clusterpro
    chkconfig --add clusterpro_webmgr
    chkconfig --add clusterpro_alertsync

For systemd environment:
    systemctl enable clusterpro_md
    systemctl enable clusterpro
    systemctl enable clusterpro_webmgr
    systemctl enable clusterpro_alertsync
```

10. Use the following command to start the initial mirror construction (disk copy).

◆ **(A)** When performing an operation on a server on which the mirror disk has not been replaced

The initial mirror construction (disk copy) is automatically started.
If you set **Execute the initial mirror construction** to Off, construction is not started automatically; use Mirror Disks or either of the following commands to start it manually

[For a mirror disk]

```
clpmdctrl --force <copy_source_server_name>
<mirror_disk_resource_name>
```

[For a hybrid disk]

```
clphdctrl --force <copy_source_server_name>
<hybrid_disk_resource_name>
```

◆ **(B)** If the operation is stopped, and is to be started after disk copy has been completed (When performing copy in the state in which the group containing the mirror disk resource is deactivated)

[For a mirror disk]

```
clpmdctrl --force <copy_source_server_name>
<mirror_disk_resource_name>
```

[For a hybrid disk]

```
clphdctrl --force <copy_source_server_name>
<hybrid_disk_resource_name>
```

11. If initial mirror construction is started while the operation is stopped (deactivated) (B), you can start the operation (activate the group) after the completion of the initial mirror construction (after the completion of disk copy).
If mirror recovery is interrupted, start the initial mirror construction without activating the group.

In case of replacing mirror disks of both servers

Note:

The data of mirror disks are lost after replacing the mirror disks of both servers. Restore the data from backup data or other media as necessary after replacing the disks.

1. Stop the both servers.

Note:

- Before shutting down both servers, it is recommended that the steps in "Disabling the EXPRESSCLUSTER daemon" in the Installation and Configuration Guide are executed. On the server on which to disable the daemon, execute the command in the order below to disable the daemon.

```
For init.d environment:
    chkconfig --del clusterpro_alertsync
    chkconfig --del clusterpro_webmgr
    chkconfig --del clusterpro
    chkconfig --del clusterpro_md

For systemd environment:
    systemctl disable clusterpro_alertsync
    systemctl disable clusterpro_webmgr
    systemctl disable clusterpro
    systemctl disable clusterpro_md
```

2. Install the new disks in both servers.

3. Startup both servers. At this time, change the setting so that the EXPRESSCLUSTER services will not be executed. In case of not having disabled the EXPRESSCLUSTER daemon in the step 1, the daemons start up on run level 1 at OS startup.

4. Construct the same partition as the original disk to the new disks of both servers by fdisk command.

Note:

- To replace shared storage with the hybrid disk, create a partition and a file system with any server connected to that shared storage.

- Initialize the cluster partition when using the disk used as an EXPRESSCLUSTER mirror disk or hybid disk with data discarded. If required, initialize the file system of the data partition.

- For more information on initializing the cluster partition (CLUSTER partition) and on creating a file system and whether to create one or not, see the related items ("Shared disk settings for hybrid disk resource", "Partition settings for hybrid disk resource", and "Partition settings for mirror disk resource") in "Settings after configuring hardware" in Chapter 1, "Determining a system configuration" in the Installation and Configuration Guide.

5. Restart both servers.

Note:

- In the case that the steps in "Disabling the EXPRESSCLUSTER daemon" in the *Installation and Configuration Guide* were executed before shutting down the server, enable the EXPRESSCLUSTER daemons at this time.
  On the server on which to enable the daemon, execute the command in the order below to enable the daemon.

```
For init.d environment:
    chkconfig --add clusterpro_md
    chkconfig --add clusterpro
    chkconfig --add clusterpro_webmgr
    chkconfig --add clusterpro_alertsync

For systemd environment:
    systemctl enable clusterpro_md
    systemctl enable clusterpro
    systemctl enable clusterpro_webmgr
    systemctl enable clusterpro_alertsync
```

6. The initial mirror construction (entire mirror recovery) starts automatically by restarting.
If you set **Execute the initial mirror construction** to Off, the normal state is assumed directly without automatically starting. Thus, in this case, use the Mirror Disks of Cluster WebUI, clpmdctrl, or the clphdctrl command to manually start full mirror recovery.

7. After the completion of full mirror recovery, recover the data from a backup or the like after the completion of full mirror recovery.

How to replace a server with a new one ~For a shared disk~

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Install the EXPRESSCLUSTER Server to the new server.

   For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the Installation and Configuration Guide. The server on which you installed the EXPRESSCLUSTER Server should be restarted after the installation.

2. Upload the cluster configuration data in config mode of Cluster WebUI you connected to.

3. Start the services of a new server in the operation mode of Cluster WebUI.For details on how to start services, see the online manual.

How to replace a server with a new one ~For a mirror disk~

Replacing a server and its mirror disk

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Replace the failed server machine and the disk. Set the same IP address and host name in the new server as the old server.
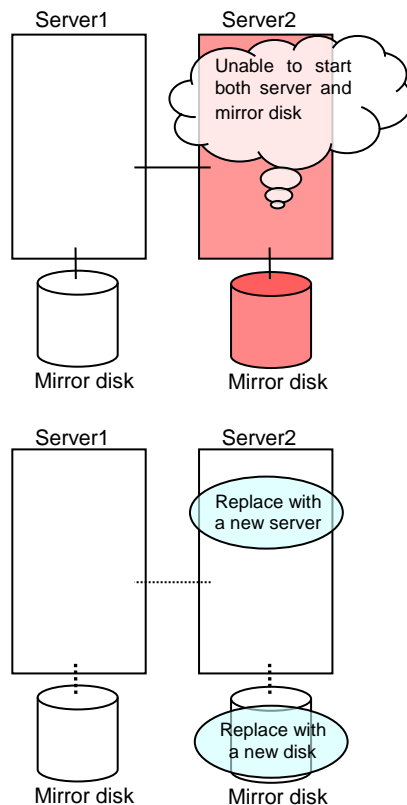
2. Create partitions in the new disk by executing the fdisk command.
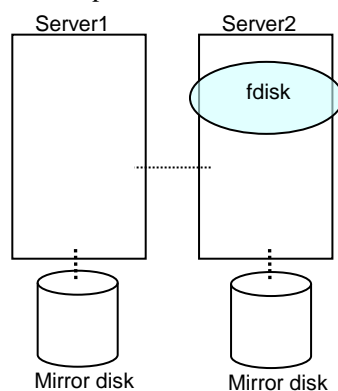
Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the Installation and Configuration Guide. The server on which you installed the EXPRESSCLUSTER Server should be restarted after the installation.

3. When using the disk that was used as a mirror disk before, initialize the cluster partition.

4. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to. When uploading the data completes, restart the replaced server.

5. After the server is restarted, the cluster partitions in the new disk will be initialized and a file system will be created in the data partition.
The mirror recovery is executed if the initial mirror construction is set. If not, you have to manually recover mirroring.
For information on recovery of disk mirroring, refer to.

"Recovering mirror with a command" and "Recovering mirror using the WebManagerCluster WebUI" of Chapter 8, "Troubleshooting" in *Reference Guide*

In mirror recovery, the data is fully copied.

Confirm that mirroring is successfully recovered by using the WebManager or by running the following command. For details, see "Mirror-related commands" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

```
clpmdstat --mirror < mirror_disk_resource_name (Example: md1)>
```
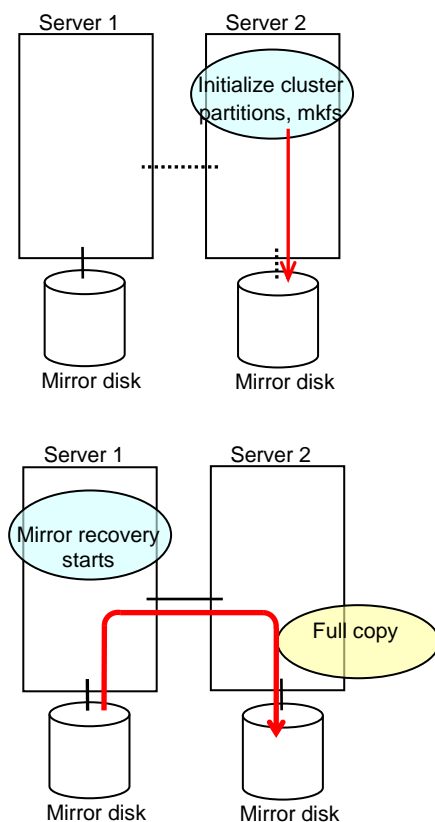
Using the mirror disk of the failed server

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Replace the failed server machine but continue using the mirror disk of the failed server. Set the same IP address and host name in the new server as before.

Server 1   Server 2

Unable to start server

Mirror disk   Mirror disk

Server 1   Server 2

Replace with new server

Mirror disk   Mirror disk
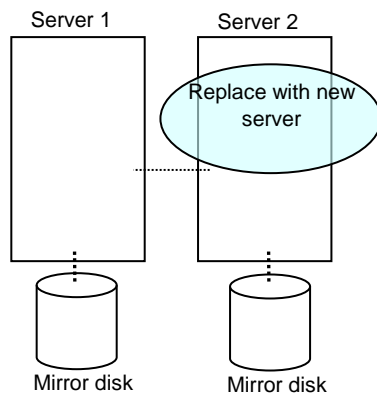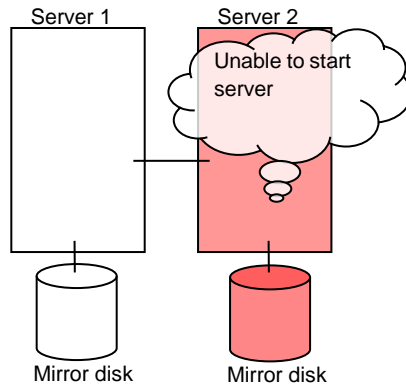
Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the *Installation and Configuration Guide*. Restart the server on which the EXPRESSCLUSTER Server was installed.

2. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to. When uploading the data completes, restart the replaced server.

3. If there is no difference in mirror disks, you can immediately start the operation after restarting the server. On the other hand, if there is any difference in mirror disks, you have to recover the mirroring data after restarting the server.
The disk mirroring is automatically recovered when auto-mirror recovery is enabled. If not, you have to manually recover disk mirroring. For information on recovery of disk mirroring, refer to "Recovering mirror with a command" and "Recovering mirror using the WebManagerCluster WebUI" of Chapter 8, "Troubleshooting" in *Reference Guide*. Confirm that mirroring is successfully recovered by using the Cluster WebUI or by running the following command. For details, see "Mirror-related commands" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

```
clpmdstat --mirror < mirror_disk_resource_name (Example: md1)>
```

How to replace a server with a new one ~For a hybrid disk~

Replacing a server and its non-shared hybrid disk

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Replace the failed server machine and the disk. Set the same IP address and host name in the new server as the old server.
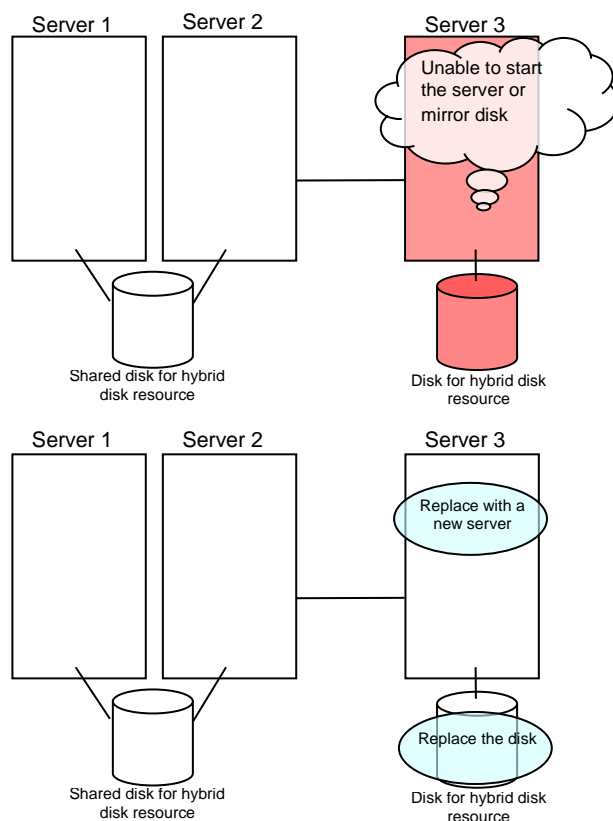
2. Create partitions in the new disk by executing the fdisk command.
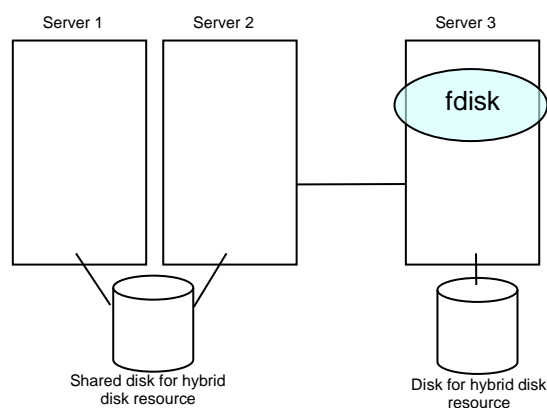
3. Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the Installation and Configuration Guide. The server on which you installed the EXPRESSCLUSTER Server should be restarted after the installation.

4. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to.

5. Execute the clphdinit command in the replaced server.

   # clphdinit --create force <Hybrid disk resource name (Example: hd1)>

6. Restart the replaced server.

7. After the server is restarted, the mirror recovery is executed if the initial mirror construction is set. If not, you have to manually recover mirroring.
   For information on recovery of disk mirroring, refer to "Recovering mirror with a command" and "Recovering mirror using the WebManagerCluster WebUI" of Chapter 8, "Troubleshooting" in *Reference Guide*.

   In mirror recovery, the data is fully copied.

   Confirm that mirroring is successfully recovered by using the Cluster WebUI or by running the following command. For details, see "Hybrid-disk-related commands" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

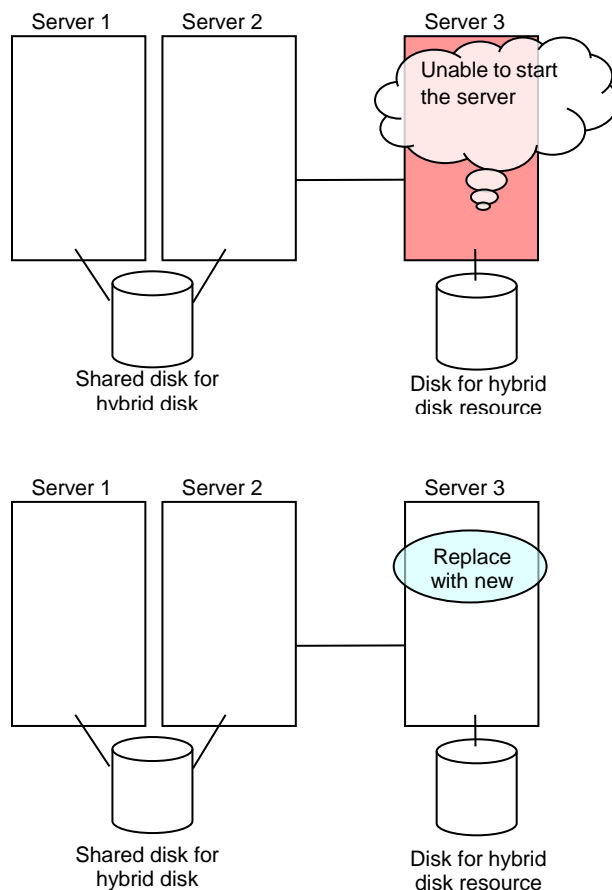   **clphdstat --mirror < hybrid_disk_resource_name (Example: hd1)>**

Replacing a server and a hybrid disk of the shared disk

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Run the chkconfig command or systemd command in the following order and configure the settings not to start the EXPRESSCLUSTER services in the server that was connected to the failing server via the shared disk. In SUSE Linux, when running the chkconfig command, run the command with the **--force** option.

    ```
    For init.d environment:
        # chkconfig --del clusterpro
        # chkconfig --del clusterpro_md

    For systemd environment:
        # systemctl disable clusterpro
        # systemctl disable clusterpro_md
    ```

2. Shut down the server that was connected to the failing server via the shared disk by running the OS shutdown command etc.
    If you want to keep the operation during replacement, move the group to server 3.
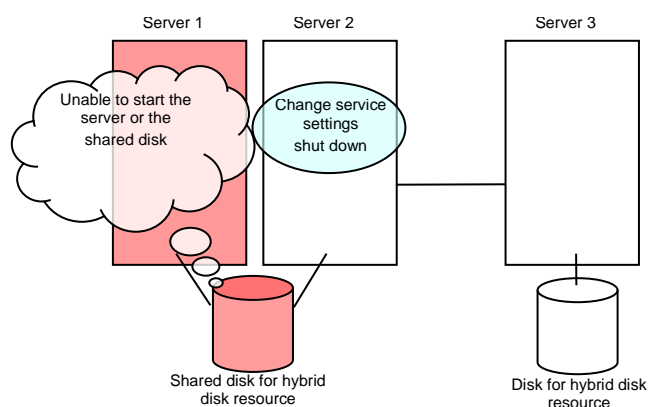
3.   Replace the failed server machine and the shared disk. Set the same IP address and host name in the new server as the old server.
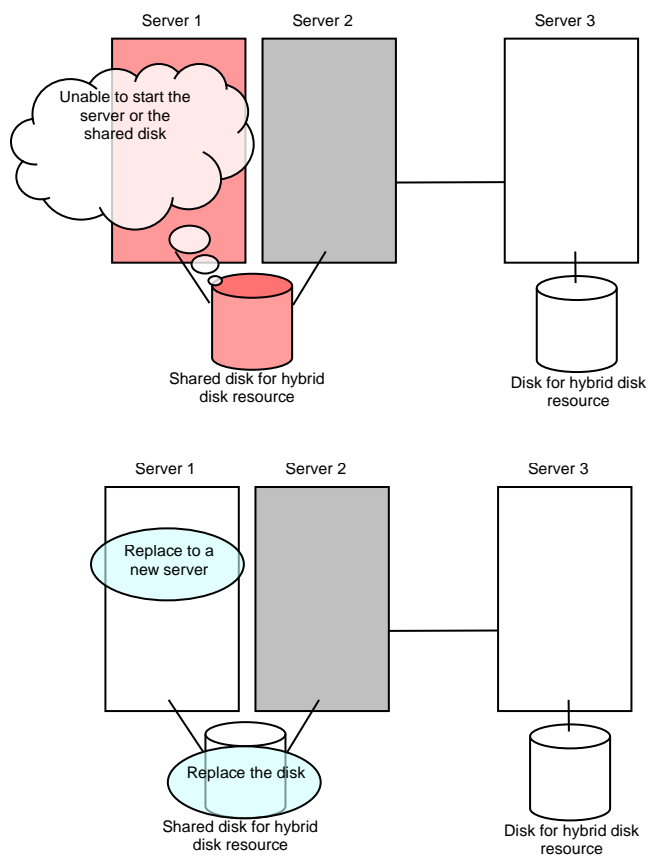
4.   Create disk partitions from the replaced server by executing the fdisk command.
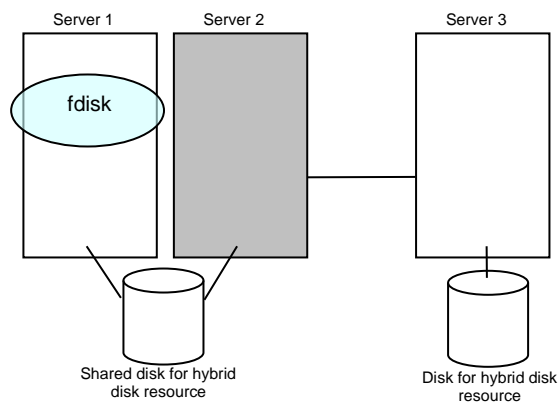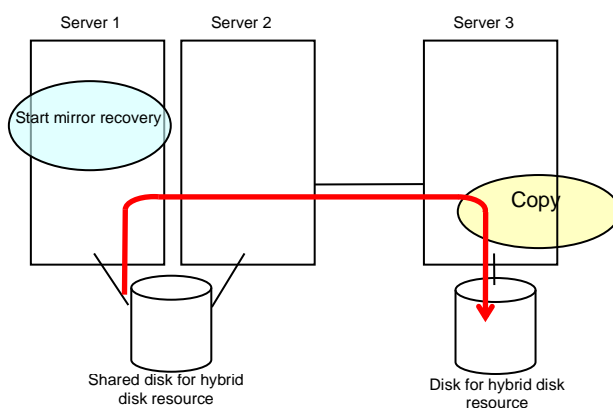
5. Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the *Installation and Configuration Guide*. The server on which you installed the EXPRESSCLUSTER Server should be restarted after the installation. Start the server that was connected to the failing server via the shared disk.
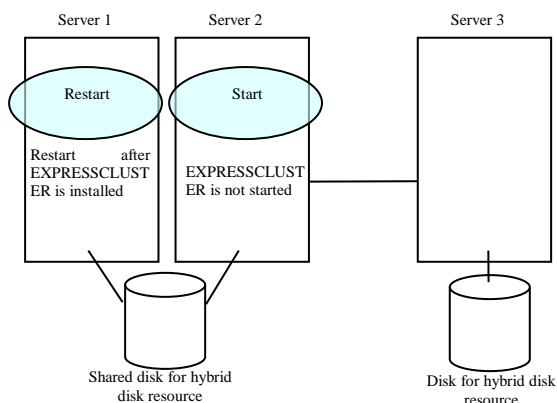
6. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to.

7. On the replaced server, run the clphdinit command.

    # clphdinit --create force <hybrid disk resource name(example: hd1)>

8. Configure the settings to start the EXPRESSCLUSTER services in the server that was connected to the failing server via the shared disk by running the chkconfig command or systemctl command.

    For init.d environment:
    # chkconfig --add clusterpro_md
    # chkconfig --add clusterpro

    For systemd environment:
    # systemctl enable clusterpro_md
    # systemctl enable clusterpro

9. Restart the replaced server as well as the server that was connected to the failing server via the shared disk.
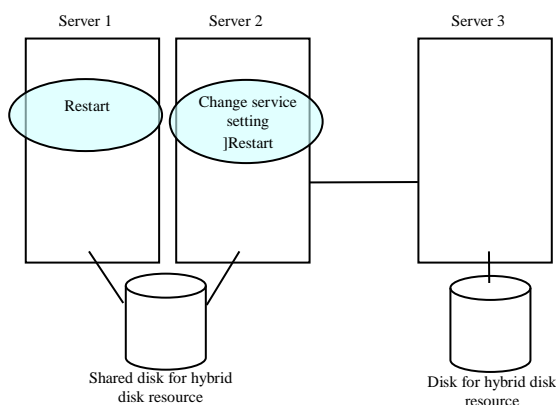
10. After the server is restarted, the mirror recovery is executed if the initial mirror construction is set. If not, you have to manually recover mirroring
For information on recovery of disk mirroring, refer to "Recovering mirror with a command" and "Recovering mirror using the WebManagerCluster WebUI" of Chapter 8, "Troubleshooting" in *Reference Guide*.

The destination server of disk mirroring is the current server of the server group to which the shared disk is connected (The figure below shows an example where the server 1 is the current server).

In mirror recovery, the data is fully copied.

Check that mirror recovery has completed by running the following command, or by using WebManager. For details, see "Hybrid-disk-related commands" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

```
clphdstat --mirror <hybrid disk resource name (example: hd1)>
```
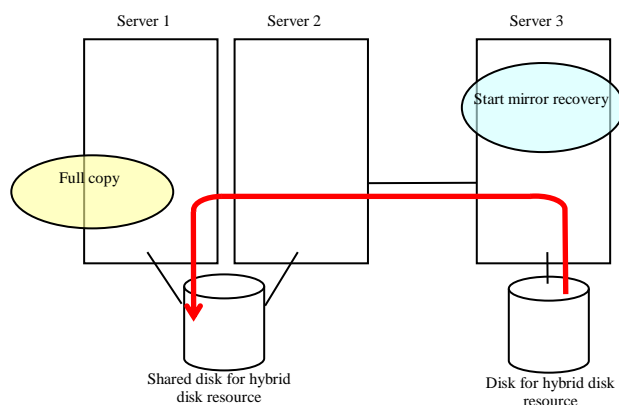
Using the disk of the failed server

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Replace the failed server machine but continue using the disk of the failed server. Set the same IP address and host name in the new server as before.

2. Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the Installation and Configuration Guide. Restart the server on which the EXPRESSCLUSTER Server was installed.

3. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to. When uploading the data completes, restart the replaced server.

4. If there is no difference in mirror disks, you can immediately start the operation after restarting the server. On the other hand, if there is any difference in mirror disks, you have to recover the mirroring data after restarting the server.
The disk mirroring is automatically recovered when auto-mirror recovery is enabled. If not, you have to manually recover disk mirroring. For information on recovery of disk mirroring, refer to "Recovering mirror with a command" and "Recovering mirror using the WebManagerCluster WebUI" of Chapter 8, "Troubleshooting" in *Reference Guide*.

Confirm that mirroring is successfully recovered by using the Cluster WebUI or by running the following command. For details, see "Hybrid-disk-related commands" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

```
clpmdstat --mirror < hybrid_disk_resource_name (Example:
hd1)>
```

Replacing a server to which the shared disk is connected

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the IP address of a server that is not to be replaced.

1. Replace the failed server machine and the shared disk. Set the same IP address and host name in the new server as the old server.

2. Install the EXPRESSCLUSTER Server on the new server. For details, see Chapter 3, "Installing EXPRESSCLUSTER" in the *Installation and Configuration Guide*. Restart the server on which the EXPRESSCLUSTER Server was installed

3. Upload the cluster configuration data in the config mode of Cluster WebUI you connected to. When uploading the data completes, restart the replaced server.

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, with EXPRESSCLUSTER, if one server is started, it 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 **Timeout** tab, and select **Synchronize Wait Time**.

For more information, see "Cluster properties Timeout tab" in Chapter 1, "Parameter details" in the *Reference Guide*.

Changing disk resources file system

Connect to the Cluster WebUI with a management IP address. If you do not have any management IP address, connect to it by using the actual IP address of any server.

To change the disk resource file system, follow the steps below:

1. In the operation mode of Cluster WebUI, click **Stop Cluster**.

2. Run the following command.

   For example, when the disk resources partition device is /dev/sdb5:

   ```
   # clproset -w -d /dev/sdb5
   ```

   This makes disk partition of disk resources readable/writable regardless of the EXPRESSCLUSTER behavior.

   Note:
   Do not use this command for any other purposes.
   If you use this command when the EXPRESSCLUSTER daemon is active, the file system may be corrupted.

3. Create the file system in the partition device.

4. Run the following command to set the disk resources partition to ReadOnly.

   For example, when the disk resources partition device is /dev/sdb5:

   ```
   # clproset -o -d /dev/sdb5
   ```

5. Change the configuration data of disk resource file system in the config mode of Cluster WebUI.

6. Upload the cluster configuration data in the config mode of Cluster WebUI.

7. In the operation mode of Cluster WebUI, click **Start Cluster**.

The settings reflecting the changes become effective.

Changing offset or size of a partition on mirror disk resource

Follow the procedure below when changing the offset (location) or size of the data partition or cluster partition configured on a mirror disk resource after the operation of a cluster is started.

Note:
Be sure to follow the steps below to change them. Mirror disk resources may not function properly if you change the partition specified as a data partition or cluster partition only by fdisk.

When not changing a device name of a partition on mirror disk resource

1. Check the name of a mirror disk resource whose size you want to change by the clpstat command or by the Cluster WebUI.

2. On the server where a group with a mirror disk resource whose size you want to change is activated, back up the data in a partition to a device such as tape. Note that backup commands that access a partition device directly are not supported.
   This step is not required if there is no problem to discard the data on a mirror disk resource.

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3. Run the chkconfig command or the systemctl command in the following order not to start the EXPRESSCLUSTER services. In SUSE Linux, when running the chkconfig command, run the command with the **--force** option.

```
For init.d environment:
# chkconfig --del clusterpro
# chkconfig --del clusterpro_md

For systemd environment:
# systemctl disable clusterpro
# systemctl disable clusterpro_md
```


4. Shut down a cluster, and then restart the OS.
    To shut down a cluster, run the clpstdn command on either of a server, or execute a cluster shutdown on the Cluster WebUI.

5. On both servers, run the fdisk command to change the offset or size of a partition.
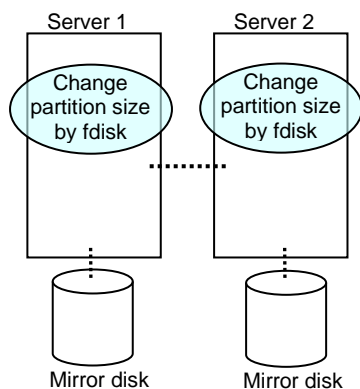
6. Run the following command on both servers.

```
# clpmdinit --create force <Mirror_disk_resource_name>
```
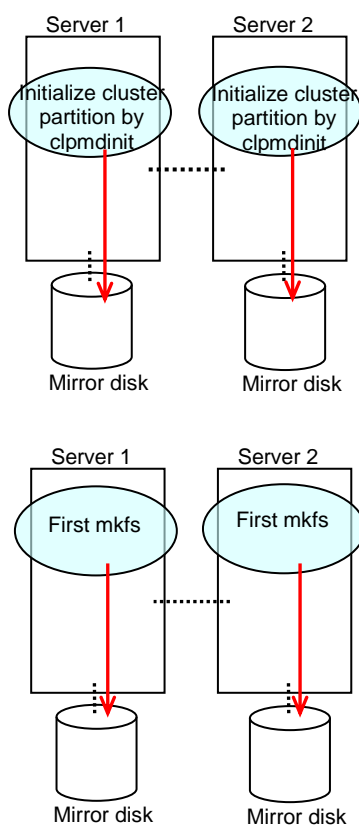

Note:
When you set **Execute initial mkfs** to off in the mirror disk resource setting, mkfs will not be executed automatically. Please execute mkfs manually to the data partition of mirror disk resource.

7. Run the chkconfig command or the systemctl command in the following order to start the EXPRESSCLUSTER services.

```
For init.d environment:
# chkconfig --add clusterpro_md
# chkconfig --add clusterpro

For systemd environment:
# systemctl enable clusterpro_md
# systemctl enable clusterpro
```
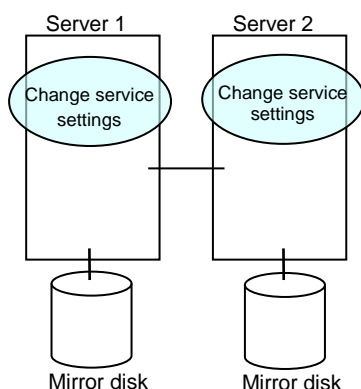

8. Run the reboot command to restart both servers. The servers are started as a cluster.

9. After a cluster is started, the same process as the initial mirror construction at cluster creation is performed. Run the following command or use the Cluster WebUI to check if the initial mirror construction is completed.

```
# clpmdstat --mirror <Mirror_disk_resource_name>
```
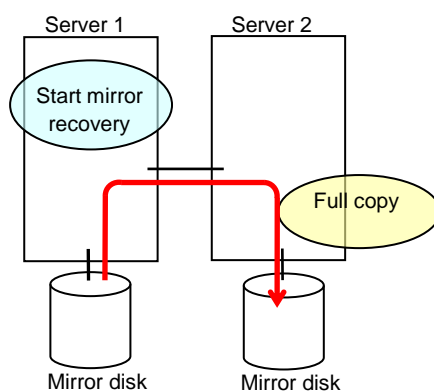
10. When the initial mirror construction is completed and a failover group starts, a mirror disk resource becomes active.

11. On the server where a group with a mirror partition whose size you changed is activated, restore the data you backed up. Note that backup commands that access a partition device directly are not supported.
This step is not required if there is no problem to discard the data on a mirror disk resource.

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When changing a device name of a partition on mirror disk resource

1. Check the name of a mirror disk resource whose size you want to change by the clpstat command or by the Cluster WebUI.

2. On the server where a group with a mirror disk resource whose size you want to change is activated, back up the data in a partition to a device such as tape. Note that backup commands that access a partition device directly are not supported.
This step is not required if destroying the data on a mirror disk resource does not cause any problem.

3. Run the chkconfig command or the systemctl command in the following order not to start the EXPRESSCLUSTER services. In SUSE Linux, when running the chkconfig command, execute the command with the --*force* option.

```
For init.d environment:
# chkconfig --del clusterpro
# chkconfig --del clusterpro_md

For systemd environment:
# systemctl disable clusterpro
# systemctl disable clusterpro_md
```
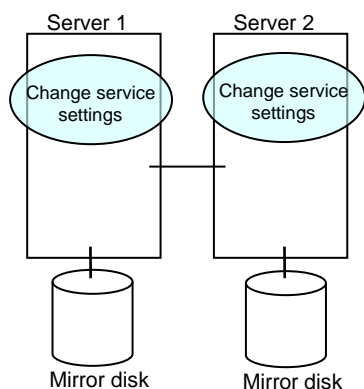
4. Shut down a cluster, and then restart the OS.
To shut down a cluster, run the clpstdn command on either of a server, or execute a cluster shutdown on the WebManager.
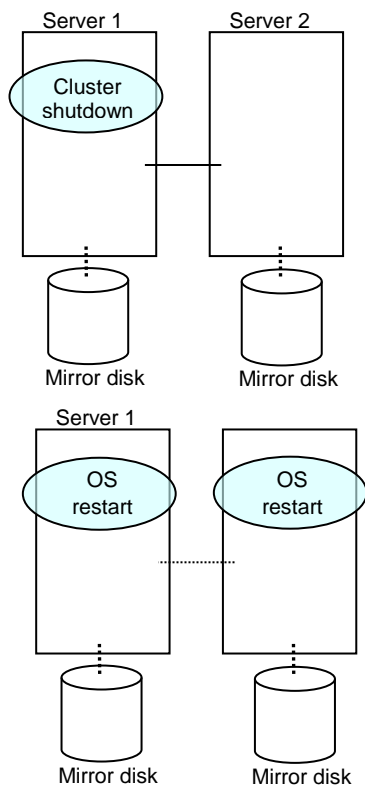
5. On both servers, run the fdisk command to change the offset or size of a partition.
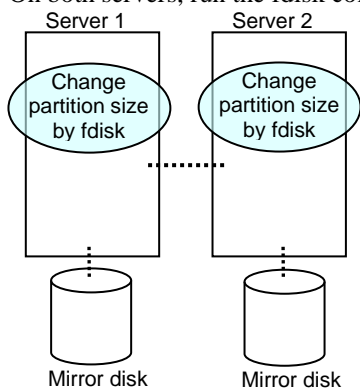
6. Change and upload the cluster configuration data. Change a mirror disk resource as described in "Modifying the cluster configuration data by using the Cluster WebUI" in Chapter 7, "Modifying the cluster configuration data" in the *Installation and Configuration Guide*.

7. Run the following command on the both servers.

 # clpmdinit --create force <*Mirror_disk_rseource_name*>
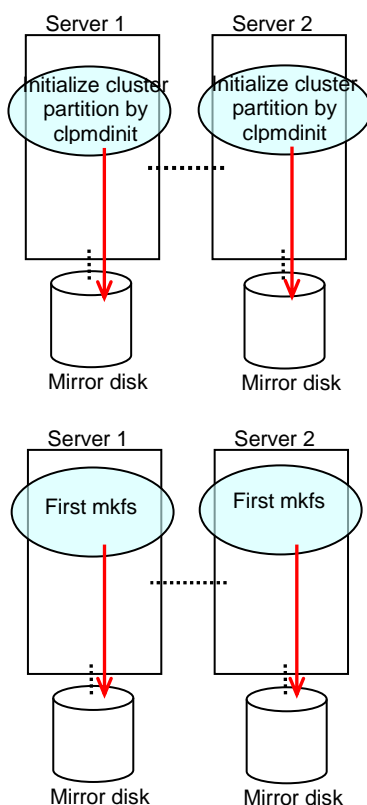
Note:
When you set **Execute initial mkfs** to off in the mirror disk resource setting, mkfs will not be executed automatically. Please execute mkfs manually to the data partition of mirror disk resource.

8. Run the chkconfig command or the systemctl command in the following order to start the EXPRESSCLUSTER services.

```
For init.d environment:
# chkconfig --add clusterpro_md
# chkconfig --add clusterpro

For systemd environment:
# systemctl enable clusterpro_md
# systemctl enable clusterpro
```
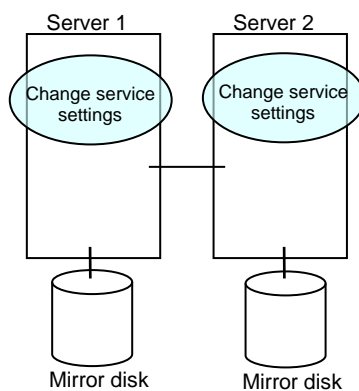

9. Run the reboot command to restart both servers. The servers are started as a cluster.

10. After a cluster is started, the same process as the initial mirror construction at cluster creation is performed. Run the following command or use the Cluster WebUI to check if the initial mirror construction is completed.

```
# clpmdstat --mirror <Mirror_disk_resource_name>
```
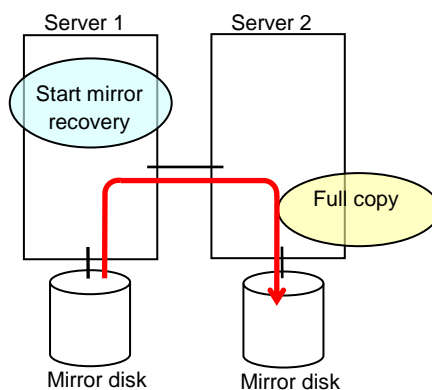
11. When the initial mirror construction is completed and a failover group starts, a mirror disk resource becomes active.
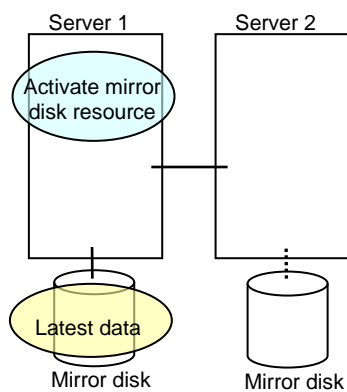
12. On the server where a group with a mirror partition whose size you changed is activated, restore the data you backed up. Note that backup commands that access a partition device directly are not supported.
   This step is not required if there is no problem to discard the data on a mirror disk resource.
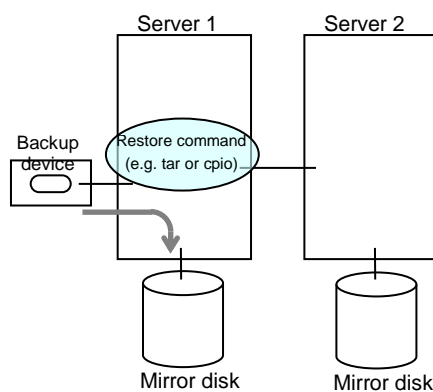
Changing offset or size of a partition on hybrid disk resource

Follow the procedure below when changing the offset (location) or size of the data partition or cluster partition configured on a hybrid disk resource after the operation of a cluster is started.

Note:
Be sure to follow the steps below to change them. Hybrid disk resources may not function properly if you change the partition specified as a data partition or cluster partition only by fdisk.

When not changing a device name of a partition on hybrid disk resource

1. Check the name of a hybrid disk resource whose size you want to change by the clpstat command or by the Cluster WebUI.

2. On the server where a group with the hybrid disk resource whose size you want to change is activated, back up the data in a partition to a device such as tape. Note that backup commands that access a partition device directly are not supported.
   This step is not required if there is no problem to discard the data on the hybrid disk resource.

3. Run the chkconfig command or the systemctl command in the following order not to start the EXPRESSCLUSTER services. In SUSE Linux, when running the chkconfig command, run the command with the **--force** option.

```
For init.d environment:
# chkconfig --add clusterpro_md
# chkconfig --add clusterpro

For systemd environment:
# systemctl enable clusterpro_md
# systemctl enable clusterpro
```
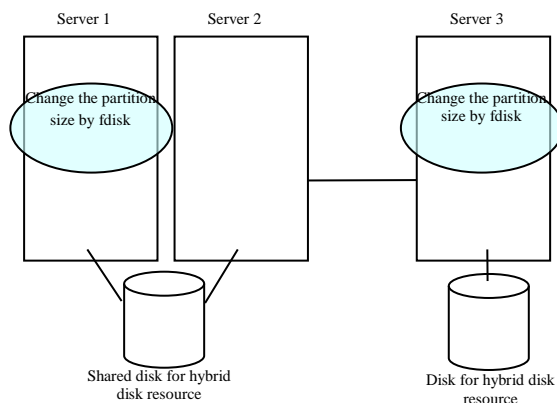

4. Shut down a cluster, and then restart the OS.
   To shut down a cluster, run the clpstdn command on either of a server, or execute a cluster shutdown on the Cluster WebUI.

75
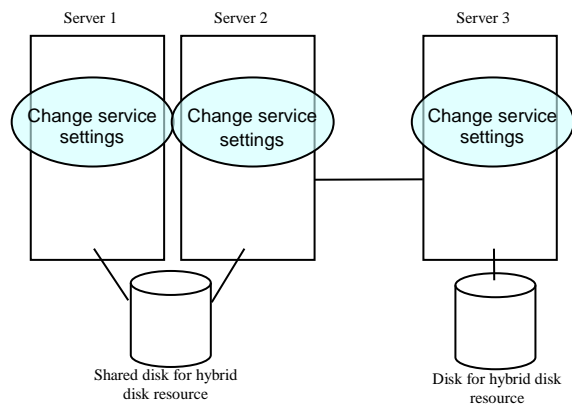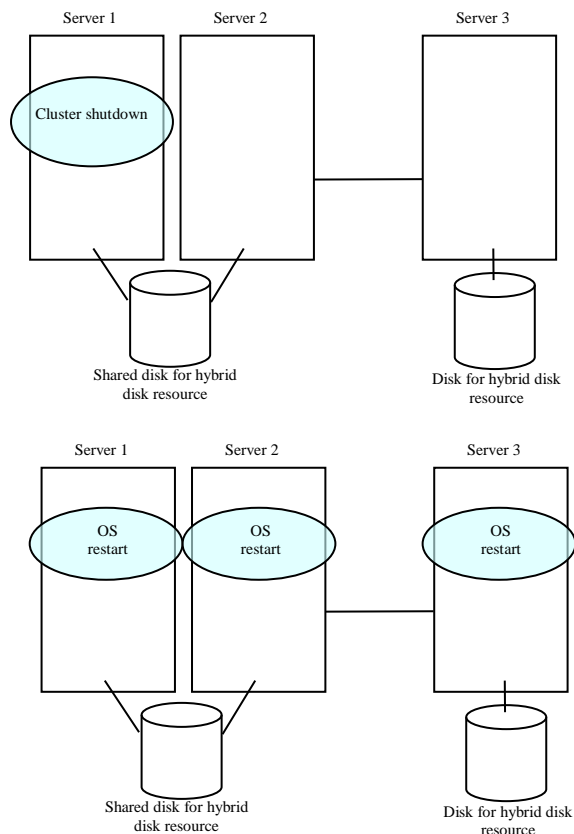
5. Run the fdisk command on a server to change the offset or size of a partition. When servers are connected to the shared disk, run the fdisk from either of the servers for the change.
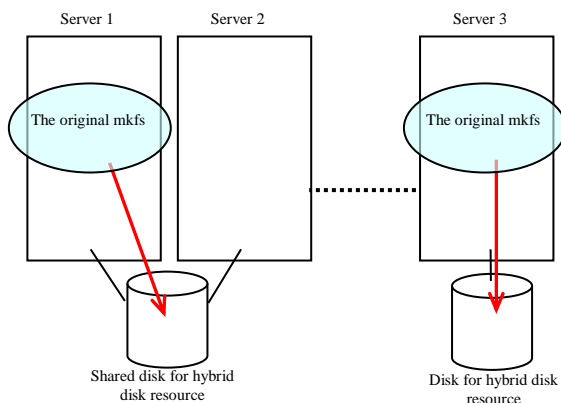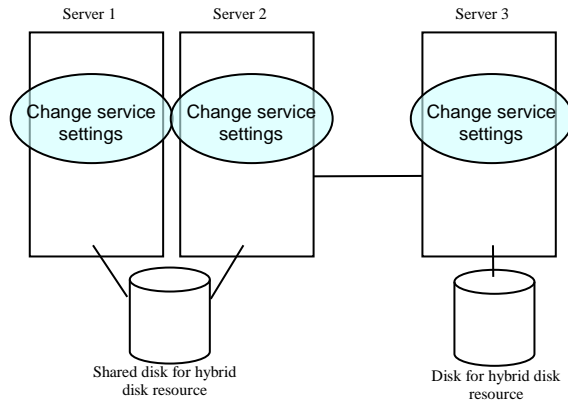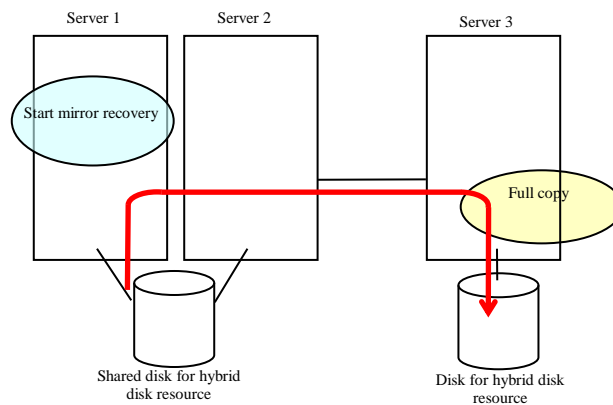

Server 1   Server 2   Server 3

Change the partition size by fdisk

Change the partition size by fdisk

Shared disk for hybrid disk resource

Disk for hybrid disk resource

6. Run the following command on a server. When servers are connected to the shared disk, run the command on the server where the command in previous step was executed.

clpmdinit --create force *<Mirror_disk_resource_name>*
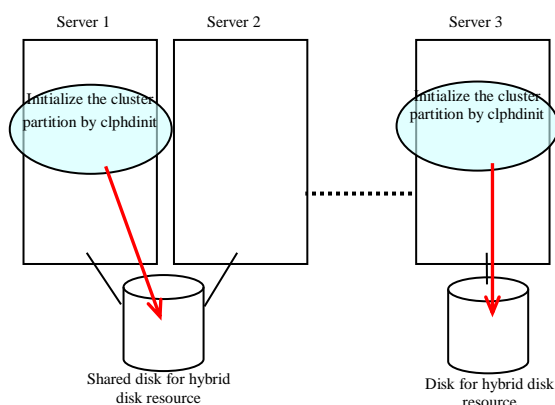
Server 1   Server 2   Server 3

Initialize the cluster partition by clphdinit

Initialize the cluster partition by clphdinit

Shared disk for hybrid disk resource

Disk for hybrid disk resource

7. Run the following command on a server.When servers are connected to the shared disk, run the command on the server where the command in previous step was executed.

mkfs -t <Type of Filesystem> <Data Partition>

Server 1   Server 2   Server 3

The original mkfs

The original mkfs

Shared disk for hybrid disk resource

Disk for hybrid disk resource

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8. Run the chkconfig command or the systemctl command in the following order to start the EXPRESSCLUSTER services.

```
For init.d environment:
# chkconfig --add clusterpro_md
# chkconfig --add clusterpro

For systemd environment:
# systemctl enable clusterpro_md
# systemctl enable clusterpro
```
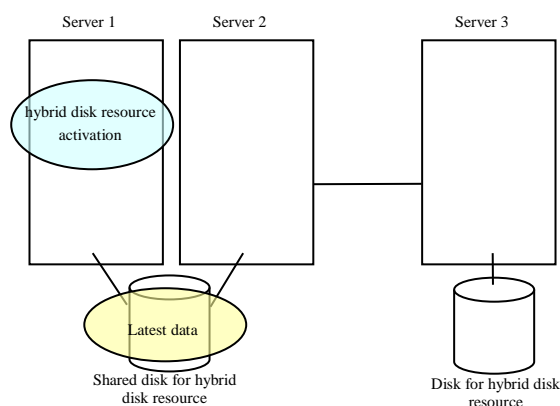

9. Run the reboot command to restart all servers. The servers are started as a cluster.

10. After the cluster is started, the same process as the initial mirror construction at cluster creation is performed. Run the following command or use the Cluster WebUI to check if the initial mirror construction is completed.

```
# clphdstat --mirror <hybrid_disk_resource_name>
```

11. When the initial mirror construction is completed and a failover group starts, a hybrid disk resource becomes active.

Server 1   Server 2   Server 3

hybrid disk resource activation

Latest data

Shared disk for hybrid disk resource

Disk for hybrid disk resource

12. On the server where a group with the partition whose size you changed is activated, restore the data you backed up. Note that backup commands that access a partition device directly are not supported.
This step is not required if there is no problem to discard the data on a hybrid disk resource.

Server 1   Server 2   Server 3

Backup device

Restore commands (e.g. tar, cpio)

Shared disk for hybrid disk resource

Disk for hybrid disk resource

When changing a device name of a partition on hybrid resource

1. Check the name of a hybrid disk resource whose size you want to change by the clpstat command or by the Cluster WebUI.

2. On the server where a group with the hybrid disk resource whose size you want to change is activated, back up the data in a partition to a device such as tape. Note that backup commands that access a partition device directly are not supported.
This step is not required if destroying the data on the hybrid disk resource does not cause any problem.
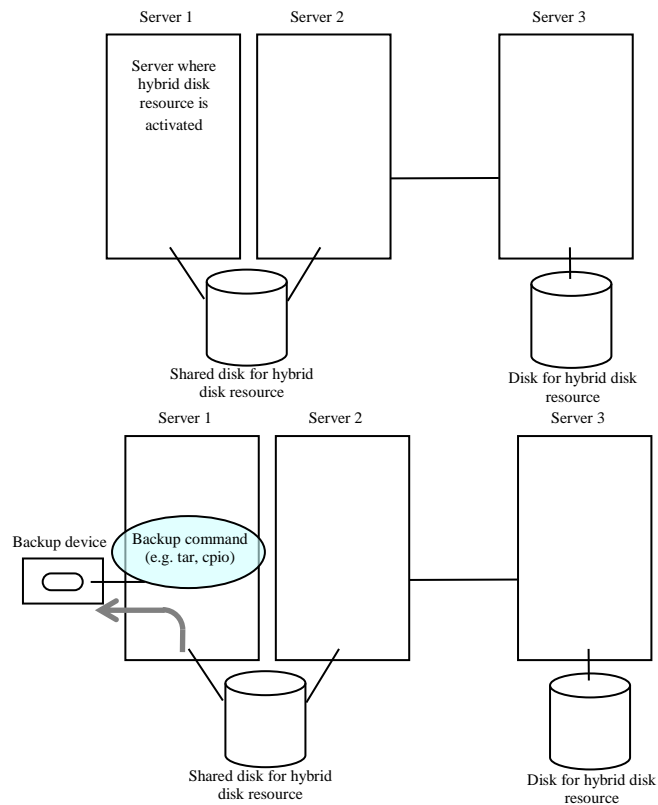
3. Run the chkconfig command or the systemctl command in the following order not to start the EXPRESSCLUSTER services. In SUSE Linux, when running the chkconfig command, run the command with the **--*force*** option.

```
For init.d environment:
# chkconfig --add clusterpro_md
# chkconfig --add clusterpro

For systemd environment:
# systemctl enable clusterpro_md
# systemctl enable clusterpro
```


4. Shut down a cluster, and then restart the OS.
To shut down a cluster, run the clpstdn command on either of a server, or execute a cluster shutdown on the Cluster WebUI.

EXPRESSCLUSTER X 4.1 for Linux Maintenance Guide
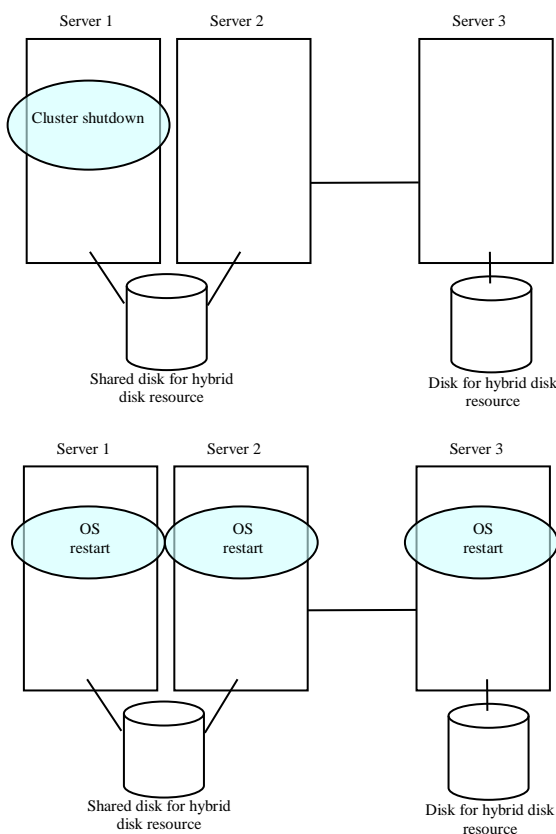
5. On a server, run the fdisk command to change the offset or size of a partition. When servers are connected to the shared disk, run the fdisk command from either of servers to change.
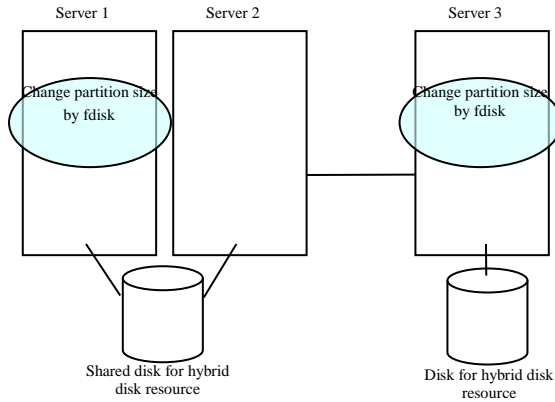

6. Change and upload the cluster configuration data. Change a hybrid disk resource as described in "Modifying the cluster configuration data by using theCluster WebUI" in Chapter 7, "Modifying the cluster configuration data" in the *Installation and Configuration Guide*.

7. Run the following command on the server. When servers are connected to the shared disk, execute the command on the server where the command was executed in step 5.

    ```
    # clphdinit --create force <Hybrid_disk_reseource_name>
    ```
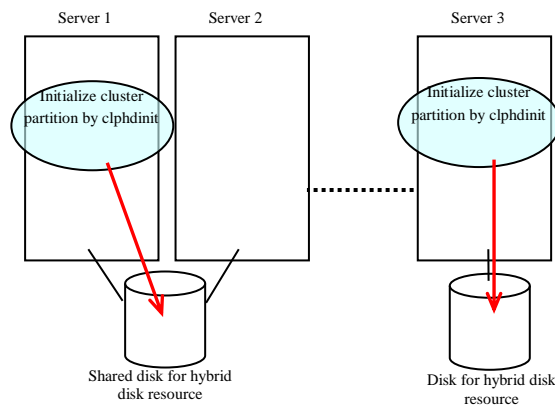
8. Run the following command on the server.When servers are connected to the shared disk, run the command on the server where the command in previous step was executed.
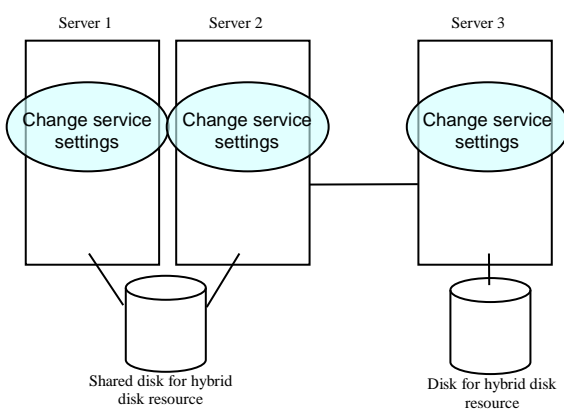
   ```
   # mkfs -t <Type of Filesystem> <Data Partition>
   ```
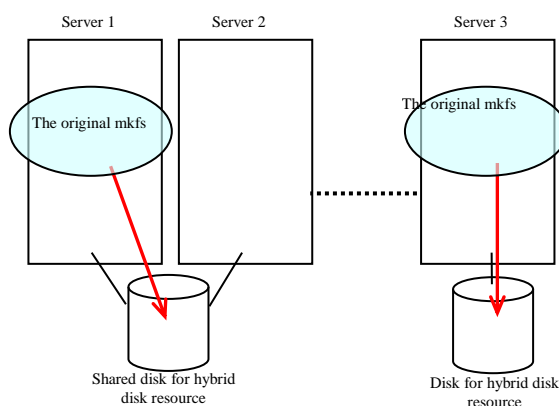

9. Run the chkconfig command or the systemctl command in the following order to start the EXPRESSCLUSTER services.

   ```
   For init.d environment:
   # chkconfig --add clusterpro_md
   # chkconfig --add clusterpro

   For systemd environment:
   # systemctl enable clusterpro_md
   # systemctl enable clusterpro
   ```
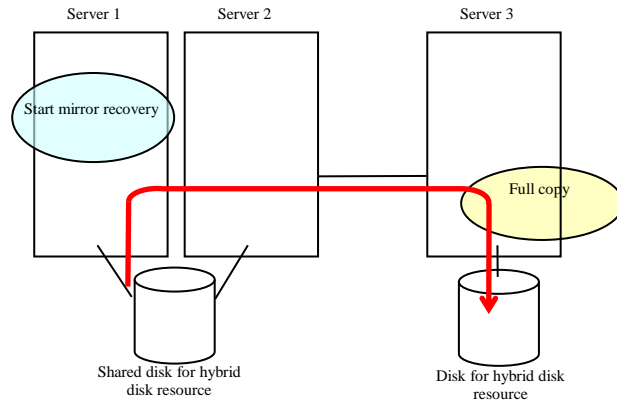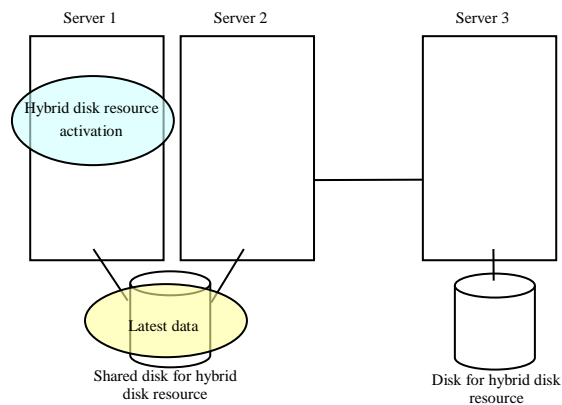

10. Run the reboot command to restart all servers. The servers are started as a cluster.

11. After the cluster is started, the same process as the initial mirror construction at cluster creation is performed. Run the following command or use the Cluster WebUI to check if the initial mirror construction is completed.
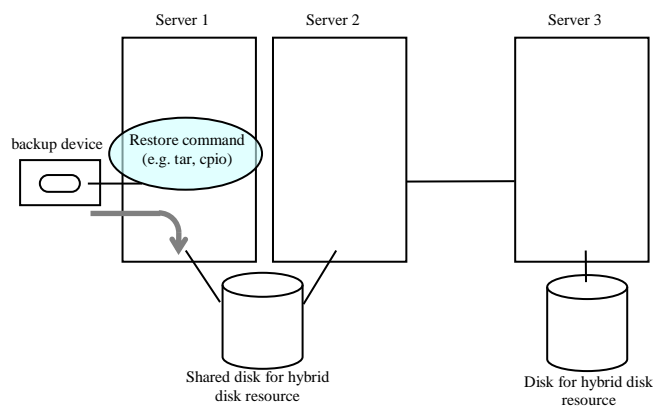
```
# clphdstat --mirror <Hybrid_disk_resource_name>
```

Server 1   Server 2   Server 3

Start mirror recovery

Full copy

Shared disk for hybrid disk resource

Disk for hybrid disk resource

12. When the initial mirror construction is completed and a failover group starts, a hybrid disk resource becomes active.

Server 1   Server 2   Server 3

Hybrid disk resource activation

Latest data

Shared disk for hybrid disk resource

Disk for hybrid disk resource

13. On the server where a group with the partition whose size you changed is activated, restore the data you backed up. Note that backup commands that access a partition device directly are not supported.
This step is not required if there is no problem to discard the data on the hybrid disk resource.

Server 1   Server 2   Server 3

backup device

Restore command (e.g. tar, cpio)

Shared disk for hybrid disk resource

Disk for hybrid disk resource

Changing the server configuration (add/delete)

Adding a server

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.

1. Make sure that the cluster is working normally.

2. Install the EXPRESSCLUSTER Server on a new server. For details, see "Setting up the EXPRESSCLUSTER Server Installing the EXPRESSCLUSTER RPM" in Chapter 3, "Installing EXPRESSCLUSTER" in the *Installation and Configuration Guide*. Restart the server on which the EXPRESSCLUSTER Server was installed.

3. In the operation mode of Cluster WebUI, click **Stop cluster**.

4. When using mirror resource or/and hybrid disk resource, in the operation mode of Cluster WebUI, click **Stop Mirror Agent**.

5. Access to other server in the cluster via the Web browser and click the server to add in the config mode of Cluster WebUI.

6. By using the config mode of Cluster WebUI, configure the following settings of theAdd server.

   - 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).

   - 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 **IP Address** of the server to add on the Details tab of Properties of the Azure DNS resources (when using an Azure DNS resource).

7. 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.

8. Click **Apply the Configuration File** in the config mode of Cluster WebUI to apply the cluster configuration information on the cluster.The window asking for the manager restart appears, and then select **OK**.

9. When using mirror resource or/and hybrid disk resource, in the operation mode of Cluster WebUI, click **Start Mirror Agent**.

10. In the operation mode of Cluster WebUI, click **Start cluster**.

11. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.

Deleting a server

To delete 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.

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. In the operation mode of Cluster WebUI, click **Stop cluster**.

3. When using mirror resource or/and hybrid disk resource, in the operation mode of Cluster WebUI, click **Stop Mirror Agent**.

4. Access to other server in the cluster via the Web browser and start the Cluster WebUI.

5. When using mirror disk resources or hybrid disk resources, click **Remove Resource** for the target resource in the config mode of Cluster WebUI.

6. When the server to be deleted is registered in a server group, click **Propertie**s of **Server** of the config mode of Cluster WebUI. Delete the server from **Servers that can run the Group** in **the Server Group** tab.

7. Click **Remove Server** of the server to delete in the config mode of Cluster WebUI.

8. Click **Apply the Configuration File** in the config mode of Cluster WebUI to apply the cluster configuration information on the cluster.

9. In the operation mode of Cluster WebUI, click Start Mirror Agent (if Mirror Agent is stopped) and then Start Cluster.

10. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.

11. Uninstall the EXPRESSCLUSTER Server from the server you are going to delete.
    For details, see "Uninstallation Uninstalling the EXPRESSCLUSTER Server" in Chapter 10, "Uninstalling and reinstalling EXPRESSCLUSTER" in the Installation and Configuration Guide.
    Shutdown of servers, from which EXPRESSCLUSTER has been uninstalled, may be executed by OS function.

Changing the server IP address

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

Changing the interconnect IP address / mirror disk connect IP address

1. Use the clpstat command or the Cluster WebUI to verify all servers in the cluster are working normally.

2. Back up the cluster configuration data. Use the clpcfctrl command to back up the data.
   If you have the configuration data that contains the data at the cluster creation, use that configuration data.

3. In the config mode of Cluster WebUI, change the server IP address based on the back up cluster configuration data, and then save it.

4. Disable the startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster. For more information, see "Suspending EXPRESSCLUSTER Disabling the EXPRESSCLUSTER daemon" in Chapter 9, "Preparing to operate a cluster system" in the Installation and Configuration Guide.

5. By the clpstdn command or in the operation mode of Cluster WebUI, to shut down the cluster, and then restart all servers.

6. Change the IP address. If a server reboot is required after changing the IP address, run the reboot command or use other means on the server where the IP address has changed.

7. Verify the changed IP address is valid by running the ping command or using other means.

8. Distribute the cluster configuration data to all the servers. Use the clpcfctrl command to deliver the data.

9. Enable the startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster.

10. Run the reboot command or use other means on all servers in the cluster to reboot them.

11. Use the clpstat command or the Cluster WebUI to verify all servers in the cluster are working normally.

Changing only the subnet mask of the interconnect IP address

1. Use the clpstat command or the Cluster WebUI to verify all servers in the cluster are working normally.

2. Back up the cluster configuration data. Use the clpcfctrl command to back up the data.
   If you have the configuration data that contains the data at the cluster creation, use that configuration data.

3. In the config mode of Cluster WebUI, change the server IP address based on the back up cluster configuration data, and then save it.

4. Disable startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster.

5. By the clpstdn command or in the operation mode of Cluster WebUI, to shut down the cluster, and then restart all servers.

6. Change the subnet mask of the IP address. If server reboot is required after changing the subnet mask of IP address, run the reboot command or use other means on the server where the subnet mask of the IP address has been changed.

7. Verify the changed IP address is valid by running the ping command or using other means.

8. Distribute the cluster configuration data to all servers. Use the clpcfctrl command to deliver the data.

9. Enable the startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster.

10. Run the reboot command or use other means on all the servers in the cluster.

11. Use the clpstat command or the Cluster WebUI to verify all the servers in the cluster are working normally.

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.

Changing the host name

1. Use the clpstat command or the Cluster WebUI to verify all the servers in the cluster are working normally.

2. Back up the cluster configuration data. Use the clpcfctrl command to back up the data.
   If you have the configuration data that contains the data at the cluster creation, use that configuration data

3. In the config mode of Cluster WebUI, change the host name of your target server based on the back up cluster configuration data, and then save it.

4. Disable the startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster. For more information, see "Suspending EXPRESSCLUSTER Disabling the EXPRESSCLUSTER daemon" in Chapter 9, "Preparing to operate a cluster system" in the *Installation and Configuration Guide*.

5. By the clpstdn command or in the operation mode of Cluster WebUI, to shut down the cluster, and then restart all servers.

6. Change the host name. If the server needs to be rebooted after changing the host name, run the reboot command or use other means on the server.

7. Verify the changed host name is valid by running the ping command or using other means.

8. Distribute the cluster configuration data to all the servers. Use the clpcfctrl command to deliver the data.

9. Enable the startup settings of the EXPRESSCLUSTER daemon in all servers in the cluster.

10. Run the reboot command or use other means on all the servers in the cluster to reboot them.

11. Use the clpstat command or the Cluster WebUI to verify all the servers in the cluster are in the normal status.

Related Information:
For information on troubleshooting clpcfctrl problems, see "Changing, backing up, and checking cluster configuration data (clpcfctrl command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.
For details on how to stop and start daemons, see "Suspending EXPRESSCLUSTER" in Chapter 9, "Preparing to operate a cluster system" in the *Installation and Configuration Guide*.

How to add a resource without stopping the group

You can add, to a group that is already running, a resource that supports dynamic resource addition without stopping the group.

Group resources that currently support dynamic resource addition are as follows:

Group resource name	Abbreviation	Supported version
Exec resource	exec	4.0.0-1~
Disk resource	disk	4.0.0-1~
Floating IP resource	fip	4.0.0-1~
Virtual IP resource	vip	4.0.0-1~
Volume manager resource	volmgr	4.0.0-1~

Related information:

If all the resources in the group to which the resource to add will belong have been started normally, the resource to add will also be started.
If at least one of the resources in the group to which the resource to add will belong is in the activation or deactivation error state, the dynamic resource addition function will be disabled and group stoppage will be requested. If the group is in the stopped state, the resource will be added and placed in the stopped state.

Perform the following procedure to dynamically add a resource after starting the operation.

How to dynamically add a resource

1. Confirm that all servers in the cluster are operating normally by running the [clpstat] command or using the Cluster WebUI.

2. Confirm that all resources in the group to which a resource is added are started normally by running the [clpstat] command or using the Cluster WebUI.

3. Use the config mode of Cluster WebUI to add a resource to the group and save it.

4. Run the [clpcl --suspend] command or use the operation mode of Cluster WebUI to suspend the cluster.

5. Distribute the cluster configuration data to all the servers. Run the [clpcfctrl] command to deliver the data. Run the following command to dynamically add a resource.

   Do either of the following depending on the type of configuration data saved in the config mode of Cluster WebUI.

   - To deliver the configuration information saved on a file system on Linux by using Cluster WebUI, execute the command below.

     ```
     clpcfctrl --dpush -l -x <path of configuration data file>
     ```

   - If the Cluster WebUI is used on Window to save a configuration information file, execute the command below.

     ```
     clpcfctrl --dpush -w -x <path of configuration data file>
     ```

6. Run the [clpcl --resume] command or use the operation mode of Cluster WebUI to resume the cluster.

7. Confirm that the resource has been added by running the [clpstat] command or using the Cluster WebUI.

Related Information:

For information on troubleshooting [clpcfctrl] problems, see "Creating a cluster and backing up configuration data (clpcfctrl command)" in Chapter 7, "EXPRESSCLUSTER command reference" in the *Reference Guide*.

Appendix A   Index