EXPRESSCLUSTER X 6.0 for Linux
Maintenance Guide

Release 3

NEC Corporation

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CHAPTER

ONE

PREFACE

1.1 Who Should Use This Guide

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

1.2 How This Guide is Organized

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

1.3 EXPRESSCLUSTER X Documentation Set

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

EXPRESSCLUSTER X Getting Started Guide

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

EXPRESSCLUSTER X 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.

EXPRESSCLUSTER X 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.

EXPRESSCLUSTER X Maintenance Guide

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

EXPRESSCLUSTER X 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.

1.4 Conventions

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

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

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

See also:

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

The following conventions are used in this guide.

Convention	Usage	Example
Bold	Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.	In **User Name**, type your name. On the **File** menu, click **Open Database**.
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	clpstat -s[-h host_name]
#	Prompt to indicate that a Linux user has logged on as root user.	# clpcl -s -a
Monospace	Indicates path names, commands, system output (message, prompt, etc.), directory, file names, functions and parameters.	`/Linux/6.0/en/server/`
bold	Indicates the value that a user actually enters from a command line.	Enter the following: # clpcl -s -a
italic	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`

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

This document uses KB, MB, GB, and TB as units of data size. Each unit represents 1,024 times the size of the next smaller unit (e.g., 1 KB = 1,024 bytes; 1 MB = 1,024 KB; 1 GB = 1,024 MB).

1.5 Contacting NEC

For the latest product information, visit our website below:

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

CHAPTER

TWO

THE SYSTEM MAINTENANCE INFORMATION

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

This chapter covers:

- 2.1. *Directory structure of EXPRESSCLUSTER*
- 2.2. *How to delete EXPRESSCLUSTER logs or alerts*
- 2.3. *Mirror statistics information collection function*
- 2.4. *System resource statistics information collection function*
- 2.5. *Process resource statistics information collection function*
- 2.6. *Cluster statistics information collection function*
- 2.7. *Function for outputting the operation log of Cluster WebUI*
- 2.8. *Function for outputting an API service operation log file*
- 2.9. *Function for exporting server-specific alert logs*
- 2.10. *Function for obtaining a log file for investigation*
- 2.11. *Communication ports*
- 2.12. *Cluster driver device information*
- 2.13. *What causes servers to shut down*
- 2.14. *Configuring the settings to temporarily prevent execution of failover*
- 2.15. *How to replace a mirror disk with a new one*
- 2.16. *How to replace a server with a new one ~For a shared disk~*
- 2.17. *How to replace a server with a new one ~For a mirror disk~*
- 2.18. *How to replace a server with a new one ~For a hybrid disk~*
- 2.19. *How to restore a virtual machine ~For a mirror disk~*
- 2.20. *How to back up a mirror/hybrid disk to its disk image*
- 2.21. *How to restore the mirror/hybrid disk from the disk image*
- 2.22. *How to back up a mirror disk with the business going on*
- 2.23. *How to restore a mirror disk from its backup created with the business going on*
- 2.24. *Wait time for synchronized cluster startup*
- 2.25. *Changing disk resources file system*

- 2.26. *Changing offset or size of a partition on mirror disk resource*
- 2.27. *Changing offset or size of a partition on hybrid disk resource*
- 2.28. *Changing the server configuration (add/delete)*
- 2.29. *Changing the server IP address*
- 2.30. *Changing the host name*
- 2.31. *How to add a resource without stopping the group*
- 2.32. *Updating data encryption key file of mirror/hybrid disk resources*

2.1 Directory structure of EXPRESSCLUSTER

Note: Executable files and script files that are not described in "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:

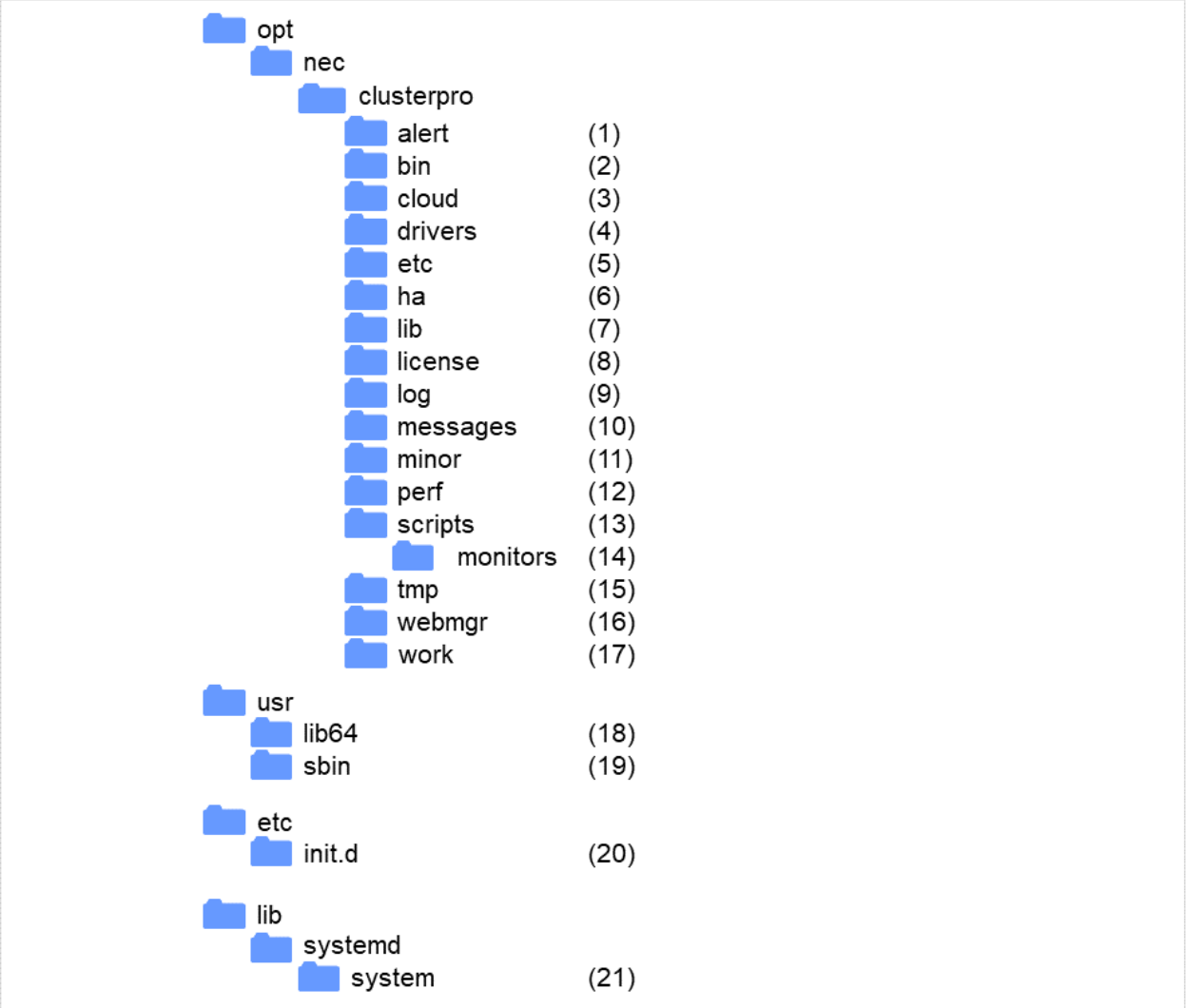

Fig. 2.1: Directory structure

1. Directory for alert synchronization
   This directory stores EXPRESSCLUSTER Alert Synchronization's modules and management files.
2. Directory for cluster modules
   This directory stores the EXPRESSCLUSTER Server's executable files.
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.

Note: The directories and files under /opt/nec/clusterpro do not have read, write, and execute permissions for group and other users.

2.2 How to delete EXPRESSCLUSTER logs or alerts

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

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

```
clpsvcctrl.sh --disable -a
```

2. Shut down the cluster with the Cluster WebUI or clpstdn command, and then reboot the cluster.
3. To delete logs, delete the files 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. Enable all cluster services on all servers in a cluster .

```
clpsvcctrl.sh --enable -a
```

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

2.3 Mirror statistics information collection function

2.3.1 Mirror statistics information

If the **Mirror Statistics** check box is already checked on the **Statistics** tab of **Cluster Properties** in the config mode of Cluster WebUI, statistics information on the mirror function is collected and saved to <*installation 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 16 MB, 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 "EXPRESSCLUSTER command reference" in the Reference Guide or the online manual.

Statistic value name	Unit Page 21, 1	Description	Output Page 21, 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)

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Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 1	Description	Output 2
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)
Sync Time, Max (Mirror communication time, maximum value)	Second/time	Time needed until the first piece of mirror synchronization data is synchronized.[#f3]_ 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)

continues on next page

Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 1	Description	Output 2
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.[Page 22, 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.[Page 22, 3] However, mirror synchronization data that results in an ACK timeout is excluded from the measurement.	LOG (A)

continues on next page

Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 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)

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Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 1	Description	Output 2
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)
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)

continues on next page

Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 1	Description	Output 2
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)

continues on next page

Table 2.2 – continued from previous page

Statistic value name	Unit Page 21, 1	Description	Output 2
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)
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 Waiting 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)

continues on next page

Table 2.2 – continued from previous page

Statistic value name	Unit [Page 21, 1]	Description	Output [2]
Recovery-Read Waiting Local-Write Time, Total2	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.	LOG
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)
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.

- If **Collect 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 "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

2.3.2 Mirror recovery performance information

During mirror recovery (including initial mirror construction), performance information of mirror recovery is recorded and saved in the *installation path*/perf/disk directory according to the following file naming rules. This file is referred to as the mirror recovery performance information file in the following description.

nmp-tx-recovery.cur nmp-tx-recovery.pre	
cur	Indicates the latest information output destination.
pre	Indicates the previous, rotated, information output destination.

The information recorded is saved to the mirror recovery performance information file. The file size is rotated at 1MB and two generations are saved. Information recorded to the mirror recovery performance information file can be used as a reference for analyzing the performance of mirror recovery. The information recorded in the mirror recovery performance information file contains the following items.

Note: The collected mirror recovery performance information is included in the logs collected by the clplogcc command or Cluster WebUI.

Specify type1,2,3,4,5 to collect the log by the clplogcc command; specify Pattern 1,2,3,4,5 to collect the log by the Cluster WebUI. For details about log collection, see "Collecting logs (clplogcc command)" in "EXPRESSCLUSTER command reference" in the Reference Guide or the online manual.

Item name	Description
Date	Time when the log was recorded. This is output in the form below (000 indicates millisecond): yyyy/mm/dd hh:mm:ss.000
RscName	Name of the mirror disk resource or hybrid disk resource.
LocalSvrName	Source server name of the mirror recovery data.
RemoteSvrName	Destination server name of the mirror recovery data.

continues on next page

(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".

Table 2.4 – continued from previous page

Item name	Description
CopyMode	Copy mode. Fast: Differential copy, UsedArea: Full copy(used area), Volume: Full copy(entire volume area).
Status	Result of mirror recovery. Success: Succeeded, Cancel: Canceled by user, Error: An error occurred.
StartTime	Transfer start time of the mirror recovery data. This is output in the form below (000 indicates millisecond): yyyy/mm/dd hh:mm:ss.000
EndTime	Transfer end time of the mirror recovery data. This is output in the form below (000 indicates millisecond): yyyy/mm/dd hh:mm:ss.000
Size	Transfer size of the mirror recovery data. (Unit: Bytes)
Time	Transfer time of the mirror recovery data. (Unit: s)
Speed	Transfer speed of the mirror recovery data. (Unit: Bytes/s)
RscType	Resource type. MD: Mirror disk resource, HD: Hybrid disk resource.
SyncMode	Setting value of synchronization mode. Sync: Synchronous mode, Async: Asynchronous mode.
RecoveryDataSize	Setting value of mirror recovery data size. (Unit: KB)
RecoveryIoSize	Setting value of mirror recovery I/O size. (Unit: KB)

The following shows an example output of the mirror recovery performance information file.

```
"Date","RscName","LocalSvrName","RemoteSvrName","CopyMode","Status","StartTime","EndTime
↪","Size(Bytes)","Time(s)","Speed(Bytes/s)","RscType","SyncMode","RecoveryDataSize(KB)",
↪"RecoveryIoSize(KB)"
"2026/01/16 15:56:39.734","md01","Server1","Server2","Fast","Success","2026/01/16␣
↪15:56:25.886","2026/01/16 15:56:39.728",49152,13.842,3550.957,"MD","Sync",32768,1024
```

2.4 System resource statistics information collection function

If the **System Resource Statistics** check box is already checked on the **Statistics** tab of **Cluster Properties** in the Cluster WebUI config mode or if system monitor resources or process resource monitor resources are already added to the cluster, information on the system resource is collected and saved under <*installation path*>/perf/system according to the following file naming rules.

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 16 MB, 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
MemoryCurrent-Size	Byte (KB)	Memory usage
MemoryBufSize	Byte (KB)	Buffer size
MemoryCached	Byte (KB)	Cache memory size
MemoryMemFree	Byte (KB)	Available memory capacity
MemoryDirty	Byte (KB)	Memory data waiting to be written on hard disk
MemoryActive(file)	Byte (KB)	Buffer or page cache memory
MemoryInac-tive(file)	Byte (KB)	Available buffer or available page cache memory
MemoryShmem	Byte (KB)	Shared memory size
SwapTotalSize	Byte (KB)	Available swap size

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Table 2.6 – continued from previous page

Statistic value name	Unit	Description
SwapCurrentSize	Byte (KB)	Currently used swap size
SwapIn	Times	Number of times of swap-in
SwapOut	Times	Number of times of swap-out
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
ProcessCurrent-Count	Quantity	Current total number of processings

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

- system.cur

```
"Date","CPUCount","CPUUtilization","CPUTotal","CPUUser","CPUNice","CPUSystem",
↪"CPUIdle","CPUIOWait","CPUIntr","CPUSoftIntr","CPUSteal","MemoryTotalSize",
↪"MemoryCurrentSize","MemoryBufSize","MemoryCached","MemoryMemFree","MemoryDirty",
↪"MemoryActive(file)","MemoryInactive(file)","MemoryShmem","SwapTotalSize",
↪"SwapCurrentSize","SwapIn","SwapOut","ThreadLimitSize","ThreadCurrentSize",
↪"FileLimitSize","FileCurrentSize","FileLimitinode","FileCurrentinode",
↪"ProcessCurrentCount"
"2019/10/31 15:44:50","2","0","34607369","106953","59","23568","34383133","89785","0
↪","3871","0","754236","231664","948","334736","186888","12","111320","167468",
↪"50688","839676","0","0","0","5725","183","71371","1696","22626","22219","121"
"2019/10/31 15:45:50","2","0","34619340","106987","59","23577","34395028","89816","0
↪","3873","0","754236","231884","948","334744","186660","12","111320","167476",
↪"50688","839676","0","0","0","5725","183","71371","1696","22867","22460","121"
"2019/10/31 15:46:50","2","0","34631314","107022","59","23586","34406925","89846","0
↪","3876","0","754236","231360","948","334764","187164","4","111348","167468",
↪"50688","839676","0","0","0","5725","183","71371","1696","22867","22460","121"
                                        :
```

2.5 Process resource statistics information collection function

If the **System Resource Statistics** check box is already checked on the **Statistics** tab of **Cluster Properties** in the Cluster WebUI config mode or if system monitor resources or process resource monitor resources are already added to the cluster, information on the process resource is collected and saved under <*installation path*>/perf/system according to the following file naming rules.

This file is in CSV-format. In the following explanations, this file is represented as the process resource statistics information file.

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

The collected information is saved to the process resource statistics information file. The time during which statistics information is output to this file (=sampling interval) is 60 seconds. .If the size of current log file reached 32 MB, it is rotated to new log file. And two generation log files can be saved. Information recorded to the process resource statistics information file can be used as a reference for analyzing the process performance.The collected statistics information contains the following items.

Statistic value name	Unit	Description
PID	-	Process ID
CPUUtilization	%	CPU utilization
MemoryPhysical-Size	Byte (KB)	Physical memory usage
MemoryVirtualSize	Byte (KB)	Virtual memory usage
ThreadCurrent-Count	Quantity	Number of running threads
FileCurrentCount	Quantity	Number of opening files
ProcessName	-	Process name * Outputted not in double quotes.

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

- process.cur

```
"Date","PID","CPUUtilization","MemoryPhysicalSize","MemoryVirtualSize",
↪"ThreadCurrentCount","FileCurrentCount","ProcessName"
"2022/09/05 17:08:41","620","0","26384","1132","1","21",/usr/lib/systemd/systemd-
↪logind
"2022/09/05 17:08:41","623","0","126384","1096","1","6",/usr/sbin/crond -n
"2022/09/05 17:08:41","1023","0","239924","2880","3","12",/usr/sbin/rsyslogd -n
                                        :
```

2.6 Cluster statistics information collection function

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

- For heartbeat resources

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

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

- For groups

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

- For group resources

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

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

- For monitor resources

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

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

Note: The cluster statistics information file is included in the logs collected by the clplogcc command or Cluster WebUI.

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

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

- For heartbeat resources
- Periodical output
- For groups[4]
- When the group startup processing is completed
- When the group stop processing is completed
- When the group move processing is completed[5]
- When the failover processing is completedPage 28, 5
- For group resources
- When the group resource startup processing is completed
- When the group resource stop processing is completed
- For monitor resources
- When the monitor processing is completed
- When the monitor status change processing is completed

The statistics information to be collected includes the following items:

- For heartbeat resources

[4] If a single unit of group resource was started or stopped, the group statistics information is not output.
[5] If a group was moved or failed over, the statistics information is output to the failover target server.

Statistic value name	Description
Date	Time when the statistics information is output. This is output in the form below (000 indicates millisecond): YYYY/MM/DD HH:MM:SS.000
Name	Name of a heartbeat resource.
Type	Type of the heartbeat resource.
Local	Host name of the local server.
Remote	Host name of the other server.
RecvCount	Heartbeat reception count during the log output interval.
RecvError	Error reception count during the log output interval.
RecvTime(Min)	Minimum interval (in milliseconds) of heartbeat reception during the log output interval.
RecvTime(Max)	Maximum interval (in milliseconds) of heartbeat reception during the log output interval.
RecvTime(Avg)	Average interval (in milliseconds) of heartbeat reception during the log output interval.
SendCount	Heartbeat transmission count during the log output interval.
SendError	Error transmission count during the log output interval.
SendTime(Min)	Minimum time (in milliseconds) for heartbeat transmission during the log output interval.
SendTime(Max)	Maximum time (in milliseconds) for heartbeat transmission during the log output interval.
SendTime(Avg)	Average time (in milliseconds) for heartbeat transmission during the log output interval.

- For others (except heartbeat resources)

Statistic value name	Description
Date	Time when the statistics information is output. This is output in the form below (000 indicates millisecond): 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 (at failover) For group resources: Start (at activation), Stop (at deactivation) For monitor resources: Monitor (at monitor execution)

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Table 2.14 – continued from previous page

Statistic value name	Description
Result	Name of the results of the executed processing. The following strings are output: When the processing was successful: Success (no errors detected in monitoring or activation/deactivation) When the processing failed: Failure (errors detected in monitoring or activation/deactivation) When a warning occurred: Warning (only for monitoring, in case of warning) When a timeout occurred: Timeout (monitoring timeout) When the processing was canceled: Cancel (canceling processings such as cluster shutdown during group startup)
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
EndTime	End time of the executed processing. This is output in the form below (000 indicates millisecond): YYYY/MM/DD HH:MM:SS.000
ResponseTime(ms)	Time taken for executing the processing (in millisecond). This is output in millisecond.

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

- Server - Host name: server1, server2
- Heartbeat resource
  - Kernel mode LAN heartbeat resource
    Resource name: lankhb1, lankhb2
- Group
  - Group name: failoverA
- Group resource which belongs to the group (failoverA)
  - EXEC resource
    Resource name: exec01, exec02, exec03
- lankhb.cur

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

- group.cur

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

- exec.cur

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

2.6.1 Notes on the size of the cluster statistics information file

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

The size of the cluster statistics information file =

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

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

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

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

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

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

2.7 Function for outputting the operation log of Cluster WebUI

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

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

The operation information to be outputted includes the following items:

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

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Table 2.16 – continued from previous page

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

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

```
"Date","Operation","Request","IP","UserName","HTTP-Status","ErrorCode",
↪"ResponseTime(ms)","ServerName","GroupName","ResourceName","ResourceType",
↪"Parameters..."
"2020/08/14 17:08:39.902","Cluster properties","/GetClusterproInfo.js","10.0.0.
↪15","user1",200,0,141,,,,
"2020/08/14 17:08:46.659","Monitor properties","/GetMonitorResourceProperty.js
↪","10.0.0.15","user1",200,0,47,,,"fipw1","fipw"
"2020/08/14 17:15:31.093","Resource properties","/GetGroupResourceProperty.js",
↪"10.0.0.15","user1",200,0,47,,"failoverA","fip1","fip"
"2020/08/14 17:15:45.309","Start group","/GroupStart.js","10.0.0.15","user1",
↪200,0,0,"server1","failoverA",,
"2020/08/14 17:16:23.862","Suspend all monitors","/AllMonitorSuspend.js","10.0.
↪0.15","user1",200,0,453,"server1",,,,"server2"
                                                    :
```

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

- When the cluster password method is used

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

- When the OS authentication method is used

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

2.8 Function for outputting an API service operation log file

With the **Output API Service Operation Log** checkbox checked in the **API** tab of **Cluster Properties** in the config mode of Cluster WebUI, a log file is outputted containing information handled by the RESTful API. This CSV-format file is hereinafter called an API service operation log file.

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

The operation information to be outputted includes the following items:

Item name	Description
Date	Time when the operation information is outputted. This is outputted in the form below (000 in milliseconds): YYYY/MM/DD HH:MM:SS.000
Method	Either of the following HTTP request methods: GET or POST.
Request	Issued request-URI.
IP	IP address of the client which issued the request.
UserName	Name of a user who executed the operation.
HTTP-Status	HTTP status code. 200: Success Other than 200: Failure
ErrorCode	Return value of the executed operation.
ResponseTime(ms)	Time taken for executing the operation (in milliseconds). This is outputted in milliseconds.

Here is an example of the contents of an outputted API service operation log file:

```
"Date","Method","Request","IP","UserName","HTTP-Status","ErrorCode",
↪"ResponseTime(ms)"
"2023/05/28 16:34:08.007","GET","https://10.0.0.1:29009/api/v1/cluster","10.0.
```

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```
↪0.15","user1",200,0,84
"2023/05/28 16:34:08.007","GET","https://10.0.0.1:29009/api/v1/servers/servers?
↪select=name","10.0.0.15","user1",200,0,84
"2023/05/28 16:35:03.283","POST","https://10.0.0.1:29009/api/v1/cluster/start",
↪"10.0.0.15","user1",200,0,142
"2023/05/28 16:35:03.283","POST","https://10.0.0.1:29009/api/v1/groups/
↪failoverA/start -d '{ "target" : "server1" }'","10.0.0.15","user1",200,0,142
"2023/05/28 16:35:03.283","POST","https://10.0.0.1:29009/api/v1/resources/fip1/
↪start -d '{ "target" : "server1" }'","10.0.0.15","user1",200,0,142
"2023/05/28 16:35:03.283","POST","https://10.0.0.1:29009/api/v1/monitors/fipw1/
↪suspend -d '{ "target" : "server1" }'","10.0.0.15","root",200,0,142
                                                        :
```

2.9 Function for exporting server-specific alert logs

By selecting the **Enable Alert Service** checkbox (go to the config mode of Cluster WebUI -> **Cluster Properties** -> **Alert Log** tab), you can export a text file (in CSV format) of server-specific alert logs. This file will be hereinafter called a "file of server-specific alert logs".

alttrace.csv	
Timing of export	* When the clpalttrace command is executed * When the log collection function is performed
Storage destination	* <Installation path>/log/ * A directory specified with the -o option for the clpalttrace command

A file of server-specific alert logs contains the latest alert logs at the time of export as above. For more information on the clpalttrace command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Exporting a file of server-specific alert logs (clpalttrace command)".

Note:

You can obtain a file of server-specific alert logs when collecting logs with the clplogcc command or Cluster WebUI. When collecting logs with the clplogcc command and Cluster WebUI, specify the type that includes the default collection information (e.g., type1). For more information on log collection, see the online manual or "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Collecting logs (clplogcc command)".

Exported data is as follows:

Item	Description
Type	Any of the following log types: Error (abnormal) Warning Information
Time	The date and time when the log was created. With time correction[6], the date and time is a corrected value. Without time correction, the date and time is the same value as RawTime. The output format of the value is as follows (000 in milliseconds): YYYY/MM/DD HH:MM:SS.000

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Table 2.20 – continued from previous page

Item	Description
RawTime	The date and time when the log was created. The date and time is original (without correction). The output format of the value is as follows (000 in milliseconds): YYYY/MM/DD HH:MM:SS.000
ModuleName	The name of the module by which the log was created.
EventID	The event ID of the log.
Message:<server name>	A message of the log. This item is outputted for each server.

Note:

You can change the log settings for a file of server-specific alert logs in the config mode of Cluster WebUI: Go to **Cluster Properties** -> **Alert Service** tab (for alert setting).

For log details and logs outputted by default, see "Reference Guide" -> "Messages reported by syslog, alert, userlog, mail, SNMP trap, and Message Topic".

The following shows an example of a file of server-specific alert logs, for a two-node cluster to which server1 and server2 belong:

```
"Type","Time","RawTime","ModuleName","EventID","Message:server1",
↪"Message:server2"
"Information","2024/12/23 21:08:25.472","2024/12/23 21:08:25.472","nm","6",,
↪"All servers have started."
"Information","2024/12/23 21:08:25.477","2024/12/23 21:08:25.477","nm","6",
↪"All servers have started.",
"Information","2024/12/23 21:08:29.773","2024/12/23 21:08:29.773","rm","1",
↪"Monitoring userw has started.",
"Information","2024/12/23 21:08:29.784","2024/12/23 21:08:29.784","rm","1",,
↪"Monitoring userw has started."
"Information","2024/12/23 21:08:29.785","2024/12/23 21:08:29.785","rm","1",
↪"Monitoring genw2 has started.",
"Information","2024/12/23 21:08:29.795","2024/12/23 21:08:29.795","rm","1",
↪"Monitoring genw4 has started.",
"Information","2024/12/23 21:08:29.799","2024/12/23 21:08:29.799","rm","1",,
↪"Monitoring genw2 has started."
"Information","2024/12/23 21:08:29.809","2024/12/23 21:08:29.809","rm","1",,
↪"Monitoring genw4 has started."
"Information","2024/12/23 21:08:30.542","2024/12/23 21:08:30.542","rc","10",
↪"Activating group failover1 has started.",
"Information","2024/12/23 21:08:31.640","2024/12/23 21:08:31.640","rm","1",
↪"Monitoring genw1 has started.",
```

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[6] For more information on time correction, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Exporting a file of server-specific alert logs (clpalttrace command)".

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```
"Information","2024/12/23 21:08:31.654","2024/12/23 21:08:31.654","rm","1",
↪"Monitoring genw3 has started.",
"Information","2024/12/23 21:08:31.672","2024/12/23 21:08:31.672","rm","1",
↪"Monitoring genw5 has started.",
"Information","2024/12/23 21:08:31.780","2024/12/23 21:08:31.780","rc","11",
↪"Activating group failover1 has completed.",
                                                    :
```

- In this file of server-specific alert logs, the data is sorted in ascending order of Time (default).

2.10 Function for obtaining a log file for investigation

If an activation/deactivation failure occurred in a group/monitor resource or a forced-stop resource failed in a forced stop, such information is collected and saved as a compressed file to the following directory: <installation path>/log/ecap. The format of the file name is <date and time when the event occurred>_<module name>_<event ID>.tar.gz.

You can obtain this log file through Cluster WebUI. To do so, in the config mode of Cluster WebUI, go to **Cluster Properties** -> the **Alert Log** tab, then check the **Enable a log file for investigation to be downloaded**.

The compressed file contains the output of an executed command shared by resource types, that of one specific to a resource type, and the results of executing external commands during resource operations.

- Output of an executed command shared by resource types
  - The output is stored as a text file in the **common** folder.
  - The information obtained with this command is the same as that described in "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Collecting logs (clplogcc command)" -> "Collecting information when a failure occurs" -> "OS information (/proc/*)" and "Information created by running a command".
- Output of an executed command specific to a resource type
  - The output is stored as a text file in Markdown format: <resource type>.ecap.md.
  - This is outputted by executing the following command specific to a resource type (even if this command does not exist, the command shared by resource types is run):

Resource type	Command name	Necessary package
Floating IP resource	ip n	iproute
	ping -w 3 <the IP address>	iputils
Dynamic DNS resource	nslookup -timeout=3 <the virtual host name>	bind-utils
	dig any +time=3 <the virtual host name>	bind-utils
NIC Link Up/Down monitor resource	ethtool <the name of the NIC interface>	ethtool
Floating IP monitor resource	ip n	iproute
	ping -w 3 <the IP address>	iputils
Dynamic DNS monitor resource	nslookup -timeout=3 <the virtual host name>	bind-utils
	dig any +time=3 <the virtual host name>	bind-utils

- Results of executing external commands during resource operations
  - The output is stored as text files in the folder named for the resource.
  - For a forced stop, the resource name is in this format: forcestop-<executed mode>. The mode is either of the following:

    - 1: Forced-stop action
    - 2: Stop check
  - The names and number of the files vary depending on the resource.
  - For resources that do not use external commands, no execution results are output.

Note: The log file for investigation may not be appropriately obtained, if the same event and the same module occurred more than once at the same period of time.

2.11 Communication ports

Refer to "Getting Started Guide" > "Notes and Restrictions" > "Communication port number" for port numbers used for EXPRESSCLUSTER.

2.12 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 253 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 254 as the minor number. Make sure that no other driver uses these major and minor numbers.

2.13 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.

2.13.1 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.

2.13.2 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.

continues on next page

Table 2.23 – continued from previous page

Action performed when a stall occurs	Result
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.

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.

2.13.3 Final action at detection of an error in monitor resource

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

Final action	Result
Stop cluster service and shut down the OS	Causes 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.

2.13.4 Forced stop action

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

Forced stop action	Result
BMC reset	Causes reset in the failing server 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.

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

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

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

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

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

Forced stop action	Result
stop and deallocate	Stops the instance of the failing server where the failover group existed.[7]
stop only	Stops the instance of the failing server where the failover group existed.[8]
reboot	Reboots the instance of the failing server where the failover group existed.

[7] Stops the instance through the shutdown sequence. Since allocated resources (e.g., public IP address) are also released, no charging occurs.
[8] Stops the instance not through the shutdown sequence. Since allocated resources are maintained, the charging continues.

2.13.5 Emergency server shutdown, emergency server reboot

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

- clprc
- clprm

2.13.6 Group resource deactivation error in stopping the EXPRESSCLUSTER daemon

If there is a failure to deactivate group resources during the EXPRESSCLUSTER daemon stop process, the action set in [Action When the Cluster Service Process Is Failure] is executed.

2.13.7 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.

2.13.8 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.

2.13.9 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 "Troubleshooting" in the "Reference Guide".

2.13.10 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 "Network partition resolution resources details" in the "Reference Guide".

2.13.11 Mirror disk error ~For Replicator~

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

2.13.12 Hybrid disk error ~For Replicator DR~

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

2.13.13 Failure in suspending or resuming the cluster

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

2.14 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 "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 "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 "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 "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

- Disabling recovery action for a monitor resource error

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

- Not disabling recovery action for a monitor resource error

  Enable recovery action for a monitor resource error. Uncheck the **Recovery action when a monitor resource error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in config mode of Cluster WebUI and update the setting.

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

- Disabling recovery action for a group resource activation error

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

- Not disabling recovery action for a group resource activation error

  Enable recovery action for a group resource activation error. Uncheck the **Recovery operation when a group resource activation error is detected** checkbox in **Disable cluster operation** under the **Extension** tab of **Cluster properties** in config mode of Cluster WebUI and update the setting.

2.15 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:

See also:

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

2.15.1 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 target server, execute the following command to disable the daemon.

   ```
   clpsvcctrl.sh --disable core mgr
   ```

   - 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 (Required for Replicator DR)", "Partition settings for Hybrid disk resource (Required for the Replicator DR)", and "Partition settings for Mirror disk resource (when using Replicator)") in "Settings after configuring hardware" in "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 target server, execute the following command to enable the daemon.

```
clpsvcctrl.sh --enable core mgr
```

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.

2.15.2 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 target server, execute the following command to disable the daemon.

     ```
     clpsvcctrl.sh --disable core mgr
     ```

   - 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 target server, execute the following command to enable the daemon.

  ```
  clpsvcctrl.sh --enable core mgr
  ```

---

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.

2.15.3 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 target server, execute the following command to disable the daemon.

     ```
     clpsvcctrl.sh --disable core mgr
     ```

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 hybrid 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 (Required for Replicator DR)", "Partition settings for Hybrid disk resource (Required for the Replicator DR)", and "Partition settings for Mirror disk resource (when using Replicator)") in "Settings after configuring hardware" in "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 target server, execute the following command to enable the daemon.

```
clpsvcctrl.sh --enable core mgr
```

---

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.

2.16 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 "Setting up the EXPRESSCLUSTER Server" in "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.

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

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

3. Restart the replaced server.

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

2.17.1 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.

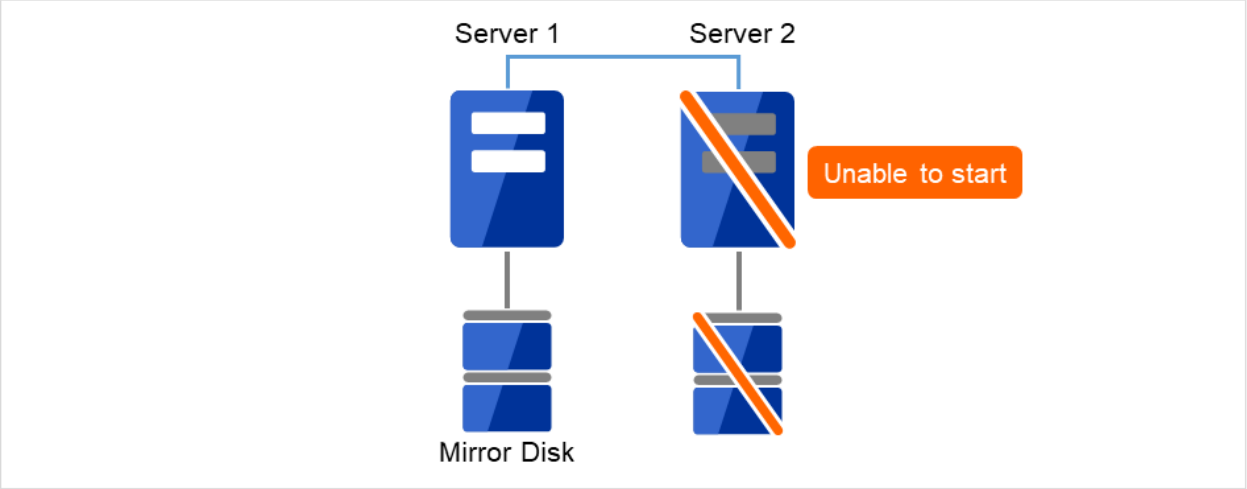

Fig. 2.2: Not able to start Server 2 or use its disk

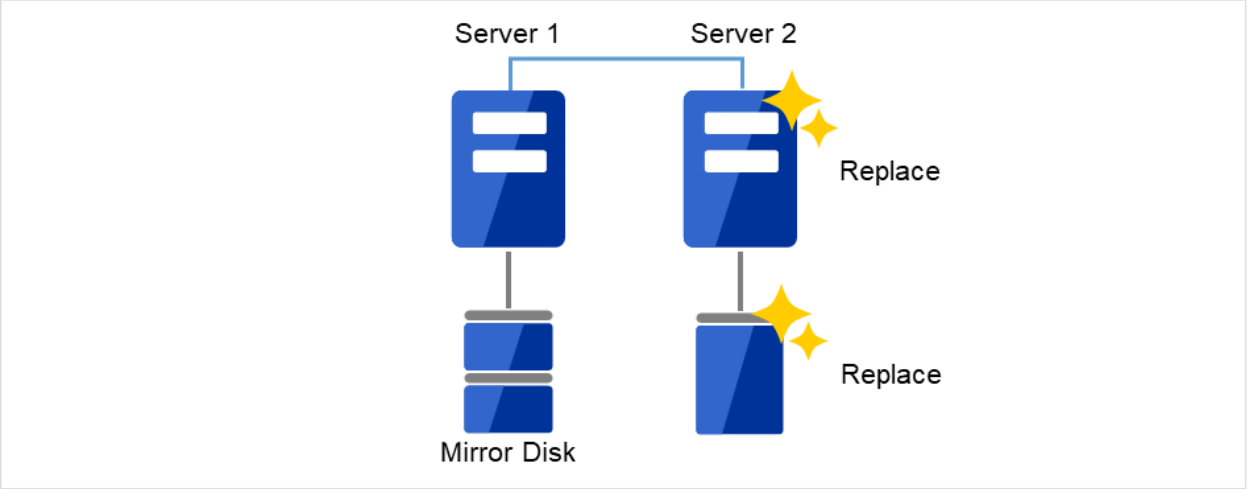

Fig. 2.3: Replacing Server 2 and its disk with a new server and a new disk

2. Create partitions in the new disk by executing the fdisk command.
   Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "Installing EXPRESSCLUSTER" in the "Installation and Configuration Guide". The server on which you installed the EXPRESSCLUSTER Server should be restarted after the installation.

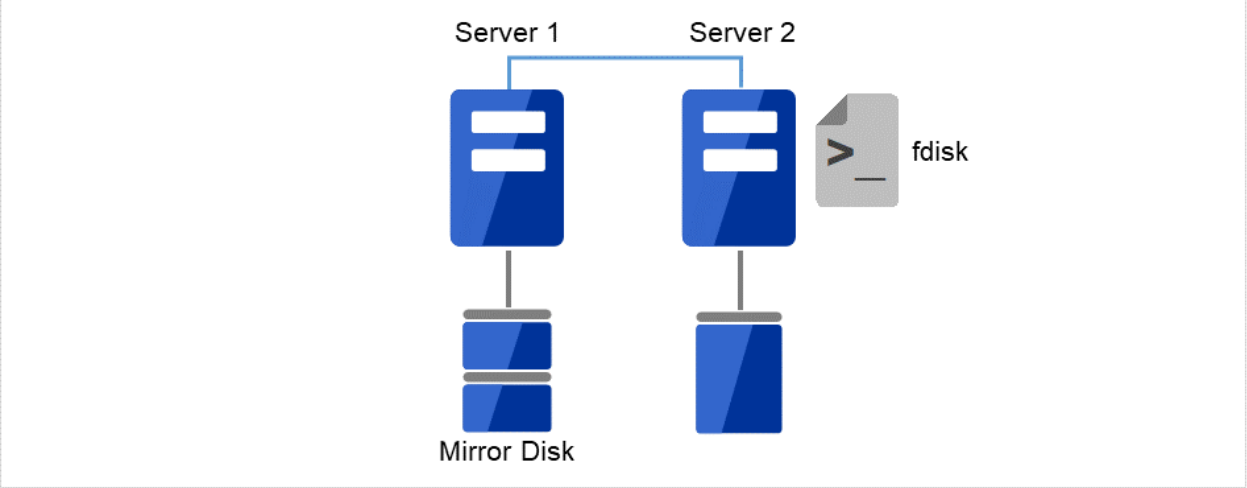

Fig. 2.4: Creating partitions in the new disk

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

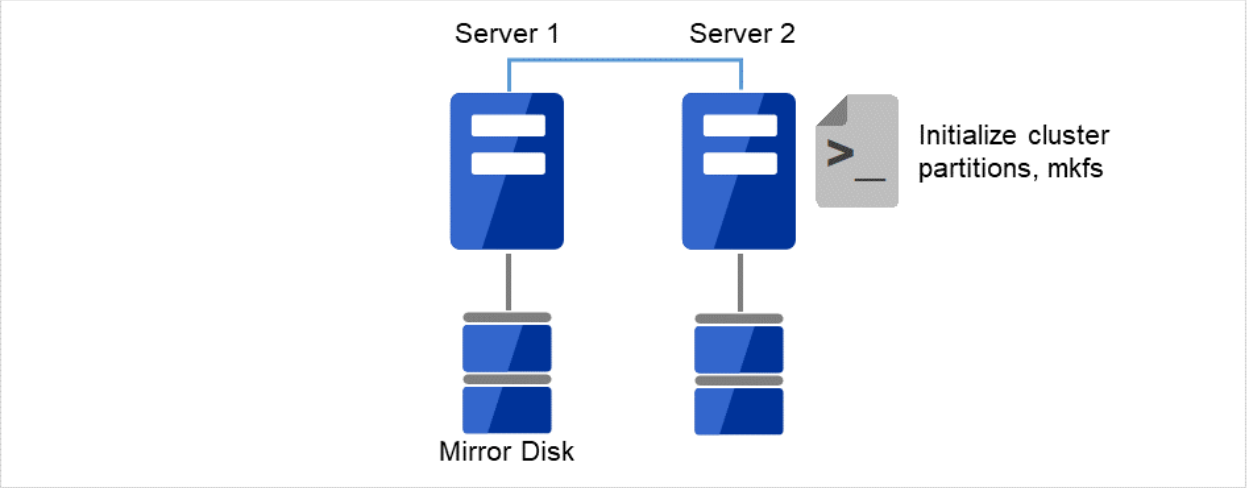

Fig. 2.5: Partitioning the new disk

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.

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

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

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 Cluster WebUI" of "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 "Displaying the mirror status (clpmdstat command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

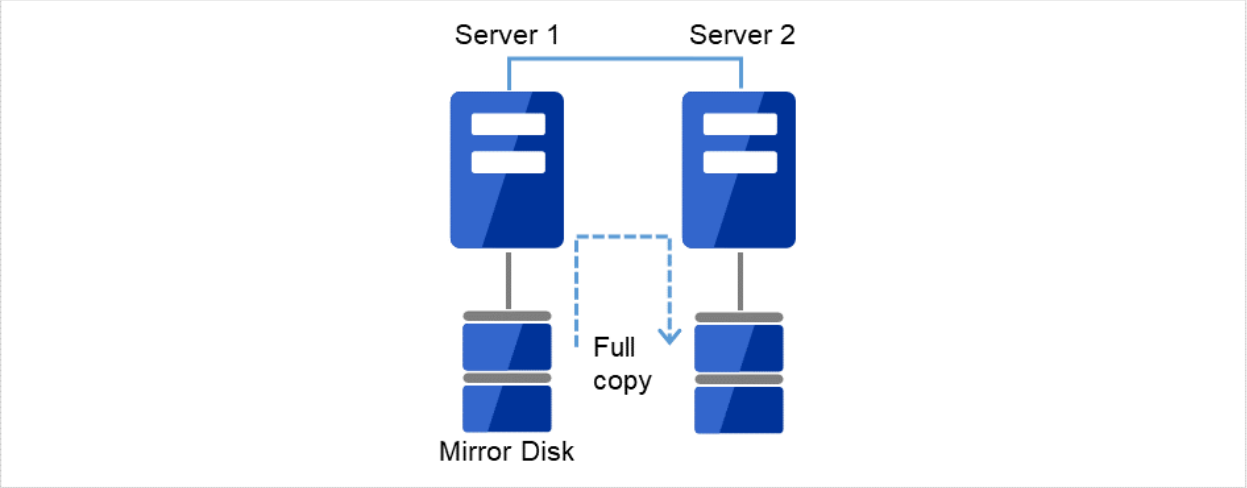

Fig. 2.6: Starting mirror recovery on Server 1 (full copy)

2.17.2 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.

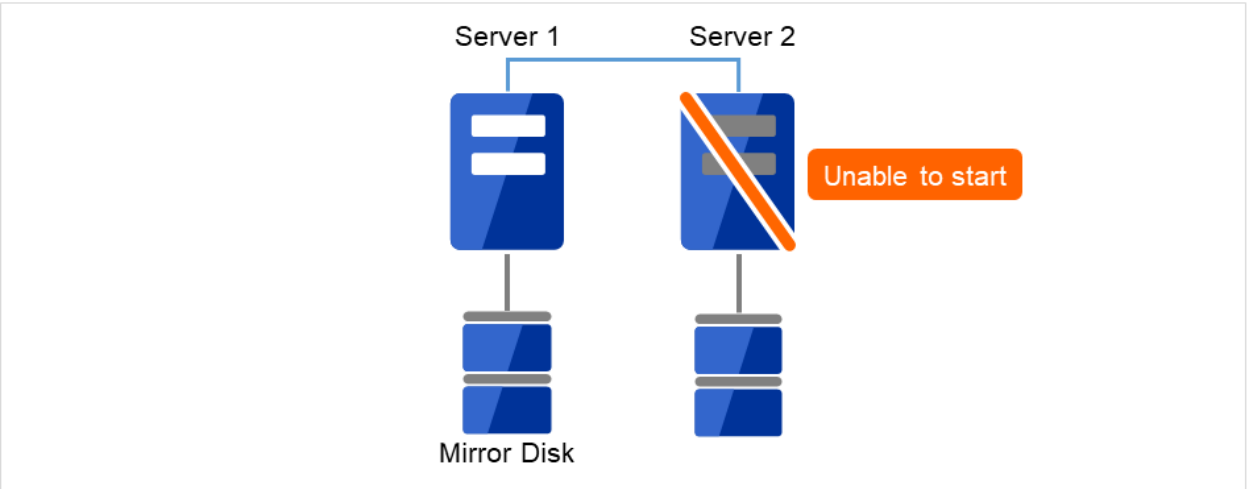

Fig. 2.7: Not able to start Server 2

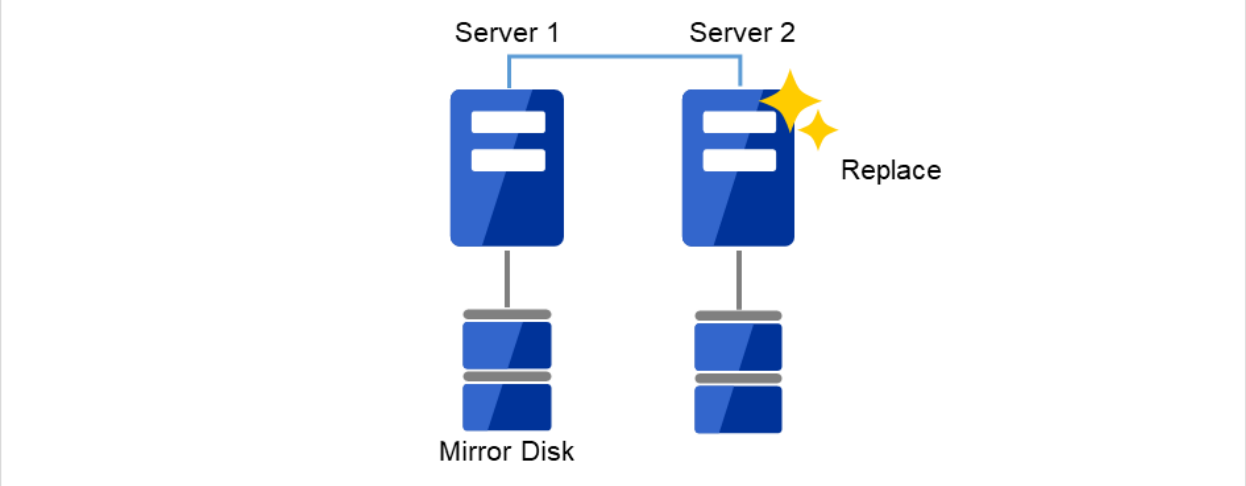

Fig. 2.8: Replacing Server 2 with a new one

Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "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.

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

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

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 Cluster WebUI" of "Troubleshooting" in "Reference Guide".

   Confirm that mirroring is successfully recovered by using the Cluster WebUI or by running the following command. For details, see "Displaying the mirror status (clpmdstat command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

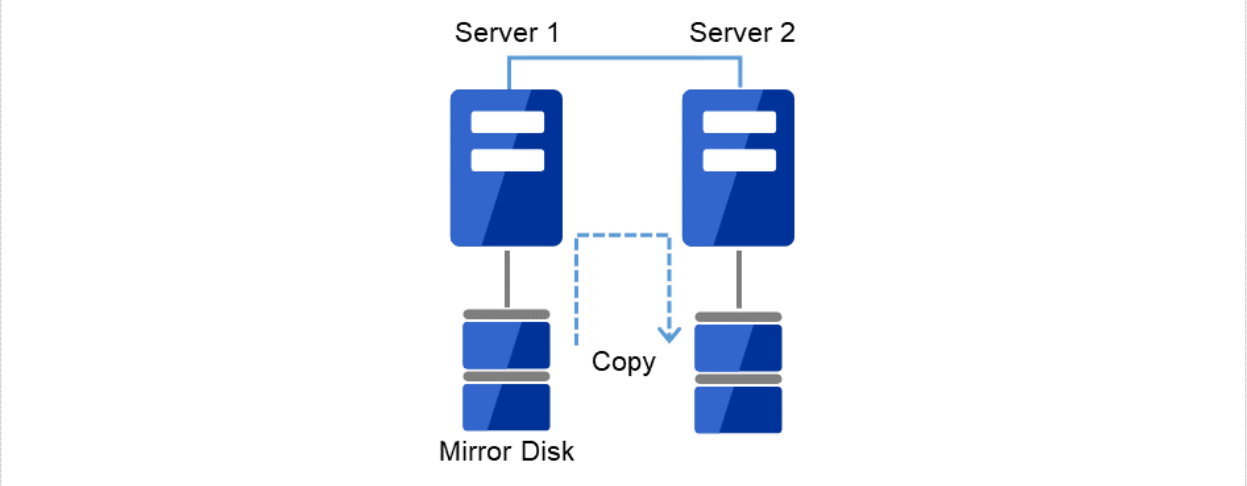

Fig. 2.9: Starting mirror recovery on Server 1 (differential copy)

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

2.18.1 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.

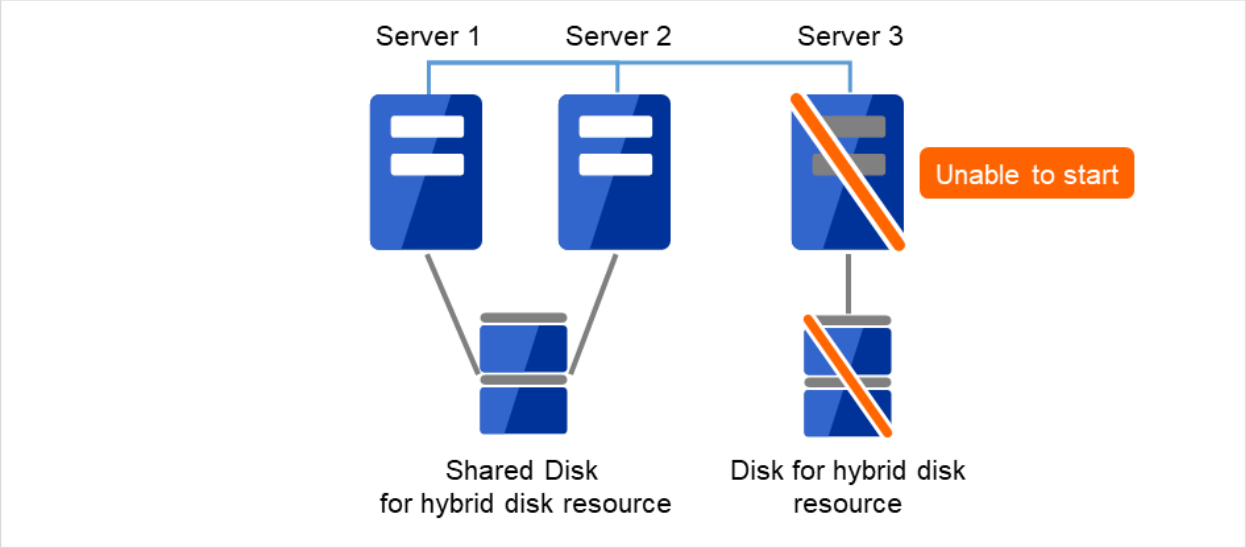

Fig. 2.10: Not able to start Server 3 or use its disk

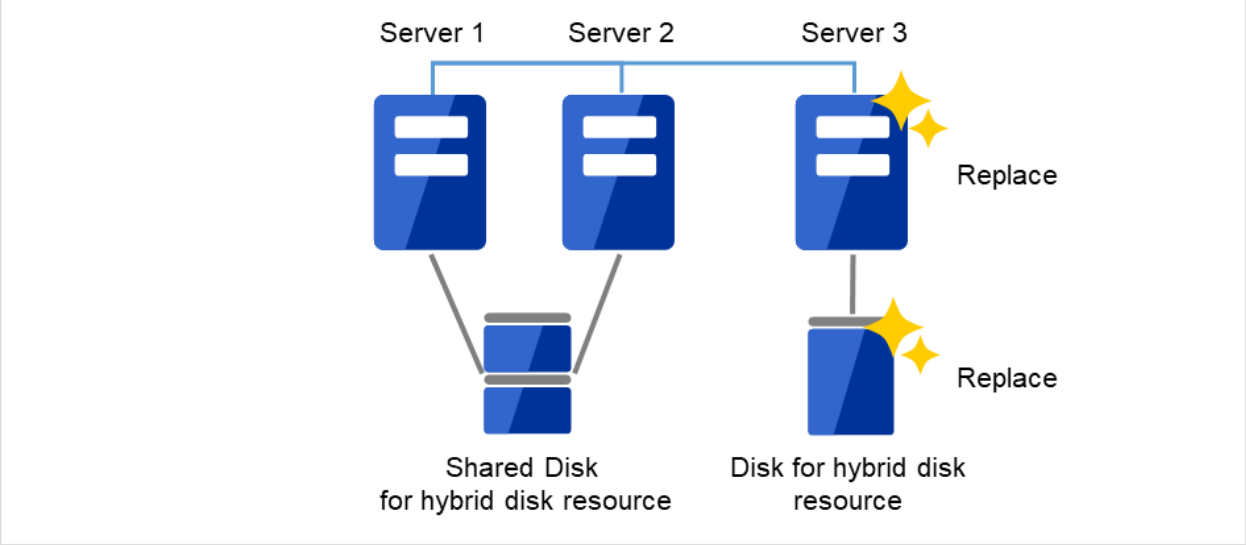

Fig. 2.11: Replacing Server 3 and its disk with a new server and a new disk

2. Create partitions in the new disk by executing the fdisk command.

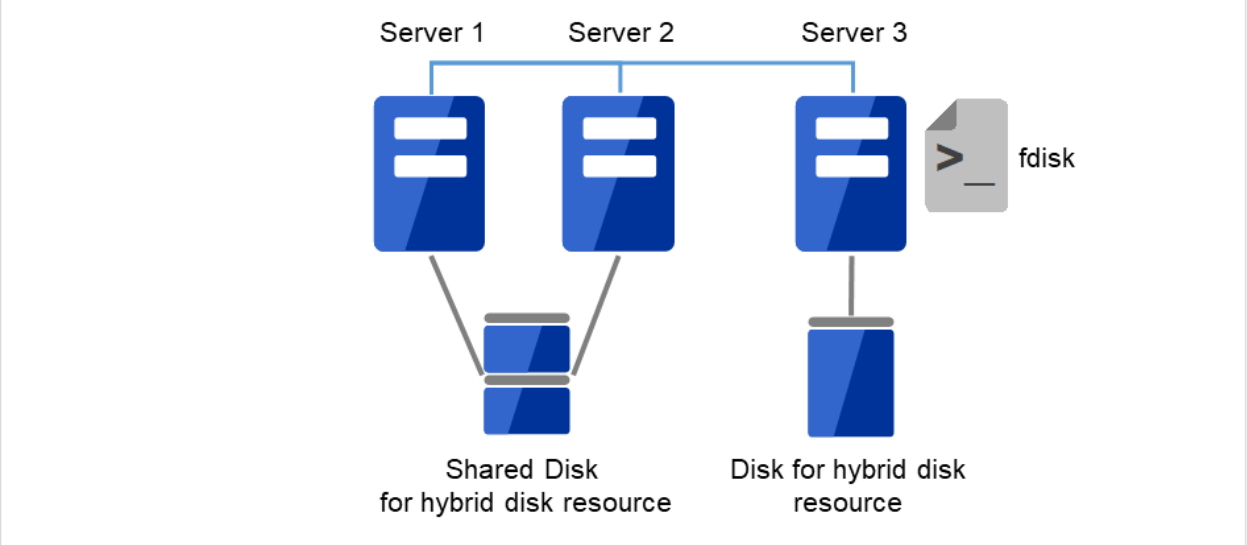

Fig. 2.12: Creating partitions in a new disk of Server 3

3. Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "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.

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

   ```
   clplcnsc --reregister <a folder path for saved license files>
   ```
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 Cluster WebUI" of "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 "Displaying the hybrid disk status (clphdstat command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

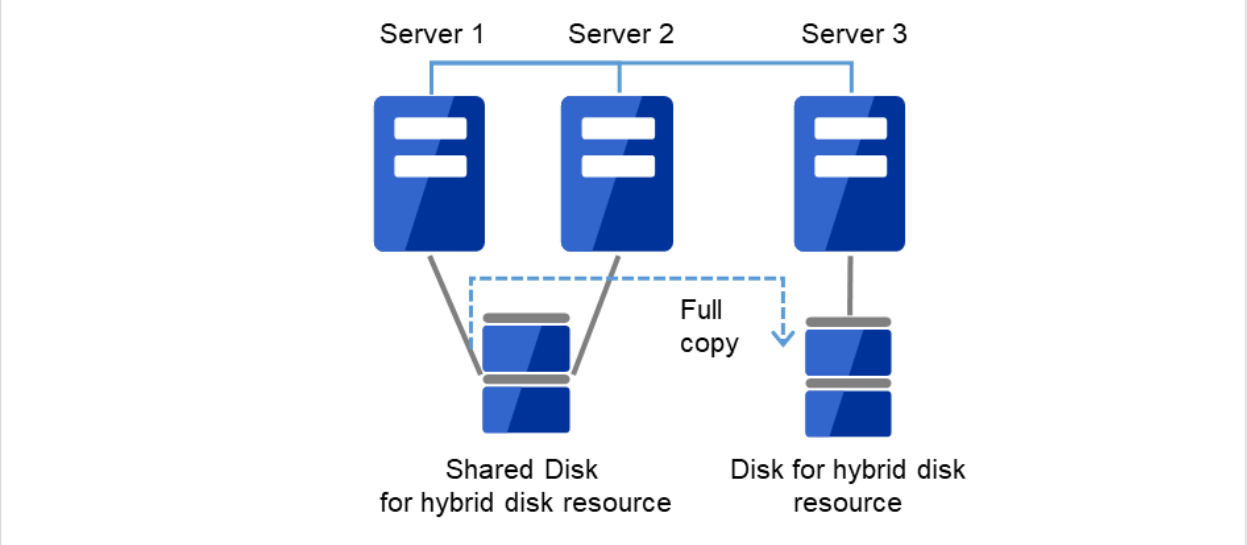

Fig. 2.13: Starting mirror recovery on Server 1 (full copy)

2.18.2 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. Set the EXPRESSCLUSTER service not to start on the failed server and the other server connecting to the same shared disk.

```
clpsvcctrl.sh --disable core
```

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.

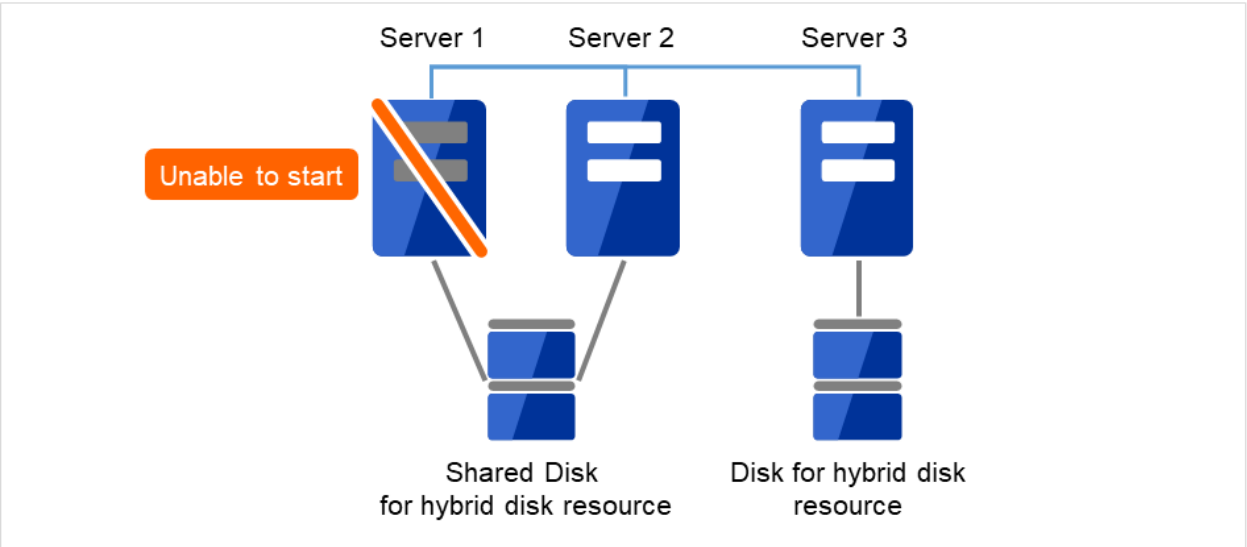

Fig. 2.14: Not able to start Server 1 or use the shared disk

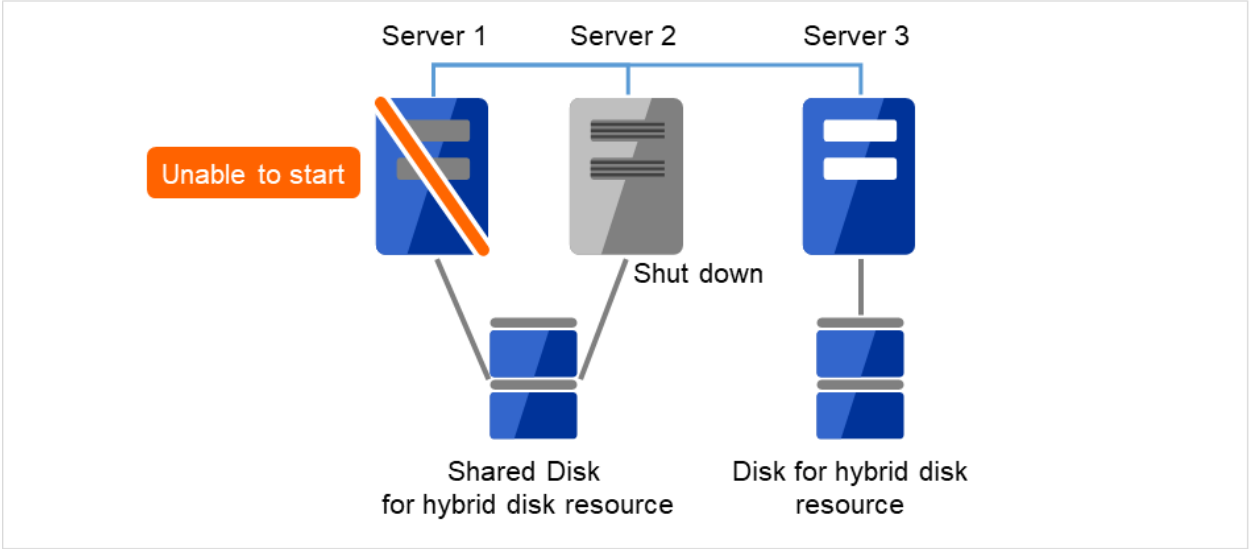

Fig. 2.15: Shutting down Server 2

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.

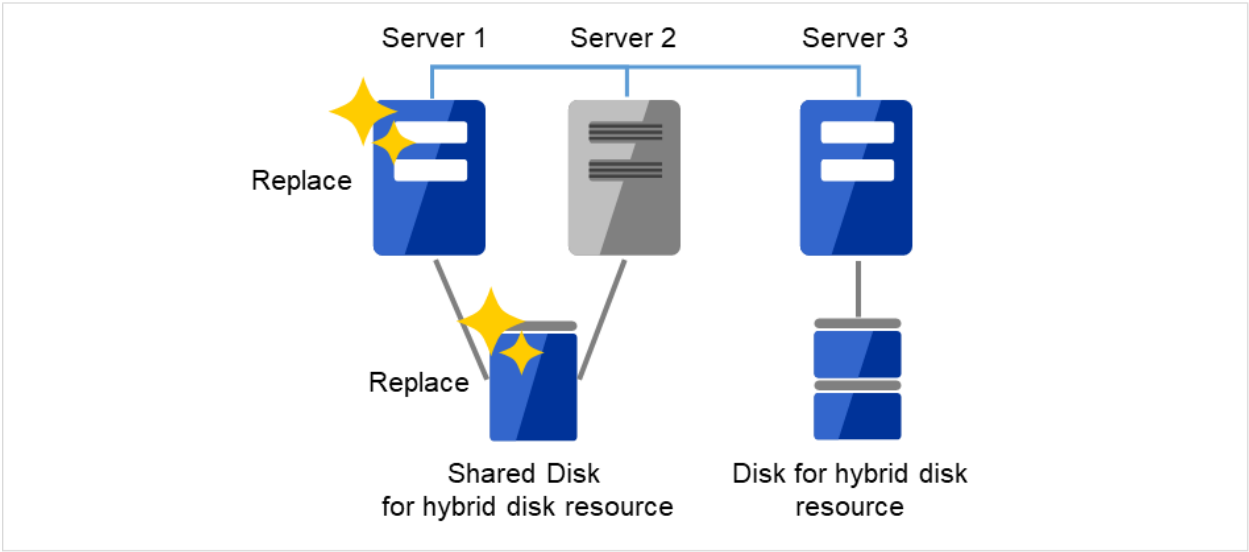

Fig. 2.16: Replacing Server 1 and the shared disk with a new server and a new disk

4. Create disk partitions from the replaced server by executing the fdisk command.

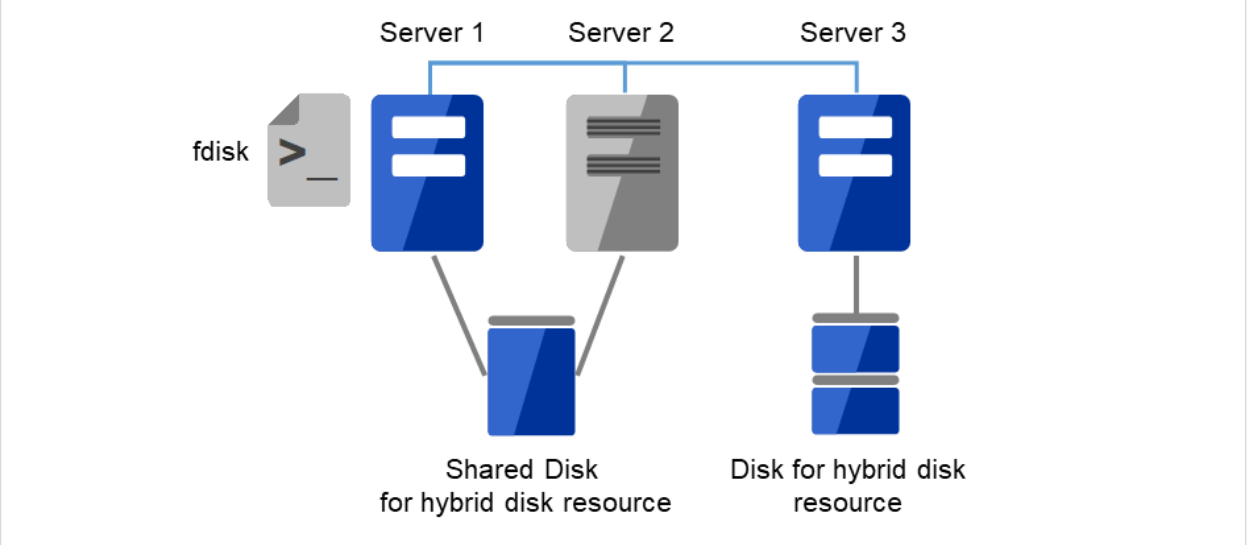

Fig. 2.17: Creating partitions in a new shared disk connected to Server 1

5. Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "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.

   EXPRESSCLUSTER is not started on the non-replaced server of the servers connected to the shared disk.

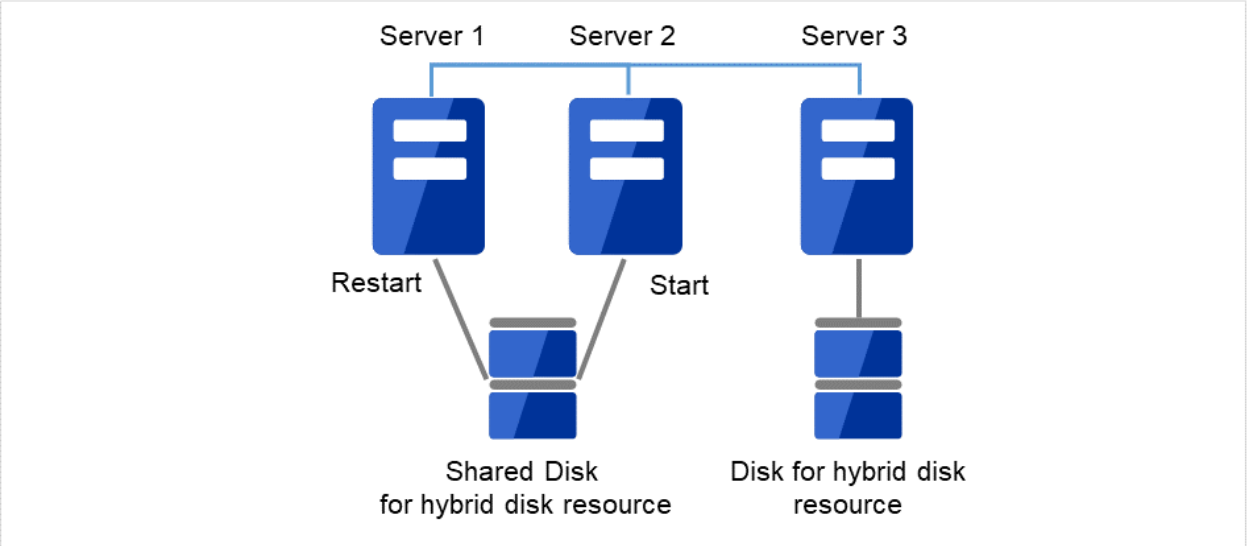

Fig. 2.18: Installing EXPRESSCLUSTER on Server 1 and starting Server 2

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

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

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

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

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

8. Set the EXPRESSCLUSTER service to start on the failed server and the other server connecting to the same shared disk.

   ```
   clpsvcctrl.sh --enable core
   ```

9. Restart the replaced server as well as the server that was connected to the failing server via the shared disk.

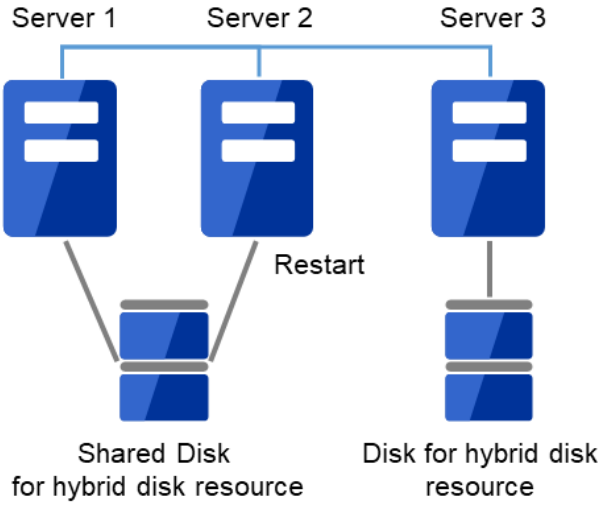

Fig. 2.19: Restarting the replaced server as well as the server that was connected to the failing server via the shared disk

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 Cluster WebUI" of "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 "Displaying the hybrid disk status (clphdstat command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

    ```
    clphdstat --mirror <hybrid disk resource name (example: hd1)>
    ```

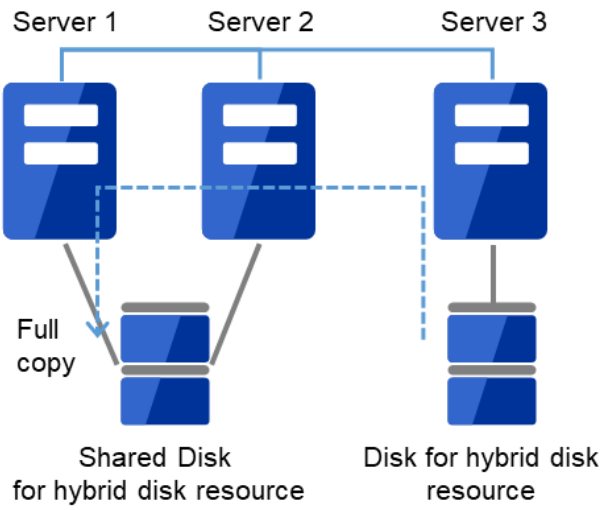

Fig. 2.20: Starting mirror recovery (full copy)

2.18.3 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.

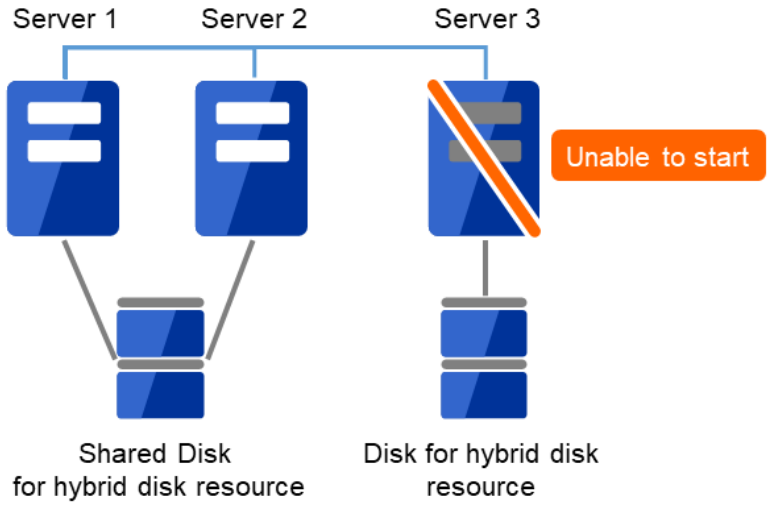

Fig. 2.21: Not able to start Server 1 or use the shared disk

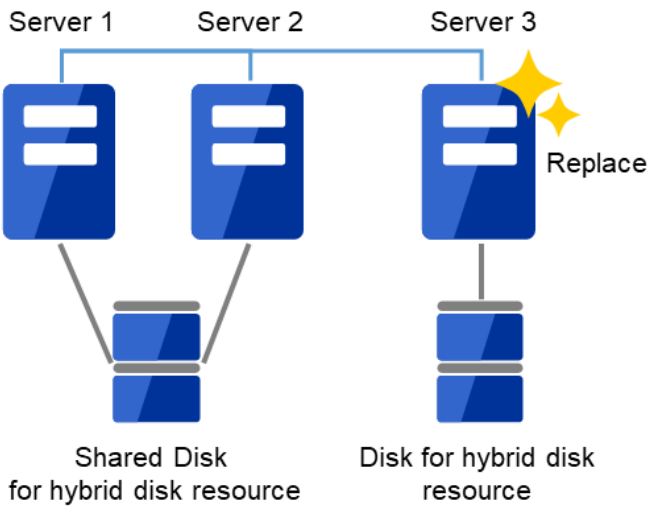

Fig. 2.22: Replacing Server 3 with a new one

2. Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "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.

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

   ```
   clplcnsc --reregister <a folder path for saved license files>
   ```
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 Cluster WebUI" of "Troubleshooting" in "Reference Guide".

   Confirm that mirroring is successfully recovered by using the Cluster WebUI or by running the following command. For details, see "Displaying the hybrid disk status (clphdstat command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

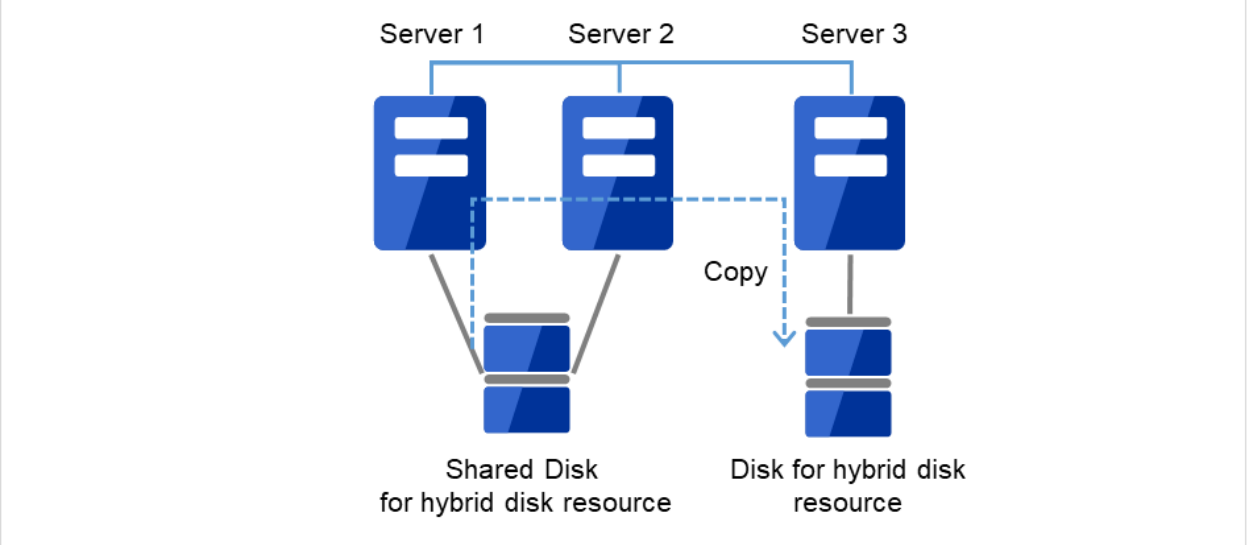

Fig. 2.23: Starting mirror recovery on Server 1 (differential copy)

2.18.4 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.

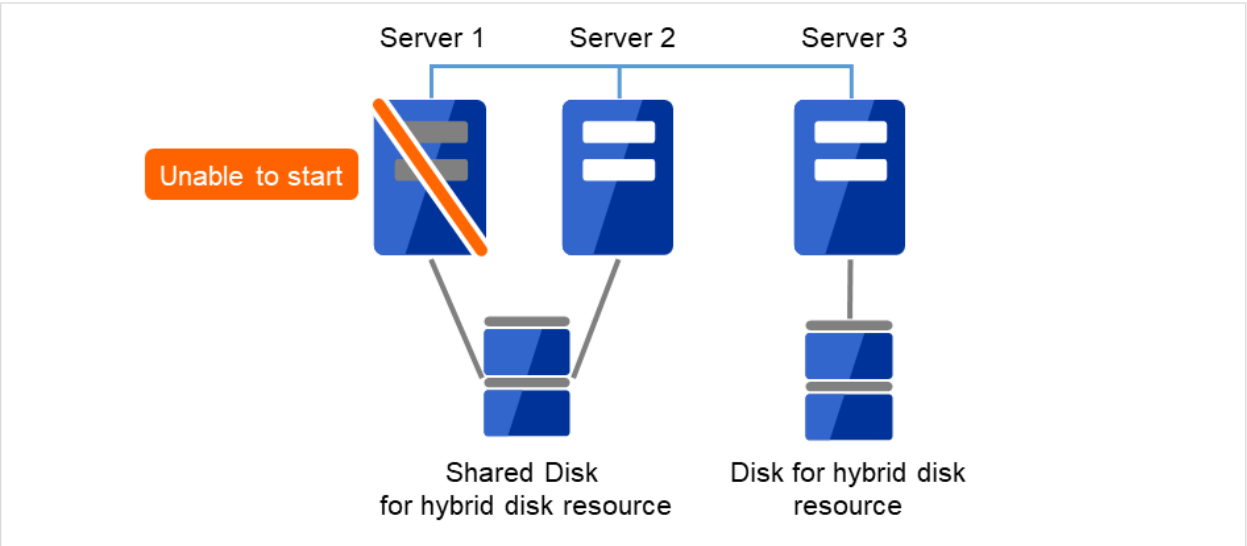

Fig. 2.24: Not able to start Server 1

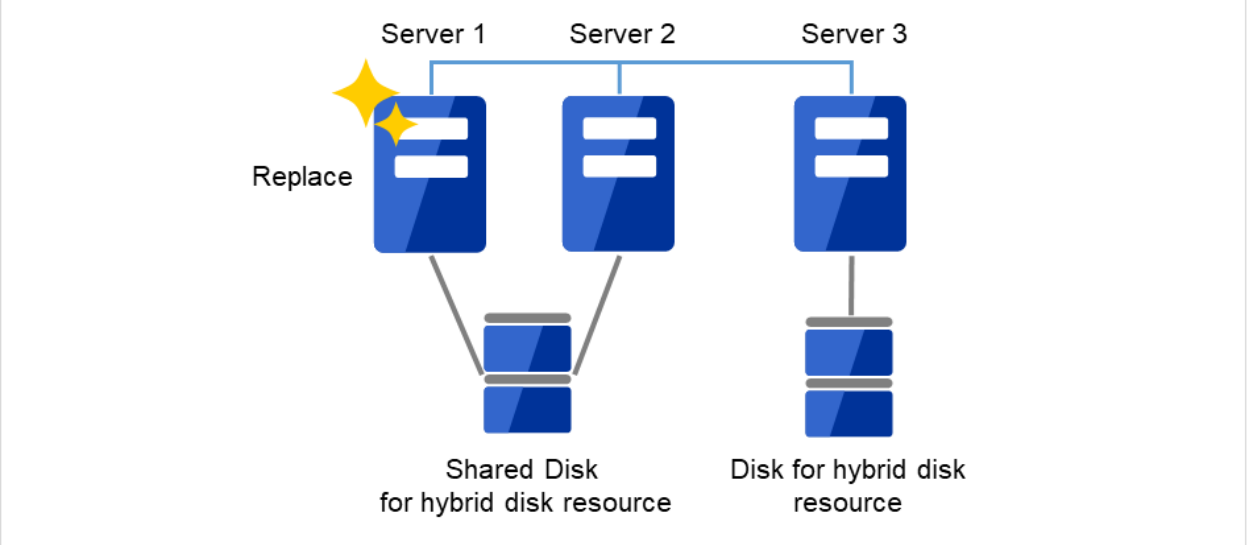

Fig. 2.25: Replacing Server 1 with a new one

2. Install the EXPRESSCLUSTER Server on the new server. For details, see "Setting up the EXPRESSCLUSTER Server" in "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.

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

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

   When uploading the data completes, restart the replaced server.

2.19 How to restore a virtual machine ~For a mirror disk~

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

Note:

- This procedure is not intended for backup/restoration by the file; but for backing up as or restoring from a disk image, outside the OS.
- This procedure requires backing up the disk as a disk image beforehand.
  For information on how to create the disk image, refer to "2.20.1. *Simultaneously backing up both active and standby mirror disks (with the business interrupted)*" and "2.20.3. *Backing up standby mirror disks (with the business interrupted)*". These sections instruct you to execute `clpbackup.sh --pre --no-shutdown` as a step for mirror disk resources. Instead, however, execute `clpbackup.sh --pre` to shut down the server, and then create the backup. This is because, when you back up the system disk, it is recommended to make the system disk static.
- This procedure is for restoring the system disk and mirror disk resources on the server, but not for separately restoring each of the resources.

---

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

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

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

```
clprestore.sh --pre
```

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

Note:

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

---

7. On the target server, check that the device file name of the disk after the restoration is the same as that before the restoration. If the name is different, set it as before.
8. Execute the following clprestore.sh command to reboot the target server.

```
clprestore.sh --post
```

9. Open Cluster WebUI -> **Mirror disks**, then make a mirror recovery (full copy) of all the mirror disk resources.

Note:

The copy source must be a server on which data to be updated exists.
Make a full copy instead of a differential copy, because the data difference may have become invalid during the restoration process.

---

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

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

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

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

Note:

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

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

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

2.20.1. *Simultaneously backing up both active and standby mirror disks (with the business interrupted)*
2.20.2. *Backing up active/standby mirror disks in each server (with the business interrupted)*
2.20.3. *Backing up standby mirror disks (with the business interrupted)*
2.20.4. *Backing up mirror disks on the single server (with the business interrupted)*

Note:

- For information on how to back up (or take a snapshot of) mirror-disk partitions without interrupting the business, see "*How to back up a mirror disk with the business going on*".
- When restoring a mirror/hybrid disk from a disk image obtained through either of the above procedures, follow the steps in "*How to restore the mirror/hybrid disk from the disk image*".
  When restoring a mirror disk from a disk image obtained through "*How to back up a mirror disk with the business going on*", follow the steps in "*How to restore a mirror disk from its backup created with the business going on*".

Note:

- These procedures are not intended for per-file backup/restoration, but for disk image backup/restoration.
  These procedures are different from that for backing up files from activated mirror disks/hybrid disks or backing up files from standby mirror disks/hybrid disks by canceling the access restriction.
  For information on the per-file backup procedure, see "Installation and Configuration Guide" -> "Verifying operation" -> "Backup procedures".
- In these procedures, backup/restoration applies to all the mirror disks and hybrid disks on the target server. These procedures are not applicable to separate backup/restoration for each resource.
- Back up/Restore both of the cluster partition and the data partition.

  * A mirror/hybrid disk consists of a data partition to be the mirroring target, and a cluster partition to record the management information.
  For information on the cluster partition and the data partition, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" or "Understanding Hybrid disk resources".

Note:

- If hybrid disk resources exist, it should be determined on which server the backup is performed, in each of the server groups.
- Each of the procedures with hybrid disk resources is written as follows: Execute `clpbackup.sh --pre` or `clpbackup.sh --post` on a server of a server group first, then perform `clpbackup.sh --pre --only-shutdown` or `clpbackup.sh --post --only-reboot` on all the other servers of the server group.

Each of the written procedures includes the current server of the server group, as a signpost for the first server of the group on which the command is executed. However, the current server does not have to be the first server.

If the server group has only one server, it is unnecessary to execute `clpbackup.sh --pre --only-shutdown` or `clpbackup.sh --post --only-reboot` on all the other servers of the server group.

* In each server group, a current server is responsible for the mirror data to be transmitted/received, and to be written to its disk.

In the active server group, the current server contains the hybrid disk resource being activated.

In the standby server group, the current server receives the mirror data, sent from the current server of the active server group, and writes such data to its mirror disk.

Note:

- When you execute the clpbackup.sh command to shut down a server, an error may occur with such a message as "`Some invalid status. Check the status of cluster.`", leading to a failure in the shutdown. Then wait a while before performing the clpbackup.sh command again.
- When you execute `clpbackup.sh --post`, a timeout may occur for the mirror agent being started, causing an error.

  In this case, wait a while before performing the clpbackup.sh command again.

See also:

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

2.20.1 Simultaneously backing up both active and standby mirror disks (with the business interrupted)

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

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

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

     `clphdstat --mirror <hd_resource_name>`

Note:

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

---

2. Stop the activated failover group (the operation) by using Cluster WebUI or by running the clpgrp command.
3. Switch the mirror disks to backup mode by running the clpbackup.sh command.
   - For mirror disk resources:

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

     ```
     clpbackup.sh --pre --no-shutdown
     ```

   - For hybrid disk resources:

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

     ```
     clpbackup.sh --pre
     ```

Note:

After the execution, the status of mirroring is changed to that for the backup, automatic startup of the cluster service is set to disabled.
For mirror disk resources: After the above actions are completed, the cluster service stops.
For hybrid disk resources: After the above actions are completed, the server shuts down.

Note:

For mirror disk resources: If you also want to immediately shot down the server, execute `clpbackup.sh --pre` instead of `clpbackup.sh --pre --no-shutdown`.

---

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

   ```
   clpbackup.sh --pre --only-shutdown
   ```

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

---

5. Execute backup on both servers.
6. After completing the backup, return the mirror disks from backup mode to normal mode.
   - For mirror disk resources:

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

     ```
     clpbackup.sh --post --no-reboot
     ```

   - For hybrid disk resources:

     Start all the servers.
     Then, execute the following command on one server in both server groups:

```
clpbackup.sh --post
```

Note:

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

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

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

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

```
clpbackup.sh --post --only-reboot
```

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

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

2.20.2 Backing up active/standby mirror disks in each server (with the business interrupted)

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

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

2.20.3 Backing up standby mirror disks (with the business interrupted)

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

Perform the following procedure:

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

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

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

Note:

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

---

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

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

---

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

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

4. Switch the mirror disks to backup mode by running the clpbackup.sh command.
   - For mirror disk resources:

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

     ```
     clpbackup.sh --pre --no-shutdown
     ```

   - For hybrid disk resources:

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

     ```
     clpbackup.sh --pre
     ```

Note:

After the execution, the status of mirroring is changed to that for the backup, automatic startup of the cluster service is set to disabled.
For mirror disk resources: After the above actions are completed, the cluster service stops.
For hybrid disk resources: After the above actions are completed, the server shuts down.

Note:

For mirror disk resources: If you also want to immediately shot down the standby server (backup side), execute `clpbackup.sh --pre` instead of `clpbackup.sh --pre --no-shutdown`.

---

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

```
clpbackup.sh --pre --only-shutdown
```

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

6. If you want to restart the operation immediately, start the failover group (operation) on the active server (i.e., the server not to be backed up) by using Cluster WebUI or by running the clpgrp command.
7. Back up the disk to its disk images on the standby server.
8. After the completion of the backup, return the mirror disks from backup mode to normal mode.
   - For mirror disk resources:

     Execute the following command on the standby server:

     ```
     clpbackup.sh --post --no-reboot
     ```

   - For hybrid disk resources:

     Start all the servers in the standby server group.
     Then, execute the following command on one server in the standby server group:

     ```
     clpbackup.sh --post
     ```

   Note:

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

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

   ```
   clpbackup.sh --post --only-reboot
   ```

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

10. The cluster service starts up on the standby server.
    If the disk monitor resources/mirror disk monitor resources/hybrid disk monitor resources stay paused, resume them through Cluster WebUI or by executing the following clpmonctrl command:

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

11. The failover group (operation), if remains stopped (if not restarted immediately in the previous step), is executable on the active server.
12. Automatic mirror recovery, if enabled, synchronizes differences in mirror disks between the active server and the standby server, generated during the backup, and then the server functions normally.
    If automatic mirror recovery is not executed and the server is not working normally, manually make a mirror recovery by clicking **Difference copy** icon in the **Mirror disks** tab of Cluster WebUI or by executing the following clpmdctrl/clphdctrl command:

- For mirror disk resources:

  `clpmdctrl --recovery <md_resource_name>`

- For hybrid disk resources:

  `clphdctrl --recovery <hd_resource_name>`

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

2.20.4 Backing up mirror disks on the single server (with the business interrupted)

For the procedure of backing up mirror disks on a single active server or its server group, while the other server or its server group is stopped and the synchronization of mirroring has not been executed, execute the backup as specified in "*Simultaneously backing up both active and standby mirror disks (with the business interrupted)*", in which "both" or "both servers" is considered as "single" or "single server" respectively.

See also:

If you want to start the failover group (operation) immediately without waiting for the startup of the other server, run the following command to cancel the cluster activation synchronization wait processing:

```
clpbwctrl -c
```

The executed command causes an error if the cluster activation synchronization wait processing is timed out or not yet started.

For information on the clpbwctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Controlling cluster activation synchronization wait processing (clpbwctrl command)".

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

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

2.21.1. *Simultaneously restoring the mirror disks on both of the active and standby servers from the same disk image*
2.21.2. *Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images*
2.21.3. *Restoring the mirror disk on the single server from the disk image*

Note:

- The above procedures are for using the disk image created through "*How to back up a mirror/hybrid disk to its disk image*" to restore the mirror/hybrid disk.

  When restoring a mirror disk from a disk image created through "*How to back up a mirror disk with the business going on*", follow the steps in "*How to restore a mirror disk from its backup created with the business going on*".

- This section describes how to restore disk images that were backed up according to "*How to back up a mirror/hybrid disk to its disk image*".

  These procedures are different from that for per-file restoration of activated mirror disks/hybrid disks.

  For information on the per-file restoration, see "Installation and Configuration Guide" -> "Verifying operation" -> "Restoration procedures" -> "Restoring the data on the mirror disk or the hybrid disk".

- In these procedures, backup/restoration applies to all the mirror disks and hybrid disks on the target server. These procedures are not applicable to separate backup/restoration for each resource.

- Back up/Restore both of the cluster partition and the data partition.

  * A mirror/hybrid disk consists of a data partition to be the mirroring target, and a cluster partition to record the management information.

  For information on the cluster partition and the data partition, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources" or "Understanding Hybrid disk resources".

Note:

- If hybrid disk resources exist, it should be determined on which server the restoration is performed, in each of the server groups.

- Each of the procedures with hybrid disk resources is written as follows: Execute `clprestore.sh --post` or `clprestore.sh --post --skip-copy` on a server of a server group first, then perform `clprestore.sh --post --only-reboot` on all the other servers of the server group.

  Each of the written procedures includes the current server of the server group, as a signpost for the first server of the group on which the command is executed. However, the current server does not have to be the first server.

  If the server group has only one server, it is unnecessary to execute `clprestore.sh --post --only-reboot` on all the other servers of the server group.

* In each server group, a current server is responsible for the mirror data to be transmitted/received, and to be written to its disk.

In the active server group, the current server contains the hybrid disk resource being activated.

In the standby server group, the current server receives the mirror data, sent from the current server of the active server group, and writes such data to its mirror disk.

Note:

- When you execute the clprestore.sh command to shut down a server, an error may occur with such a message as "`Some invalid status. Check the status of cluster.`", leading to a failure in the shutdown. Then wait a while before performing the clprestore.sh command again.
- After the restoration, if an error such as "`Invalid configuration file.`" is displayed and the server is not restarted, check to see if the configuration data is registered, or there are any problems with the installation of EXPRESSCLUSTER or the setting of the firewall.

See also:

- For information on the clprestore.sh command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Perform the processing after restoring from a disk image (clprestore.sh command)".

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

This procedure is intended for simultaneously restoring both of active/standby mirror disks from the same mirror disk image.
This procedure allows the mirror data of the active server and that of the standby server to be the same, thus eliminating the operation of mirror recovery (full copy) after restoration.

Important:

In this procedure, **Execute the initial mirror construction** needs to be set to disabled in advance in the setting of mirror resources/hybrid resources.
If **Execute the initial mirror construction** or **Execute initial mkfs** is enabled, an error occurs. In this case, disable the setting by using Cluster WebUI.

---

1. Stop the activated failover group by using Cluster WebUI or by running the clpgrp command.
2. Run the following command on all the active/standby servers:

Note: If the OS cannot be started and the OS or EXPRESSCLUSTER needs to be reinstalled or restored, run the following command on the server where the reinstallation or the restoration was performed:

```
clprestore.sh --pre
```

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

3. Restore the cluster partition and the data partition on both of the active server and standby server.
   If you restore the cluster and data partitions from a snapshot: Use it to create a disk volume which includes the partitions, then replace an old disk volume with the new one.

   Note: Restore the active server and the standby server from the same disk images.

4. After the completion of restoring both of the active server and the standby server, start all the servers.
5. After starting the servers, check the paths to the restored cluster partition and data partition.
   If any of the paths differs from before, start Cluster WebUI, switch to **Config mode**, change the path setting in **Details** tab of the mirror disk resource/hybrid disk resource properties, and then perform **Apply the Configuration File**.

   Important:

   Carefully specify the path. Its incorrect setting could cause the start of mirroring to fail or the corresponding partition to be destroyed.
   Should you set a wrong path leading to a failure in the start of mirroring, begin the procedure over again from step 1.

6. Execute the following command on each of the active server and the standby server:

   Note: For a hybrid disk, perform this command on one server (e.g. the current server) of the active server group and on that of the standby server group:

   ```
   clprestore.sh --post --skip-copy
   ```

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

   Note:

   If **Execute the initial mirror construction** is enabled in the setting of mirror disk resources/hybrid disk resources, the command fails.
   In this case, set **Execute the initial mirror construction** to disabled by using Cluster WebUI, click **Apply the Configuration File**, and then execute the command again.

   Note:

   If a stopped server exists, thereby causing **Apply the Configuration File** to be interrupted with Cluster WebUI, check the **Forcibly apply settings** checkbox to forcibly continue applying the settings.
   Remember to perform the distribution to the stopped server later to avoid inconsistency in the configuration data.

Note:

If the mirror agent is started, the cluster partition is initialized, causing the command to fail.
In this case, after running the `clprestore.sh --pre` command, start the server, and run the `clprestore.sh --post --skip-copy` command again.

7. For hybrid disk resources: When the server starts rebooting with the command in step 6 above, execute the following command on all the other servers of the server group:

```
clprestore.sh --post --only-reboot
```

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

8. After both of the active/standby servers are started, check the status of mirroring by using Cluster WebUI or by running the clpmdstat / clphdstat command.
   The status of mirroring for both the active server and the standby server is "Normal" (GREEN).
   - For mirror disk resources:

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

     `clphdstat --mirror <hd_resource_name>`

Note:

If you restored a server from a backup or snapshot created through "*How to back up a mirror disk with the business going on*", execute the following command on the server:

```
clprestore.sh --post --online --skip-copy
```

After that, if the failover group does not start automatically, start it manually.

9. If the setting of **Execute the initial mirror construction** is changed, restore the original setting by using Cluster WebUI as required.
   The cluster needs to be stopped when applying the configuration.

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

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

See also:

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

1. Stop the activated failover group by using Cluster WebUI or by running the clpgrp command.
2. Run the following command on all the active/standby servers:

Note: If the OS cannot be started and the OS or EXPRESSCLUSTER needs to be reinstalled or restored, run the following command on the server where the reinstallation or the restoration was performed:

```
clprestore.sh --pre
```

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

3. Restore the cluster partition and the data partition on both of the active server and standby server.
   If you restore the cluster and data partitions from a snapshot: Use it to create a disk volume which includes the partitions, then replace an old disk volume with the new one.
4. After restoring both of the active server and standby server, start all the servers.
5. After the startup, confirm that the paths of the restored cluster partition and the data partition are correct.
   If any of the paths differs from before, start Cluster WebUI, switch to **Config mode**, change the path setting in **Details** tab of the mirror disk resource/hybrid disk resource properties, and then perform **Apply the Configuration File**.

Important:

Carefully specify the path. Its incorrect setting could cause the start of mirroring to fail or the corresponding partition to be destroyed.
Should you set a wrong path leading to a failure in the start of mirroring, begin the procedure over again from step 1.

Note:

If a stopped server exists, thereby causing **Apply the Configuration File** to be interrupted with Cluster WebUI, check the **Forcibly apply settings** checkbox to forcibly continue applying the settings.
Remember to perform the distribution to the stopped server later to avoid inconsistency in the configuration data.

6. Execute the following command on each of the active server and the standby server:

   Note: For a hybrid disk, perform this command on one server (e.g. the current server) of the active server group and on that of the standby server group:

   ```
   clprestore.sh --post
   ```

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

7. For hybrid disk resources: When the server starts rebooting with the command in step 6 above, execute the following command on all the other servers of the server group:

   ```
   clprestore.sh --post --only-reboot
   ```

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

8. After both of the active/standby servers are started, check the status of mirroring by using Cluster WebUI or by running the clpmdstat / clphdstat command.
   The status of the mirror for both the active server and the standby server is "Abnormal" (RED).
   - For mirror disk resources:

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

     `clphdstat --mirror <hd_resource_name>`

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

   Note:

   If you restored a server from a backup or snapshot created through "*How to back up a mirror disk with the business going on*", execute the following command on the server:

   ```
   clprestore.sh --post --online
   ```

10. Stop the failover group that failed the startup by using Cluster WebUI or by running the clpgrp command.
11. Change the status of the mirror side to be updated to "Normal" (GREEN) by clicking **Forced mirror recovery** icon in the **Mirror disks** tab of Cluster WebUI or by executing the clpmdctrl/clphdctrl command with the --force option on the server whose status is to be "Normal" (GREEN).
    - For mirror disk resources:

      `clpmdctrl --force <md_resource_name>`
    - For hybrid disk resources:

      `clphdctrl --force <hd_resource_name>`

12. On the latest server, by using Cluster WebUI or by running the clpgrp command, the failover group can be started (the operation can be started).
13. After the failover group is started, make a mirror recovery by clicking **Full copy** icon in the **Mirror disks** tab of Cluster WebUI or by executing the following clpmdctrl/clphdctrl command:
    - For mirror disk resources:

      `clpmdctrl --recovery <md_resource_name>`
    - For hybrid disk resources:

      `clphdctrl --recovery <hd_resource_name>`

Note:

Mirror recovery can also be started by using Cluster WebUI or by running the clpmdctrl / clphdctrl command, before starting the failover group.
In this case, however, the failover group cannot be started unless mirror recovery (full copy) is completed or canceled.

- For mirror disk resources:

  `clpmdctrl --force <copy_source_server> <md_resource_name>`
- For hybrid disk resources:

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

See also:

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

If forced mirror recovery (the method of not specifying a copy source server) is specified as the --force option, the command is executed on the server that you want to be the latest (status: "Normal" GREEN). After the execution, the failover group can be started (the operation can be started) on the server whose status is "Normal" (GREEN).
If full copy (the method of specifying a copy source server) is specified as the --force option, the command is executable on any servers. After the execution, mirror recovery (full copy) is started. Once mirror recovery is started, the failover group cannot be started (the operation cannot be started) unless mirror recovery is completed or interrupted.

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

To restore only the mirror disk of the standby server with the active server operating, see "*How to restore a virtual machine ~For a mirror disk~*", read "the server with the system disk to be restored" as " the server with the mirror disk to be restored", and then follow the procedure from step 1 (moving a failover group) through step 11 (confirming that the mirror is synchronized normally). In steps 4 and 5, create only a virtual hard disk for the mirror disk and replace with it the existing disk.

For the procedure of restoring mirror disks only on the active server or its server group, with the standby server or its server group (not to be restored) stopped, execute restoration as specified in "*Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images*", in which "both" or "both servers" is considered as "single" or "single server", respectively.

See also:

If you want to start the cluster service immediately without waiting for the startup of the other server, run the following command to cancel the cluster activation synchronization wait processing:

```
clpbwctrl -c
```

The executed command causes an error if the cluster activation synchronization wait processing is timed out or not yet started.
For information on the clpbwctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Controlling cluster activation synchronization wait processing (clpbwctrl command)".

Important:

- If you change configuration data (such as a path to a partition) through the procedure, and then the distribution fails for any server, remember to distribute the changed configuration data to the server later.

  If incorrect path information is used, the start of mirroring may fail or the corresponding partition may be destroyed.

- It is not supported to separately restore, connect, and operate an active server and a standby server according to this procedure.

  There is no problem even in such a case, if mirror recovery (full copy) is executed right after both servers are connected and activated. If operation is carried out without executing mirror recovery (full copy), however, the mirror data can be damaged.

2.22 How to back up a mirror disk with the business going on

This section describes how to back up (or take a snapshot of) a disk volume of mirror-disk partitions (cluster and data partitions) with the failover group operating. Depending on your situation, follow either of the following procedures with prerequisites and notes:

2.22.1. *For backing up the mirror disk of either of the active and standby servers (with the business going on)*
2.22.2. *For backing up active- and standby-side mirror disks individually (with the business going on)*

Important:

- In the above procedures, you execute the clpbackup.sh command on a server whose mirror disk resources are activated. This uses the fsfreeze command to flush a cache to and pause writing to the mirror disk.

  Writing to the mirror disk is paused by running `clpbackup.sh --pre --online`. This interruption continues, through the completion of backing up (or taking a snapshot of) the disk, until you perform `clpbackup.sh --post --online`.

  This interruption may cause timeouts in some applications in their attempts at writing.

  For any system with such an application, do either of the following:

  - Before backing up (or taking a snapshot of) the mirror disk, configure the application so that it cannot start writing to the disk.

  - According not to either of the above procedures but to the procedure described in "2.20. *How to back up a mirror/hybrid disk to its disk image*", back up (or take a snapshot of) the disk.

- In the above procedures, the pause in writing to the mirror disk does not prevent data consistency on the file system level, but does it on the application or database level.

  To ensure data consistency on the application or database level, do either of the following:

  - With timing of ensuring the data consistency, perform either of the above procedures.

  - According not to either of the above procedures but to the procedure described in "2.20. *How to back up a mirror/hybrid disk to its disk image*", and with the data consistency able to be ensured, back up the disk.

- In the above procedures, the cluster service is suspended by running `clpbackup.sh --pre --online`. This interruption continues until you perform `clpbackup.sh --post --online`.

  During this suspension period, no failure triggers its detection or a failover.

Note:

- For restoration from a backup/snapshot obtained through either of the above procedures, see "*How to restore a mirror disk from its backup created with the business going on*".

Important:

- In the above procedures, it is not expected to use a snapshot (as a means of backup or restoration) which includes the memory of an operating virtual machine.

Note:

- The above procedures do not support any cluster environment which includes a hybrid disk resource.
- The above procedures assume that the mirror disk uses a file system supported by the fsfreeze command. The operation has been verified with xfs and ext4.

  They fail to work properly with no file system or with any one not supported by the fsfreeze command.

In addition, pay attention to the following common to "*How to back up a mirror/hybrid disk to its disk image*".

Note:

- The above procedures apply to backup/restoration not by the file but by the disk image.

  They are not for backing up files on the activated mirror disk of an active server or ones on the mirror disk (with access control removed) of a standby server.

  For more information on backup by the file, see "Installation and Configuration Guide" -> "Verifying operation" -> "Backup procedures".
- The above procedures back up/restore all mirror disk resources on a target server, but not each of them individually.
- Back up/restore both the cluster partition and the data partition.

  * A mirror/hybrid disk consists of a data partition to be mirrored, and a cluster partition to record management information.

  For more information, see "Reference Guide" -> "Group resource details" -> "Understanding Mirror disk resources".

Note:

- As a path to the cluster and data partitions of mirror disk resources, it is recommended to specify a path to a logical volume of LVM or a path to by-id or by-partuuid of udev.

See also:

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

2.22.1 For backing up the mirror disk of either of the active and standby servers (with the business going on)

This section describes how to back up (or take a snapshot of) the mirror disk of either of the active and standby servers to a disk image.
Whether the backup or snapshot target is the mirror disk of an active server (with the corresponding standby server off) or that of either of the active and standby servers (both operating), proceed as follows:

1. Switch a target mirror disk to the backup mode by using the clpbackup.sh command.

```
clpbackup.sh --pre --online
```

Note: This leads to the following:

- The cluster service is suspended; the monitoring is paused.
- Data cached in memory is flushed to the mirror disk.
  Then requests to write to the mirror disk are paused.
- The mirror disk becomes in the backup mode.
- Automatically starting the cluster service and the failover group is disabled.

2. Back up (or take a snapshot of) the mirror disk (cluster and data partitions).
3. After completing Step 2, return the mirror disk from the backup mode to the normal mode.

```
clpbackup.sh --post --online
```

Note: This leads to the following:

- The suspended cluster service returns to normal; the monitoring is resumed.
- Writing to the mirror disk is resumed.
- The mirror disk is returned to the normal mode.
- Automatically starting the cluster service and the failover group is enabled again.

2.22.2 For backing up active- and standby-side mirror disks individually (with the business going on)

Take the following steps one at a time:

1. Seeing "*For backing up the mirror disk of either of the active and standby servers (with the business going on)*", back up (or take a snapshot of) the active-side mirror disk.
2. Seeing "*For backing up the mirror disk of either of the active and standby servers (with the business going on)*", back up (or take a snapshot of) the standby-side mirror disk.

Important:

When restoring both the active and standby servers from their backups/snapshots obtained as above and then making a mirror recovery (full copy): Specify the mirror disk whose server was active during the backup/snapshot acquisition, as the copy source.

2.23 How to restore a mirror disk from its backup created with the business going on

Any of the following procedures are for restoring a mirror disk from its backup or snapshot created through "2.22. *How to back up a mirror disk with the business going on*".

When restoring from a disk image obtained through "2.20. *How to back up a mirror/hybrid disk to its disk image*", see "2.21. *How to restore the mirror/hybrid disk from the disk image*".

2.23.1. *For restoring the same mirror disk image to active and standby servers simultaneously*
2.23.2. *For restoring the respective mirror disks of active and standby servers simultaneously*
2.23.3. *For restoring the mirror disk of either of the active and standby servers from a mirror-disk backup of a server which was active during its acquisition*
2.23.4. *For restoring the mirror disk of a standby server*

Important:

- In the above procedures, it is not expected to use a snapshot which includes the memory of an operating virtual machine as a means of backup or restoration.

Note:

- Restoring a mirror disk may change the path of the cluster partition or data partition.
  In this case, adjust the settings to the changed path with Cluster WebUI.
- For other notes, see "2.21. *How to restore the mirror/hybrid disk from the disk image*".

2.23.1 For restoring the same mirror disk image to active and standby servers simultaneously

This section describes how to simultaneously restore both the mirror disk of an active server and that of a standby server from the same disk image.

This procedure makes no difference of mirror data between the two servers, eliminating the need for post-restoration mirror recovery (full copy).

For the steps, see "2.21.1. *Simultaneously restoring the mirror disks on both of the active and standby servers from the same disk image*".

Note that, in Step 8 (to check the status of the failover group), execute the following command on both the active and standby servers:

```
clprestore.sh --post --online --skip-copy
```

Important:

Before this procedure, disable **Execute the initial mirror construction** and **Execute initial mkfs** in the settings for the mirror/hybrid disk resource by using Cluster WebUI or other tools; otherwise an error will occur.

2.23.2 For restoring the respective mirror disks of active and standby servers simultaneously

This section describes how to simultaneously restore both the mirror disk of an active server and that of a standby server from their respective backups or snapshots.

For the steps, see "2.21.2. *Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images*".

Note that, in Step 9 (to check the status of the failover group), execute the following command on both the active and standby servers:

```
clprestore.sh --post --online
```

In Step 11 (for forcible mirror recovery), change the status of the mirror disk to be updated (whose server was active during the backup/snapshot acquisition) to "Normal" (GREEN).

In Step 13 (for full copy), specify the mirror disk whose server was active during the backup/snapshot acquisition, as the copy source.

2.23.3 For restoring the mirror disk of either of the active and standby servers from a mirror-disk backup of a server which was active during its acquisition

This section describes how to restore the mirror disk of one of the active and standby servers (with the other off) from a mirror-disk backup or snapshot of a server which was active during its acquisition.

For the steps, in the procedure of "2.21.2. *Simultaneously restoring the mirror disks on both of the active and standby servers from their respective disk images*", do the following:

- Read the expressions like "both of active/standby mirror disks" and "both of the active/standby servers" as "either of the active and standby mirror disks" and "either of the active and standby servers" respectively.
- Follow the procedure from Step 1 (to stop the failover group) through Step 12 (to start the failover group).

In addition, in Step 9 (to check the status of the failover group), execute the following command:

```
clprestore.sh --post --online
```

See also:

When you start up a server, running the following command allows you to immediately start up the cluster service without awaiting other servers' startup:

```
clpbwctrl -c
```

* Note that the command execution causes an error with the cluster activation synchronization wait processing timed out or not yet started.

For more information on the clpbwctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Controlling cluster activation synchronization wait processing (clpbwctrl command)".

Important:

- The procedure is for restoring a mirror disk from a disk image created through "2.22. *How to back up a mirror disk with the business going on*".
  For this restoration, use a backup/snapshot of a mirror disk whose server was active during the backup/snapshot acquisition.
- After changing configuration data (e.g., on a path setting) through the procedure, you may fail to distribute the changed data to a server. In that case, remember to distribute the data to the server later.
  If incorrect path information is used, the start of mirroring may fail or the corresponding partition may be destroyed.
- When individually restoring active and standby servers through the procedure:
  After the restoration, connect both of the servers; then make a mirror recovery (full copy) with the active server's mirror disk specified as the copy source.
  Operating the cluster without making the full copy may cause the mirror data to be corrupted.

2.23.4 For restoring the mirror disk of a standby server

This section describes how to restore the mirror disk of a standby server with the corresponding active server operating.
The mirror disk contents are copied from the active server to the standby server.

1. On a standby server to be restored, move its failover group in operation, if any, to the corresponding active server. After the transfer, check if each of the group resources works properly on the active server.
2. On the standby server, execute the following command to shut it down:

   ```
   clprestore.sh --pre
   ```

3. On the standby server, restore the cluster and data partitions.
   If you restore the cluster and data partitions from a snapshot: Use it to create a disk volume which includes the partitions, then replace an old disk volume with the new one.
4. Start the standby server.
5. On the started server, check paths to the restored cluster and data partitions and to other disks.
   If any of the paths are changed: Start Cluster WebUI, then switch it to the config mode. In the **Details** tab of the mirror disk resource properties or in any other setting place, correct the path; then perform **Apply the Configuration File**.

Important:

Carefully specify the path. Its incorrect setting may cause the start of mirroring to fail or the corresponding partition to be destroyed.
Should you set a wrong path leading to a failure in the start of mirroring, begin the above procedure over again from Step 2.

Note:

If **Apply the Configuration File** fails or if you do not want to perform **Apply the Configuration File** because it requires stopping the cluster, use the [clpcfctrl] command to forcibly apply the settings as follows. - Perform **Export** to save the configuration data to the disk.

- Extract and put the configuration data file on a disk accessible from a server which belongs to the cluster. Then forcibly distribute the file to servers by executing the clpcfctrl command:

```
clpcfctrl --push -x <path to the directory where the extracted configuration
↪data file, clp.conf, exists> --force --nocheck
```

- After completing the distribution, you can delete the saved compressed file and the extracted configuration data file.

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

See also:

For more information on the clpcfctrl command, see "Reference Guide" -> "EXPRESSCLUSTER command reference" -> "Changing, backing up, and checking cluster configuration data (clpcfctrl command)".

6. Executing the following command to restart the standby server:

```
clprestore.sh --post
```

7. On the restarted server, execute the following command:

```
clprestore.sh --post --online
```

8. Make a mirror recovery (full copy) of all the mirror disk resources, from the mirror disk list in Cluster WebUI or by executing the clpmdctrl command as follows:

   `clpmdctrl --force <copy-source server name> <md resource name>`

9. Make sure that the mirror synchronization is normal, by using Cluster WebUI or by executing the clpmdstat command as follows:

```
clpmdstat --mirror <md resource name>
```

Note: The GREEN status on each of the two servers indicates that the mirror synchronization is normal.

2.24 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 "Parameter details" in the "Reference Guide".

2.25 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.

2.26 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.

2.26.1 Data partition configured with LVM

If LVM is used for partitioning, you can extend data partition without re-creating resources or stopping your business (depending on the file system used).

Table 2.33: LVM data partition extension

File system of data partition	Resource re-creation	Business down	Reference
xfs, ext3, ext4, No file system	Not required	Not required	2.26.1. *Data partition extension for an ext-based or xfs system, or no file system used*
Other than above	Required	Required	2.26.1. *Data partition extension for other file systems*

Note: This method is intended for only extension. To shrink partitions, refer to "2.26.2. *Data partition configured with other than LVM*".

Note: If you follow the instruction below to extend data partition, LVM must be used for the data partition and unused PE (physical extents) of the volume group are sufficient.

Data partition extension for an ext-based or xfs system, or no file system used

1. Confirm the mirror disk resource name you want to resize by [clpstat] command or Cluster WebUI.
2. For unexpected events, back up partition data in a server where an active group has mirror disk resources you want to resize (use a backup device such as tape device). Note that backup commands to access partition device directly is not supported. Ignore this step if you can discard the data on mirror disk resources.
3. Confirm the followings:
   - Mirror disk resource status is normal.
   - On both servers, unused PE (physical extents) of the volume group that data partition belongs to are sufficient.
4. Suspend all the mirror disk monitor resources in the operation mode of Cluster WebUI to prevent automatic mirror recovery.

5. Run the following [clpmdctrl] command on the server an inactive mirror disk resource belongs to. If the resource is not activated on either server, run the command on either of the servers. The following is an example for extending an md01 data partition to 500 gibibytes.

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

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

---

6. Run the [clpmdctrl] command on the other server. The following is an example for extending an md01 data partition to 500 gibibytes.

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

7. If an xfs or ext-based file system is configured on the data partition, extend the file system area by running the command on the server where mirror disk resources are activated.

   <For xfs file systems>

   ```
   # xfs_growfs /mnt/nmp1
   ```

   Change /mnt/nmp1 as necessary depending on the mirror disk resources mount point.)

   <For ext-based file systems>

   ```
   # resize2fs -p /dev/NMP1
   ```

   (Replace NMP1 with the mirror partition device name.)

   If you have not configured any file system on the data partition, ignore this step.

8. In the operation mode of Cluster WebUI, restart all the mirror disk monitor resources that were suspended in step 4.

Important:

The [clpmdctrl --resize] command is effective only when mirror disk resources are in the normal status.
If the mirror becomes inconsistent (mirror break) between step 5 and 6, you can not extend a data partition at step 6. In this case, use the [-force] option to forcibly extend the data partition in step 6 and complete all the steps. Then recover the mirror disk.
If you use the [-force] option for extension, full copy is performed to rebuild the mirror first time.

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

Note:

Data partition size changes depending on PE size.

If PE size is 4M and `# clpmdctrl --resize 1022M md01` is specified, the data partition size becomes 1024M and the file system extension limit becomes 1022M.

Note: During the execution of the xfs_growfs command or the resize2fs command , a massive writing process may degrade the operation I/O performance. It is recommended that the execution be performed during off-peak hours.

Data partition extension for other file systems

The basic procedure is the same as "2.26.2. *Data partition configured with other than LVM*".

Note: Use the [lvextend] command instead of [fdisk] to resize partition size.

2.26.2 Data partition configured with other than LVM

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.

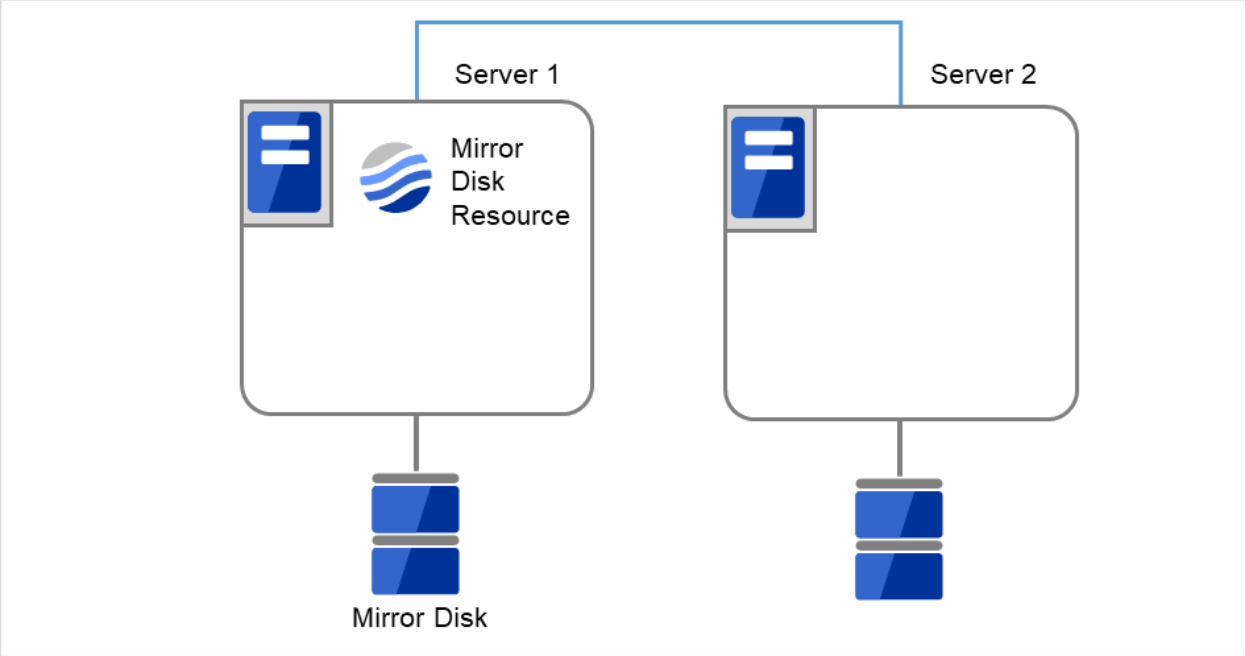

Fig. 2.26: Mirror disk resources activated on Server 1

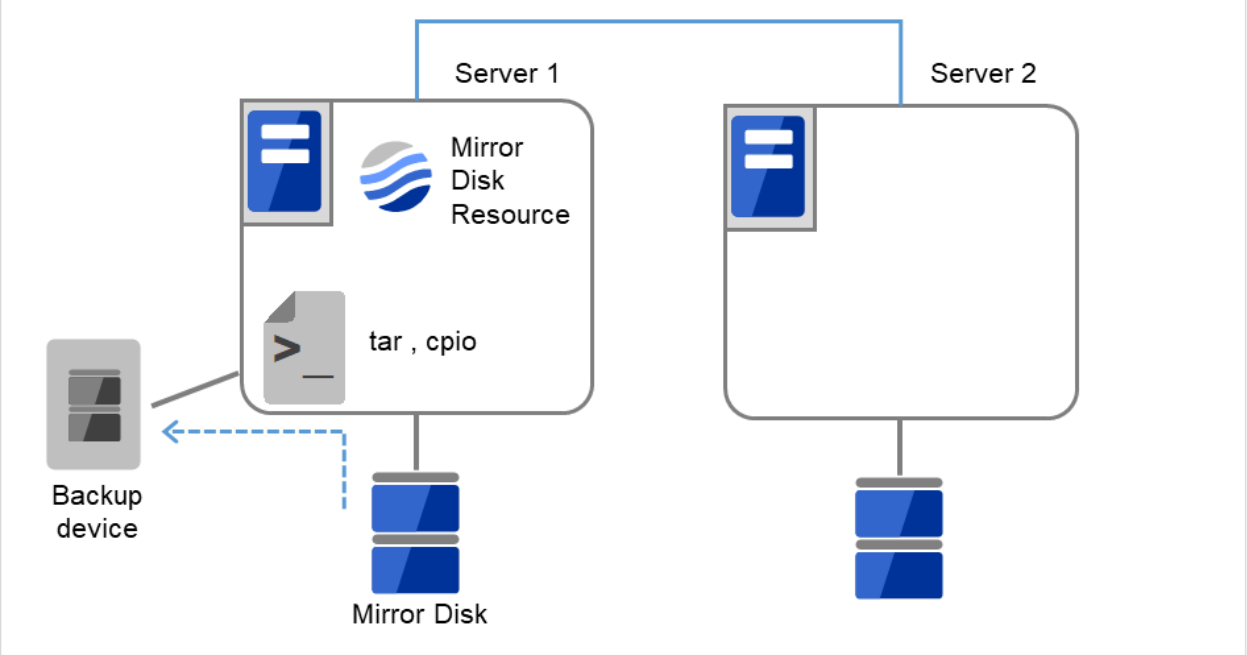

Fig. 2.27: Back up the data on Server 1

3. Set the EXPRESSCLUSTER service not to start up on either of the servers.

```
clpsvcctrl.sh --disable core
```

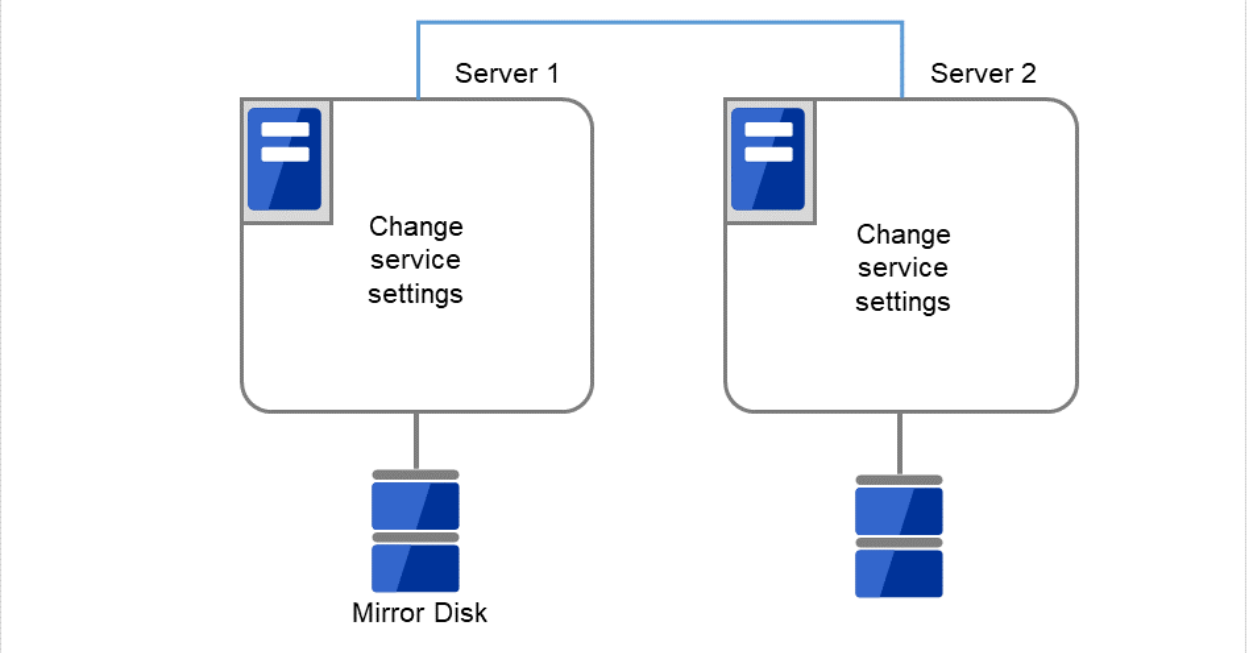

Fig. 2.28: Set the EXPRESSCLUSTER service not to start

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.

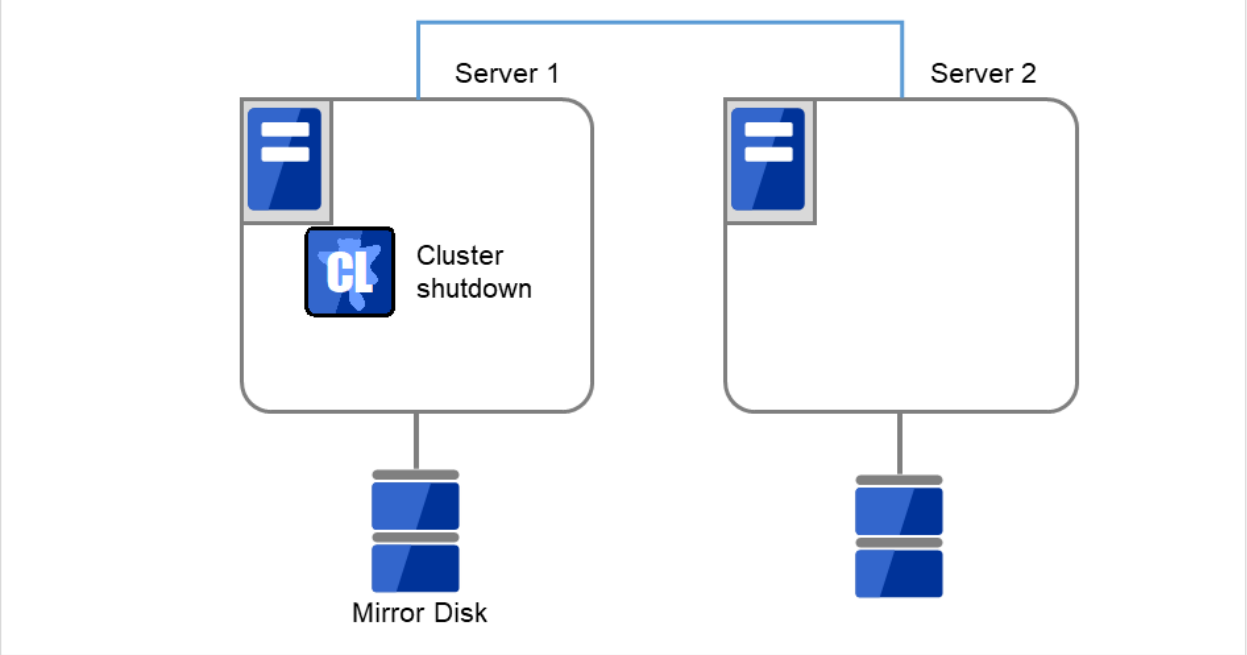

Fig. 2.29: Execute a cluster shutdown on either of the servers

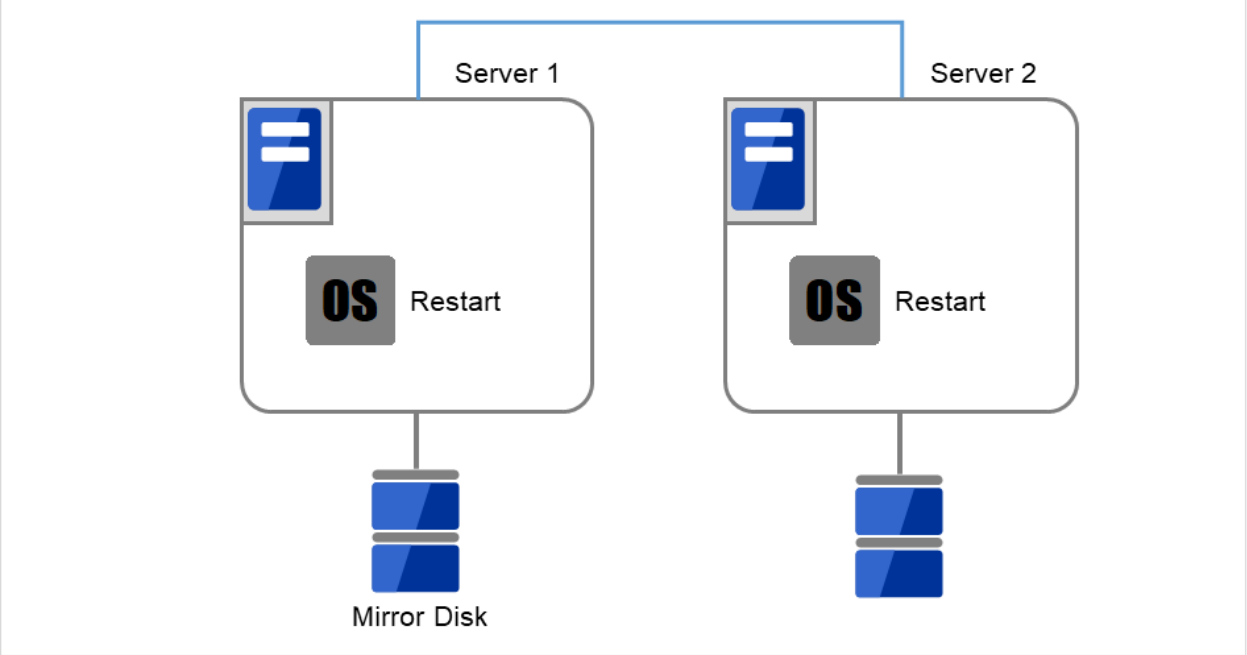

Fig. 2.30: Restart the OS

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

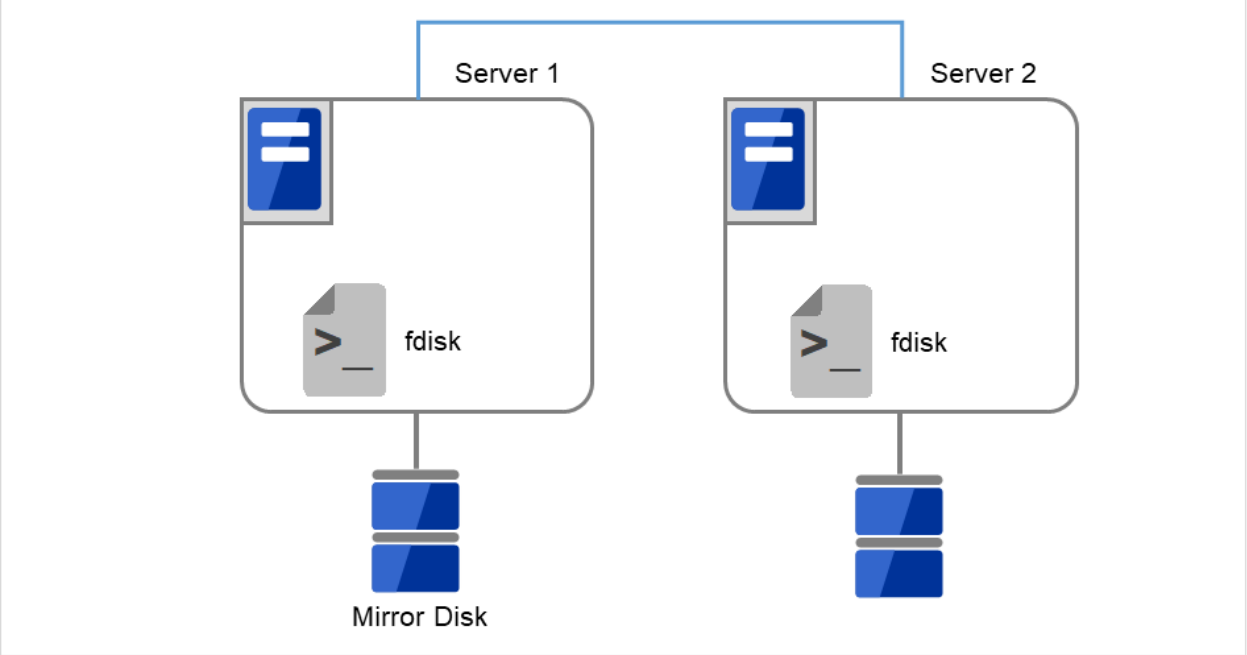

Fig. 2.31: Change the size of a partition

6. Run the following command on both servers.

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

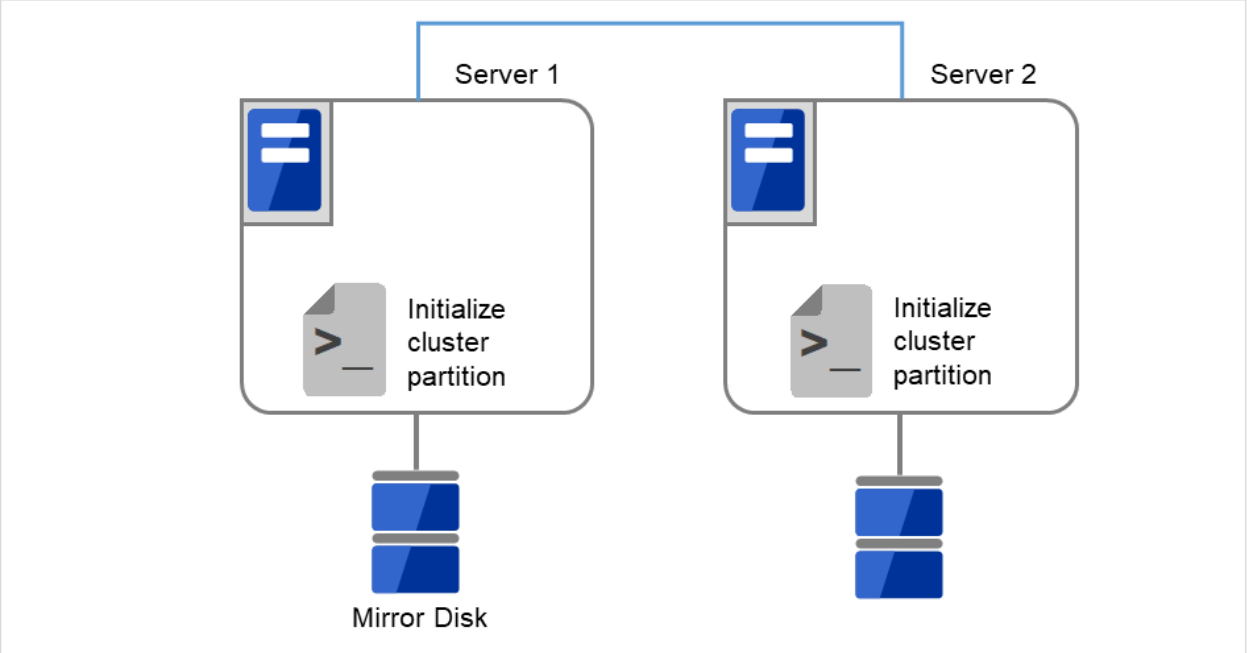

Fig. 2.32: Initialize a cluster partition

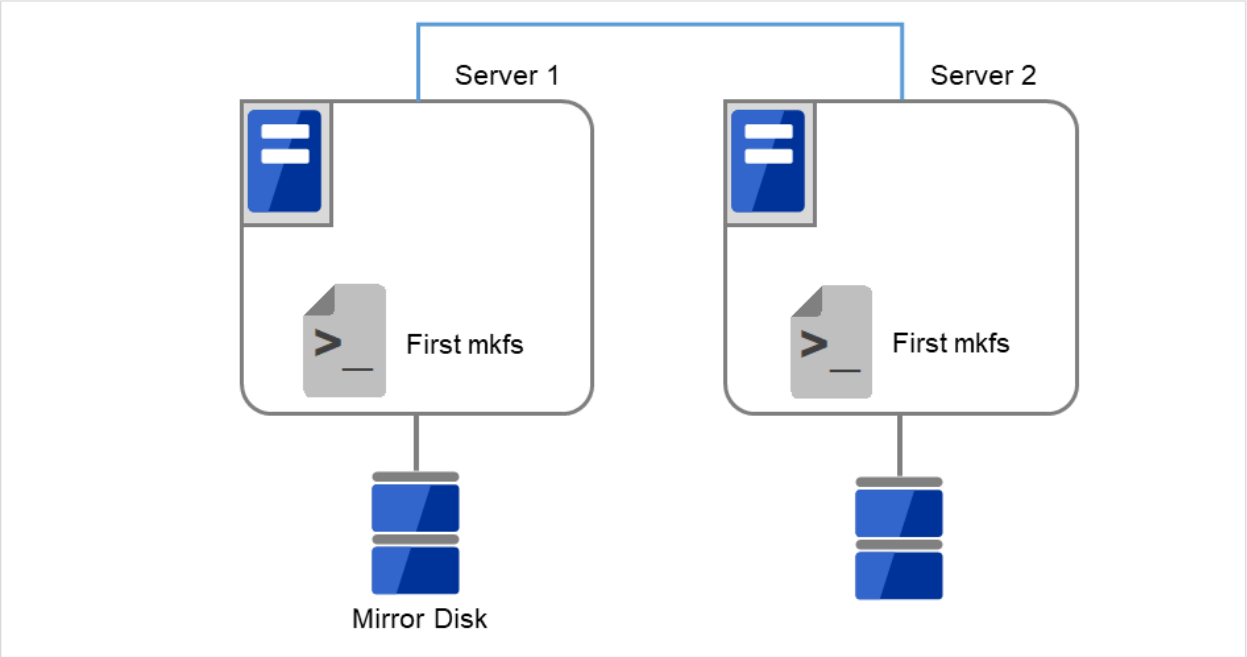

Fig. 2.33: Execute the first mkfs to create a file system

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. Set the EXPRESSCLUSTER service to start up on both servers.

```
clpsvcctrl.sh --enable core
```

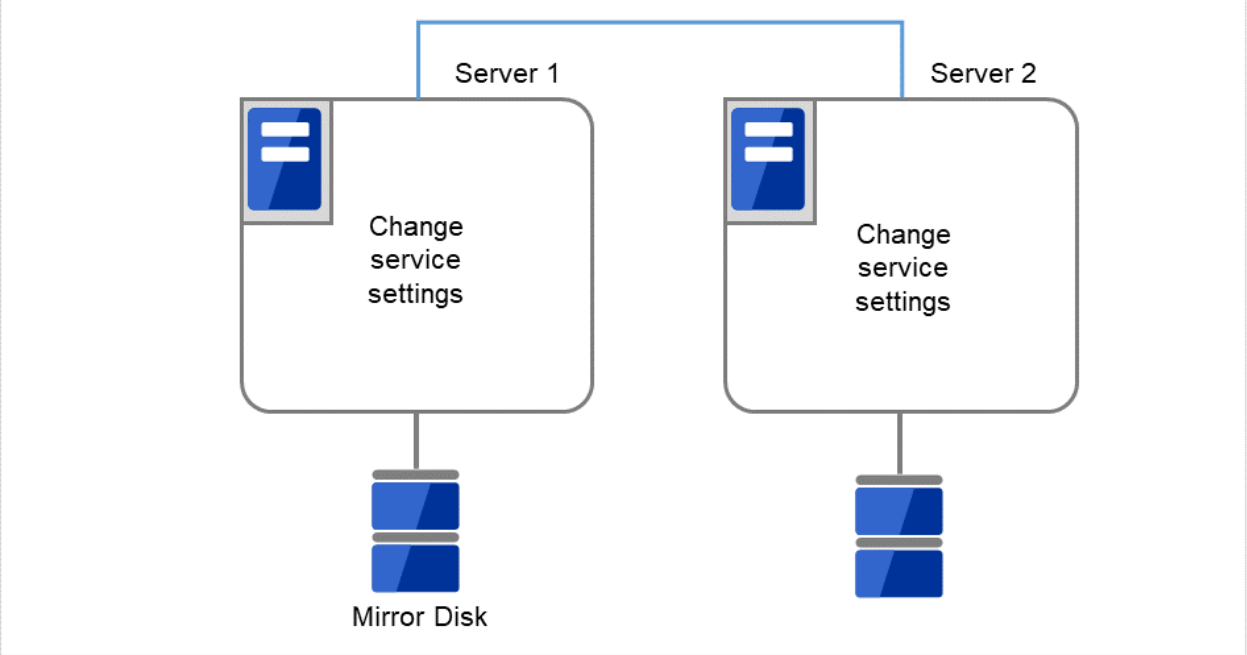

Fig. 2.34: Set the EXPRESSCLUSTER service to start

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>
   ```

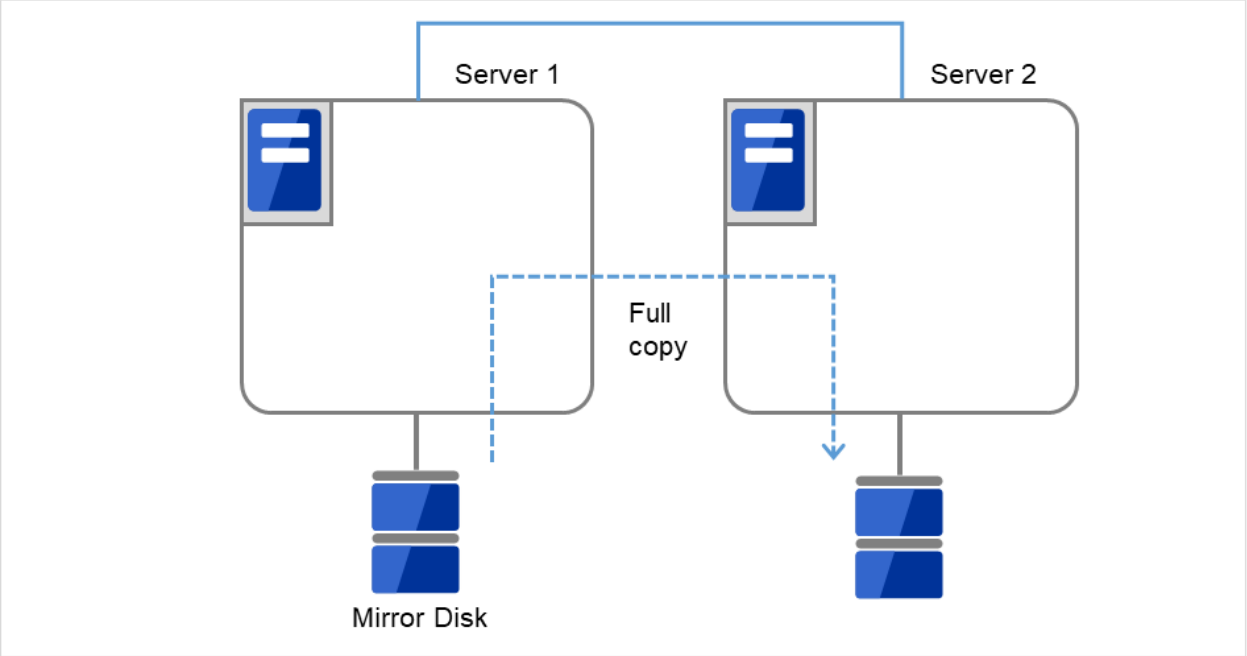

Fig. 2.35: Start mirror recovery on Server 1

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

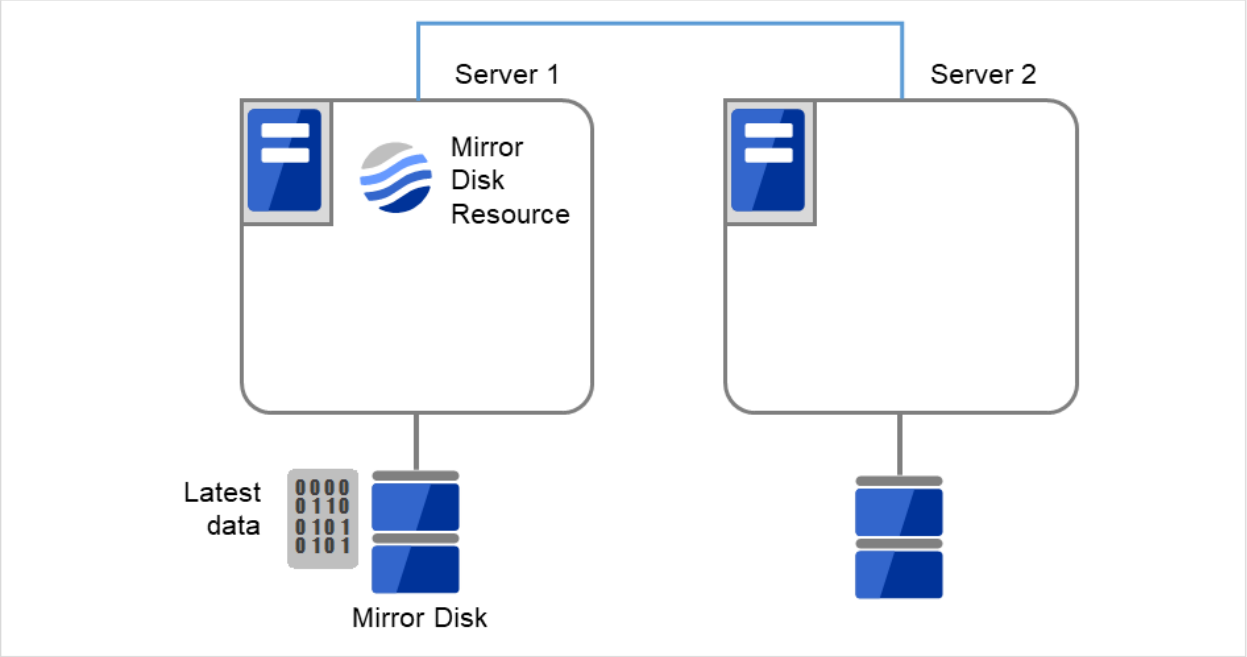

Fig. 2.36: Initial mirror construction is completed

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.

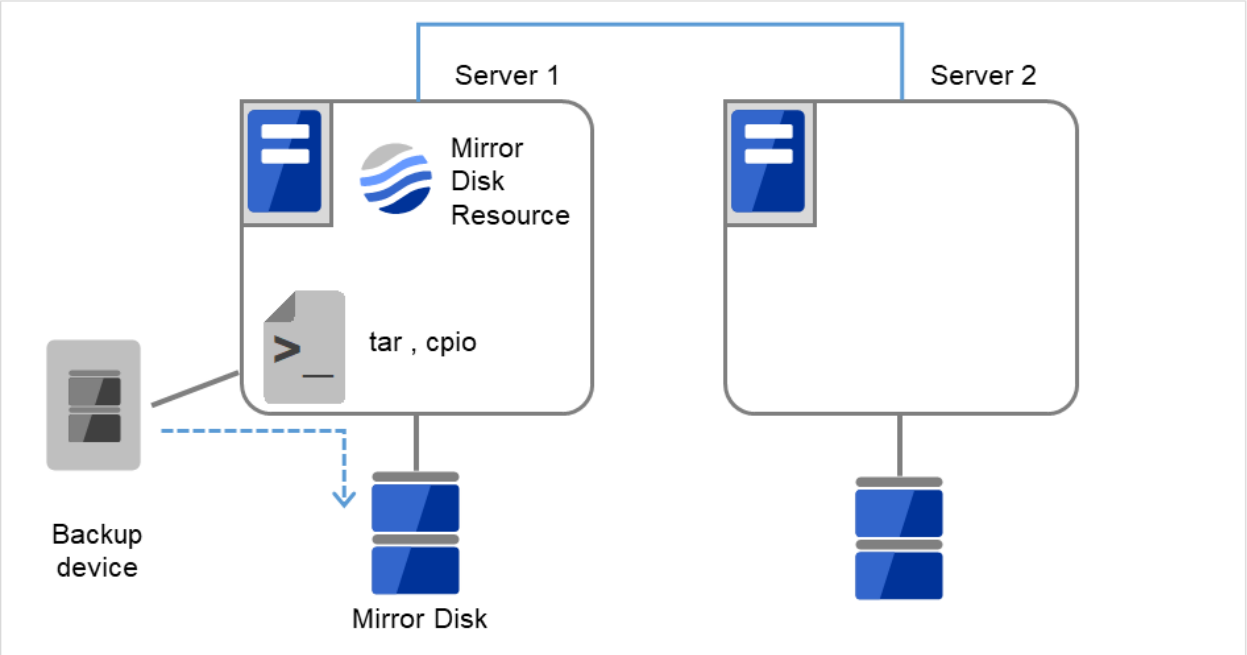

Fig. 2.37: Restore the data that was backed up

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.

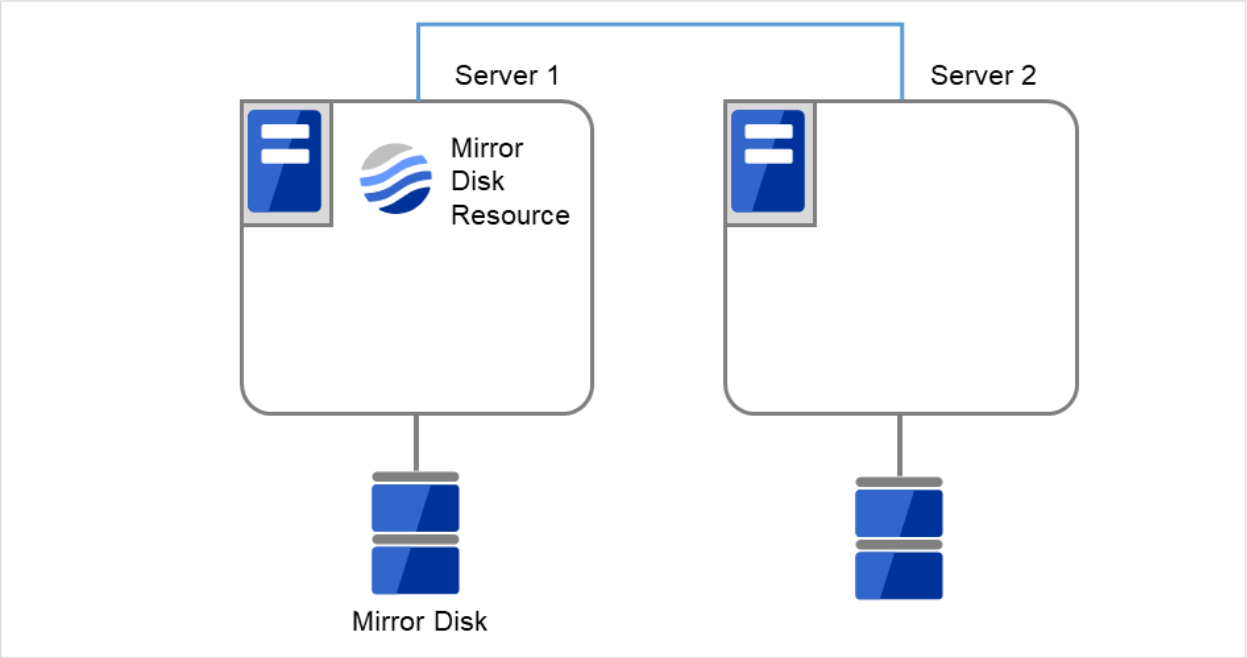

Fig. 2.38: Mirror disk resources activated on Server 1

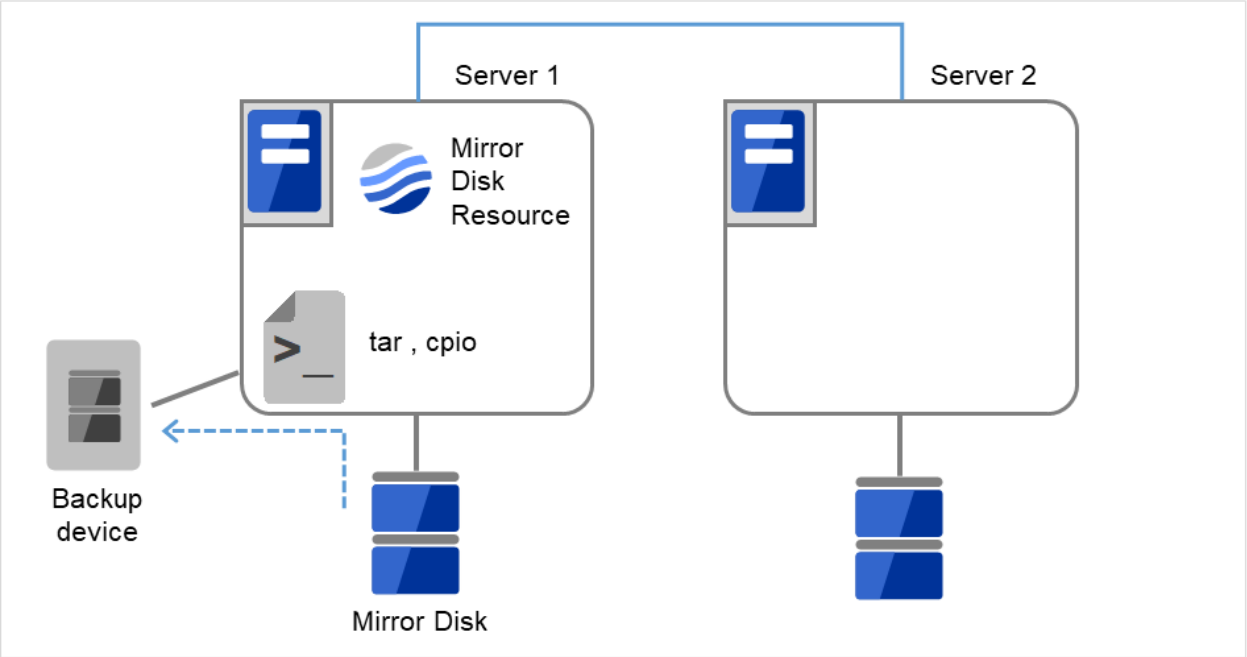

Fig. 2.39: Back up the data on Server 1

3. Set the EXPRESSCLUSTER service not to start up on either of the servers.

```
clpsvcctrl.sh --disable core
```

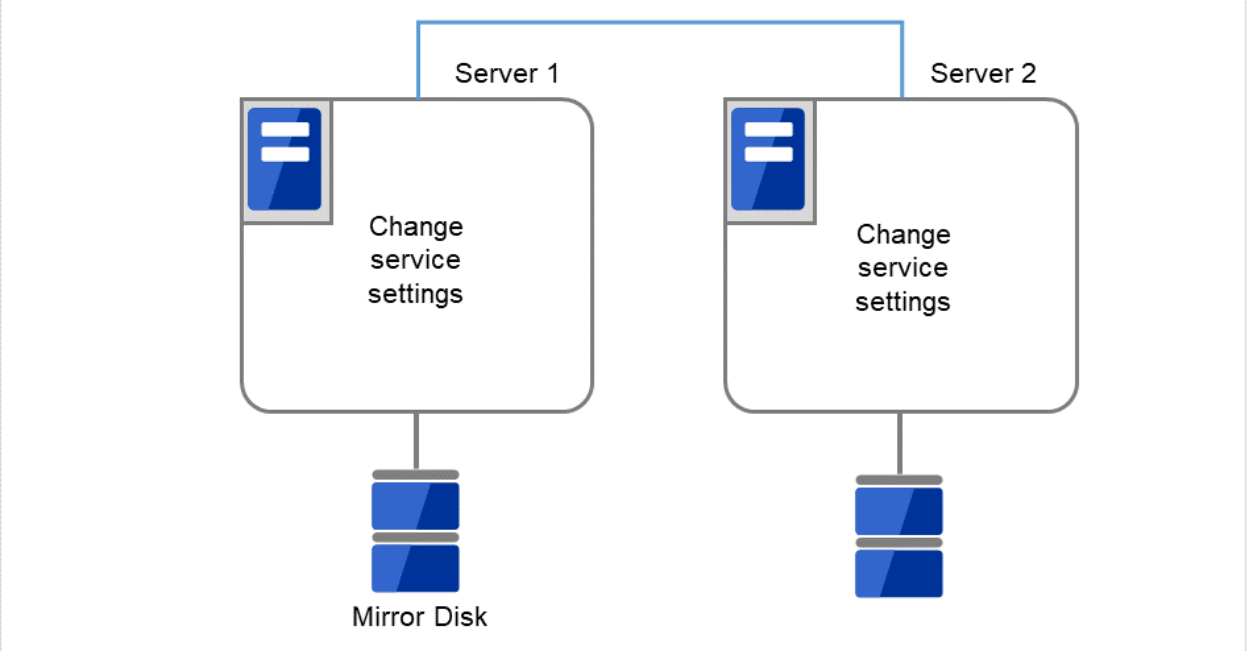

Fig. 2.40: Set the EXPRESSCLUSTER service not to start

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.

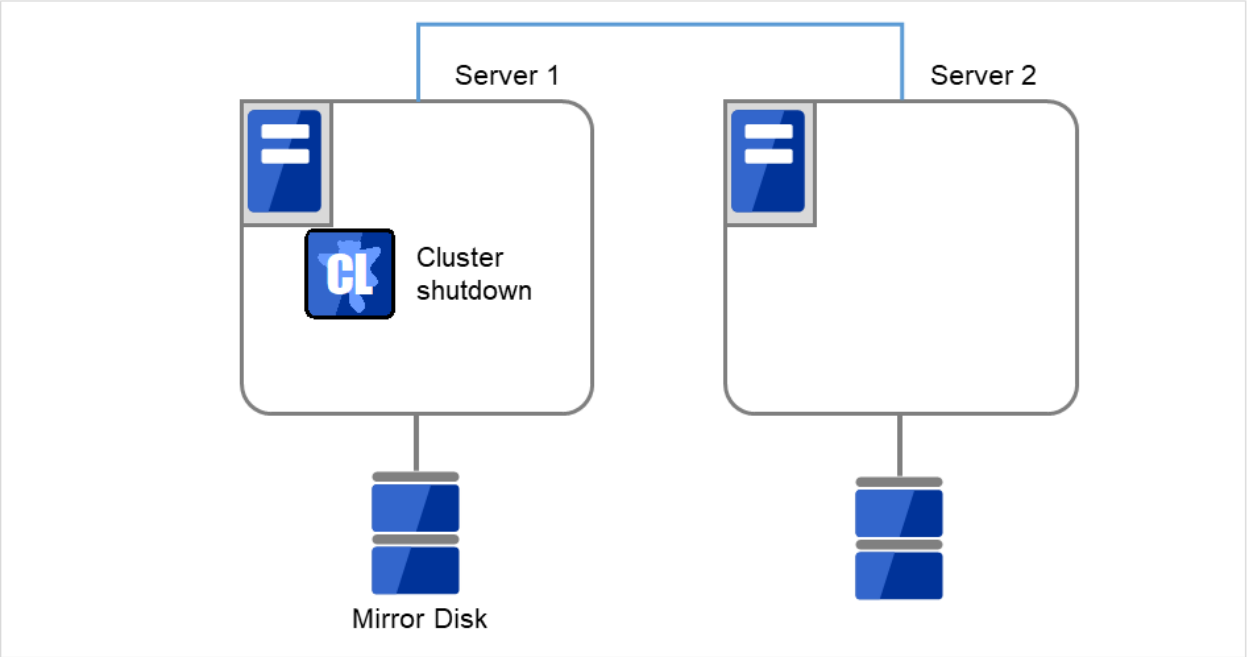

Fig. 2.41: Execute a cluster shutdown on either of the servers

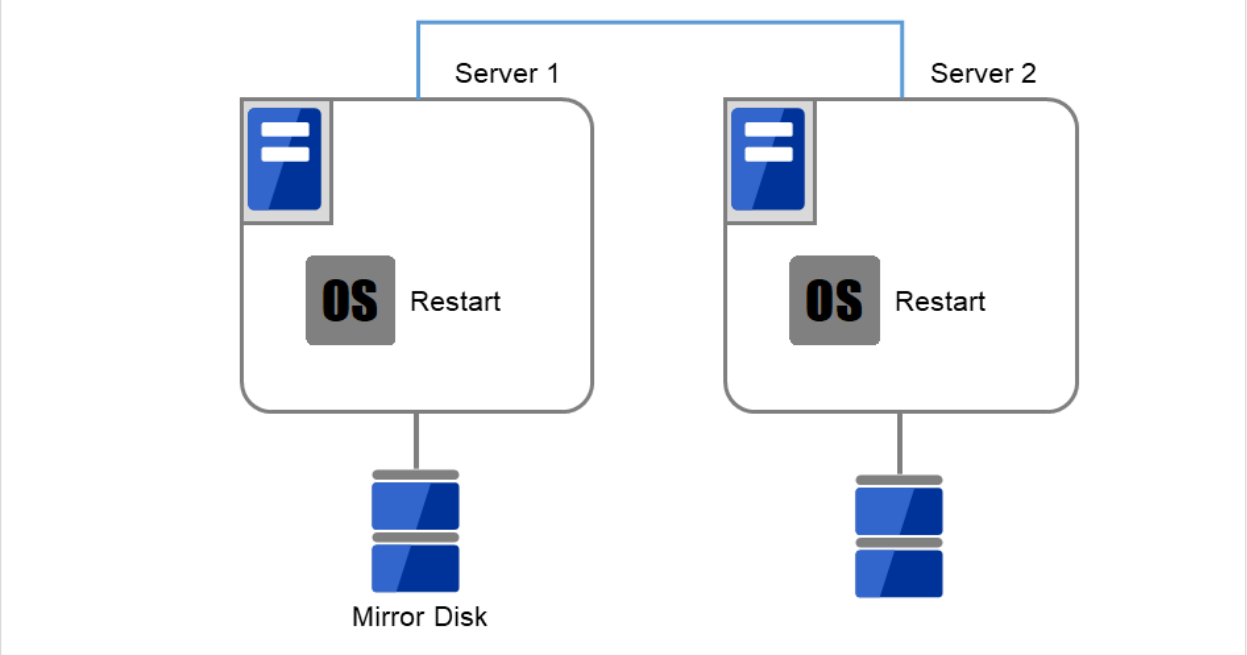

Fig. 2.42: Restart the OS

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

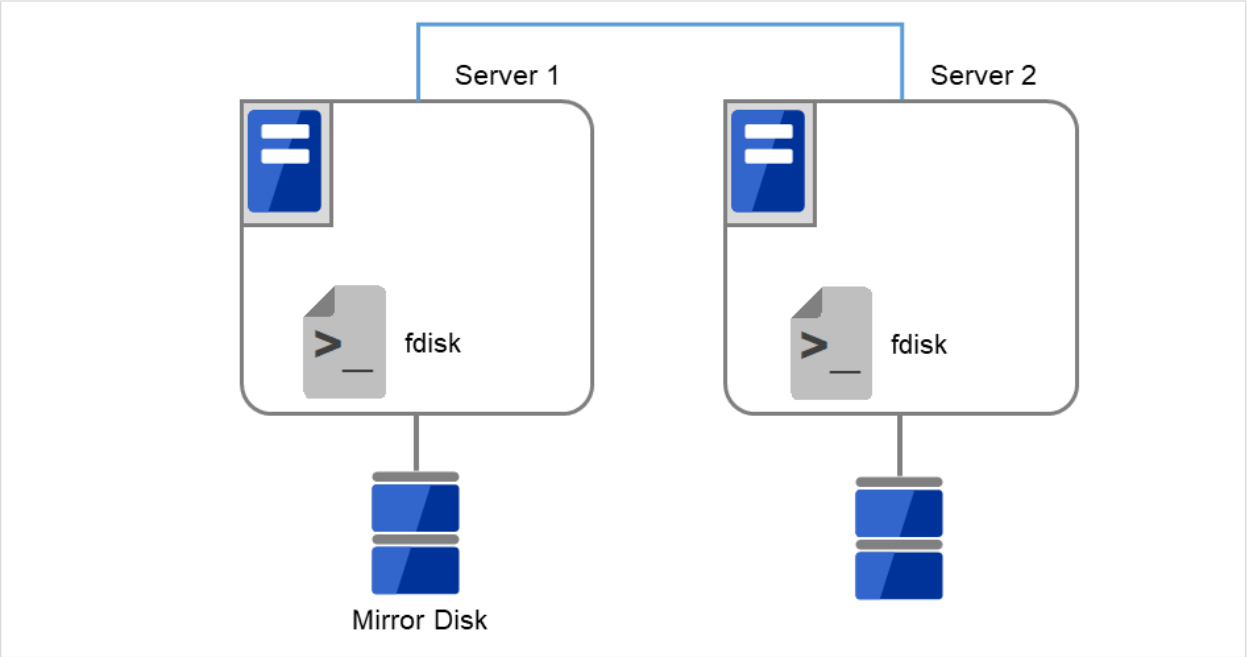

Fig. 2.43: Change the size of a partition

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 "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_resource_name>
   ```

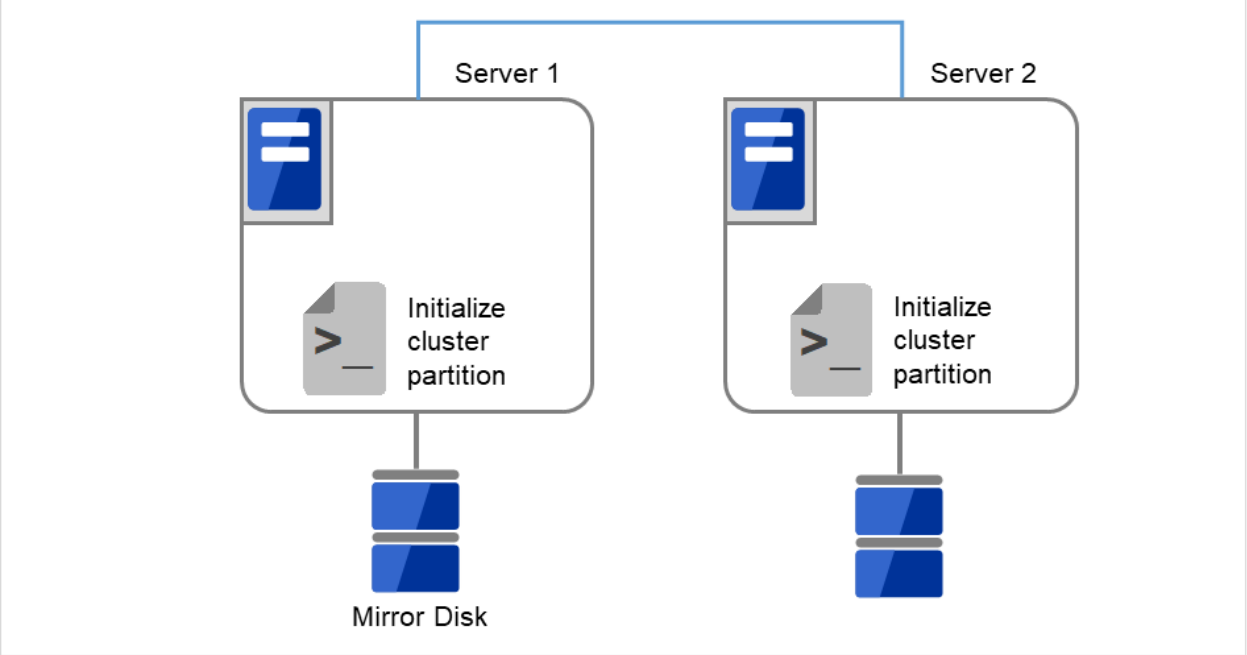

Fig. 2.44: Initialize a cluster partition

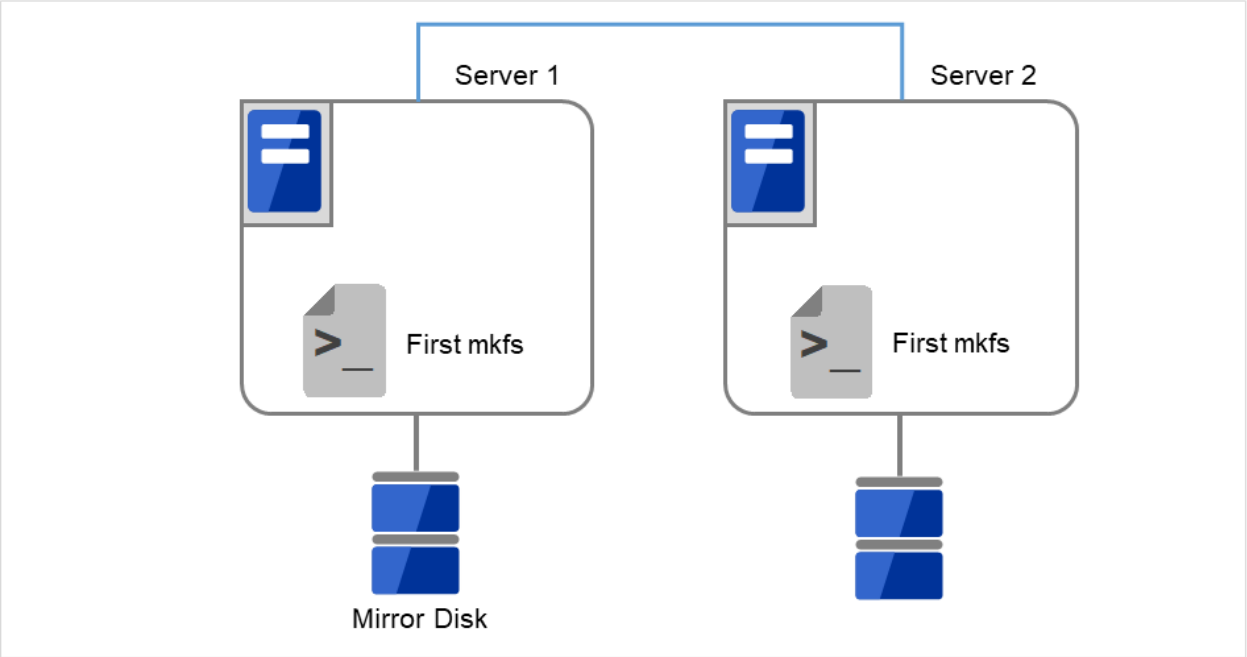

Fig. 2.45: Execute the first mkfs to create a file system

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. Set the EXPRESSCLUSTER service to start up on both servers.

```
clpsvcctrl.sh --enable core
```

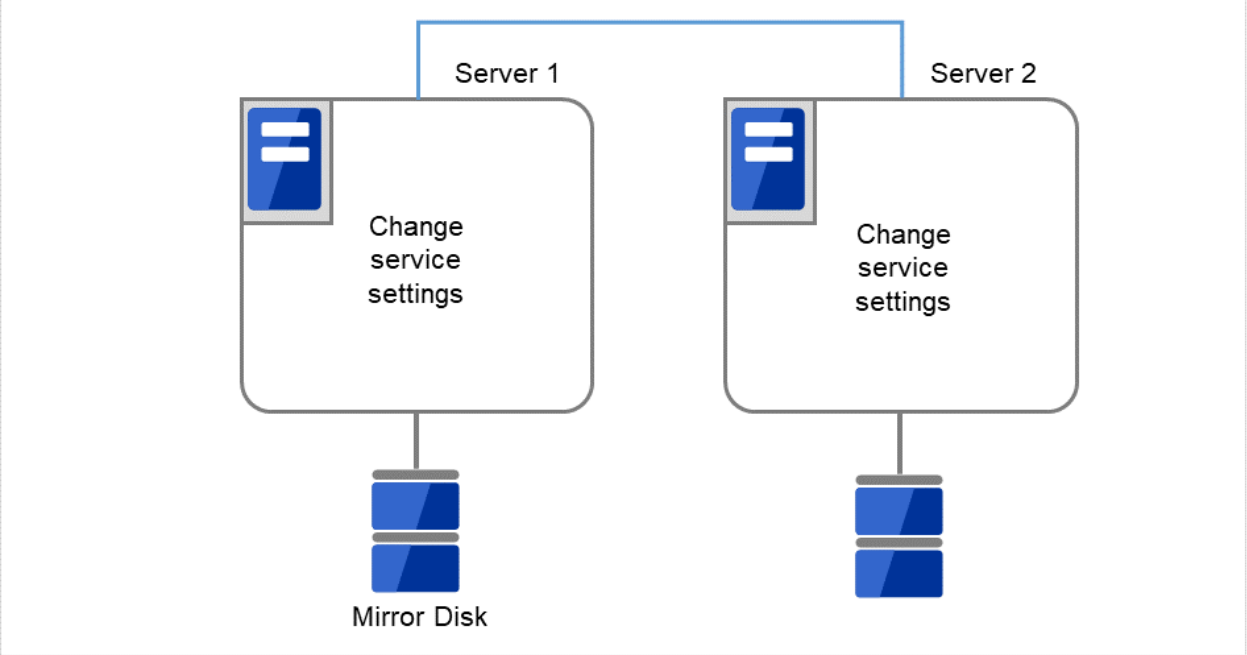

Fig. 2.46: Set the EXPRESSCLUSTER service to start

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>
    ```

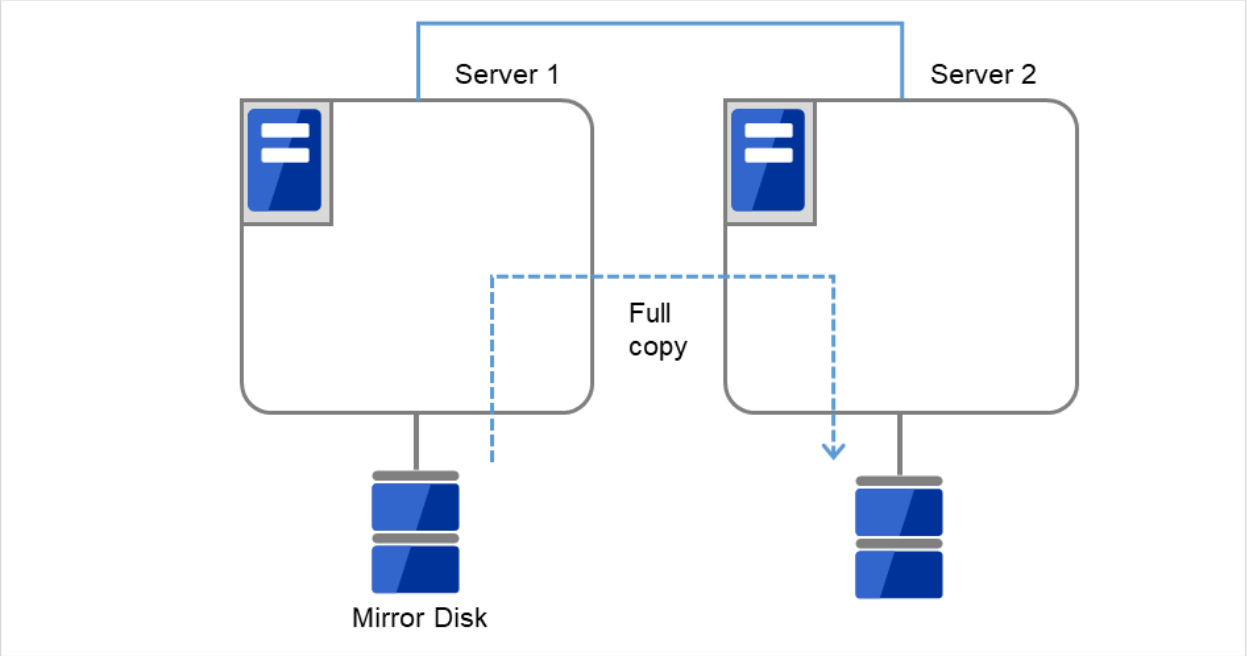

Fig. 2.47: Start mirror recovery on Server 1

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

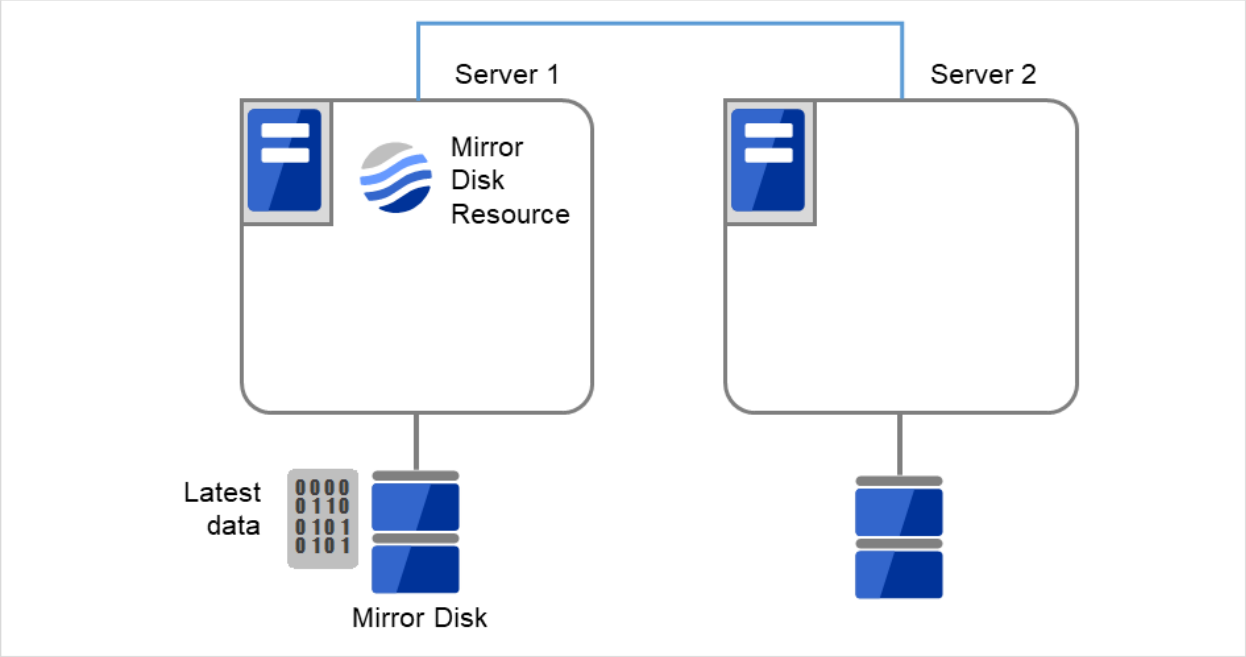

Fig. 2.48: Initial mirror construction is completed

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.

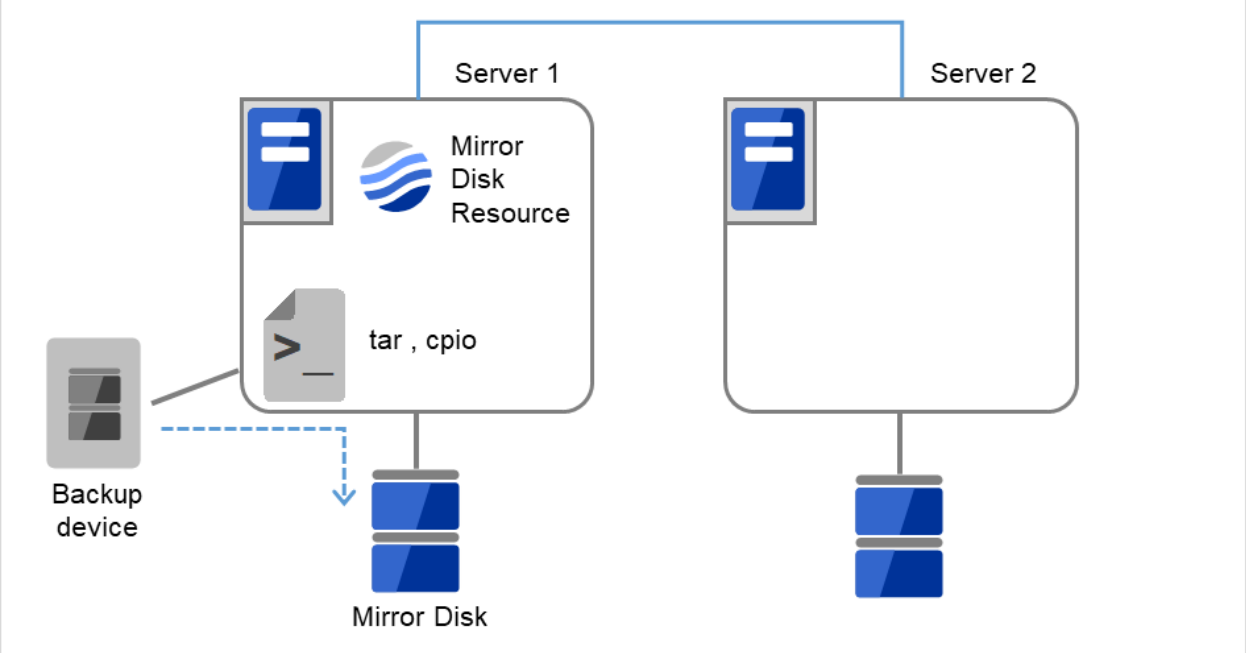

Fig. 2.49: Restore the data that was backed up

2.27 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.

2.27.1 With the data partition configured with LVM

If LVM is used for partitioning, you can extend the data partition without re-creating resources or stopping your business (depending on the file system used).

Table 2.34: LVM data partition extension

File system of data partition	Resource re-creation	Business down	Reference
xfs, ext3, ext4, or no file system (none)	Not required	Not required	2.27.1. *Expanding data partition for an ext-based or xfs system, or no file system used*
Other than above	Required	Required	2.27.1. *Expanding data partition for other file systems*

Note: This method is intended only for extension. To shrink partitions, refer to "2.27.2. *With the data partition configured without LVM*".

Note: If you follow the instruction below to extend data partition, LVM must be used for the data partition, and unused PE (physical extents) of the volume group must be sufficient.

Expanding data partition for an ext-based or xfs system, or no file system used

1. Run the [clpstat] command or use Cluster WebUI to confirm the name of a hybrid disk resource you want to resize.
2. On the server containing the activated group with the hybrid disk resource to be resized, back up the data in a partition to a device (such as tape) for unexpected events. However, there is no support for any backup command for direct access to the partition device. You can skip this step if there is no problem with discarding the data on the hybrid disk resource.
3. Confirm the following:
   - The status of the hybrid disk resource is normal.
   - On both servers, there is sufficient, unused PE (physical extent) of the volume group that the data partition belongs to.
4. Suspend all the hybrid disk monitor resources in the operation mode of Cluster WebUI to prevent automatic mirror recovery.

5. Keeping in operation the current server of each server group, shut down all the other servers. You can check the status of the current server by executing the clphdstat with the -a option. The following shows an example of checking the status of the current server in the hd01 resource:

```
clphdstat -a hd01
```

6. Execute the following clphdctrl command on the current server of the server group where the hybrid disk resource is deactivated.

   If the resource is not activated on either server group, run the command on either of the servers. The following is an example for extending an hd01 data partition to 500 gibibytes.

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

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

---

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

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

8. If an xfs or ext-based file system is configured on the data partition, extend the file system area by running the command on the server where hybrid disk resources are activated.

   <For xfs file systems>

   ```
   # xfs_growfs /mnt/nmp1
   ```

   (Change /mnt/nmp1 as necessary depending on the hybrid disk resources mount point.)

   <For ext-based file systems>

   ```
   # resize2fs -p /dev/NMP1
   ```

   (Replace NMP1 with the mirror partition device name.)

   You can skip this step if no file system is used for the data partition (none).

9. In the operation mode of Cluster WebUI, restart all the hybrid disk monitor resources that were suspended in step 4.
10. Start up all the servers that you shut down in step 5.

Important:

The [clpmdctrl --resize] command is effective only when hybrid disk resources are in the normal status.
If the mirror becomes inconsistent (mirror break) between step 5 and 6, the data partition cannot be extended at step 6. In this case, use the -force option to forcibly extend the data partition in step 6 and complete all the steps. Then recover the mirror disk.

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

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

Note:

The size of the data partition depends on that of PE.
If the size of PE is 4M and `# clphdctrl --resize 1022M hd01` is specified, the size of the data partition becomes 1024M and the limit of the file system extension becomes 1022M.

Note: During the execution of xfs_growfs and resize2fs, a massive writing process may degrade the operation I/O performance. It is recommended that the execution be performed during off-peak hours.

Expanding data partition for other file systems

The basic procedure is the same as "2.27.2. *With the data partition configured without LVM*".

Note: Use the [lvextend] command instead of [fdisk] to resize a partition size.

2.27.2 With the data partition configured without LVM

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.

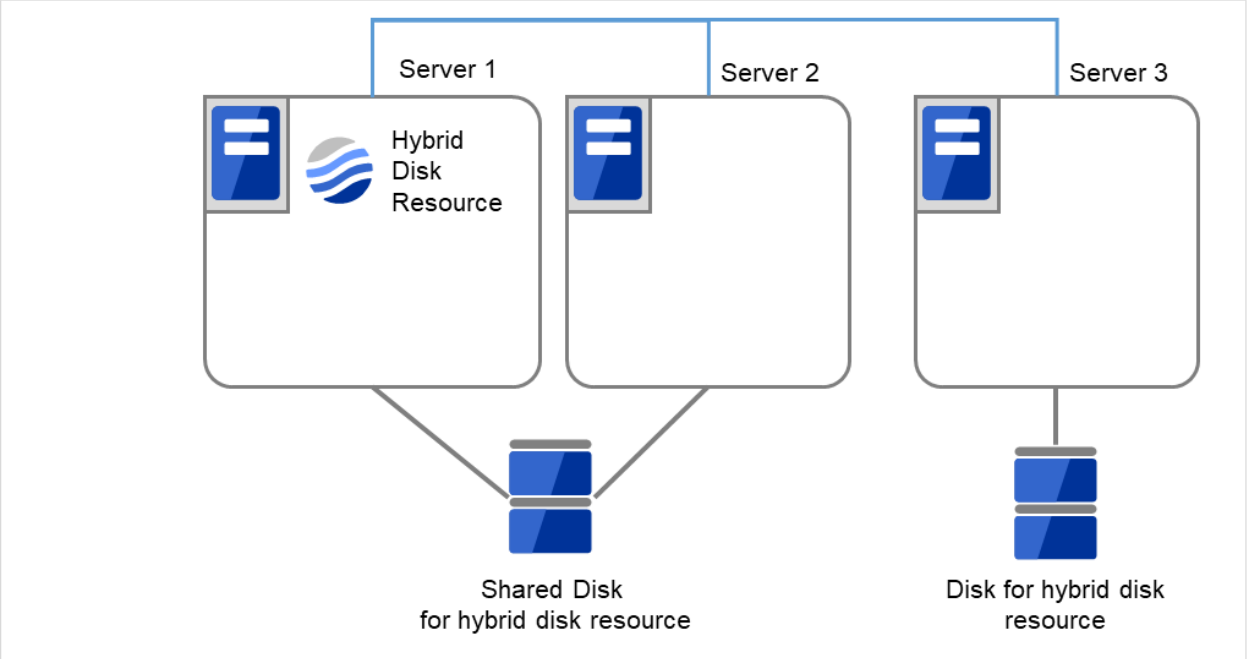

Fig. 2.50: Server 1 containing the activated group with the hybrid disk resource

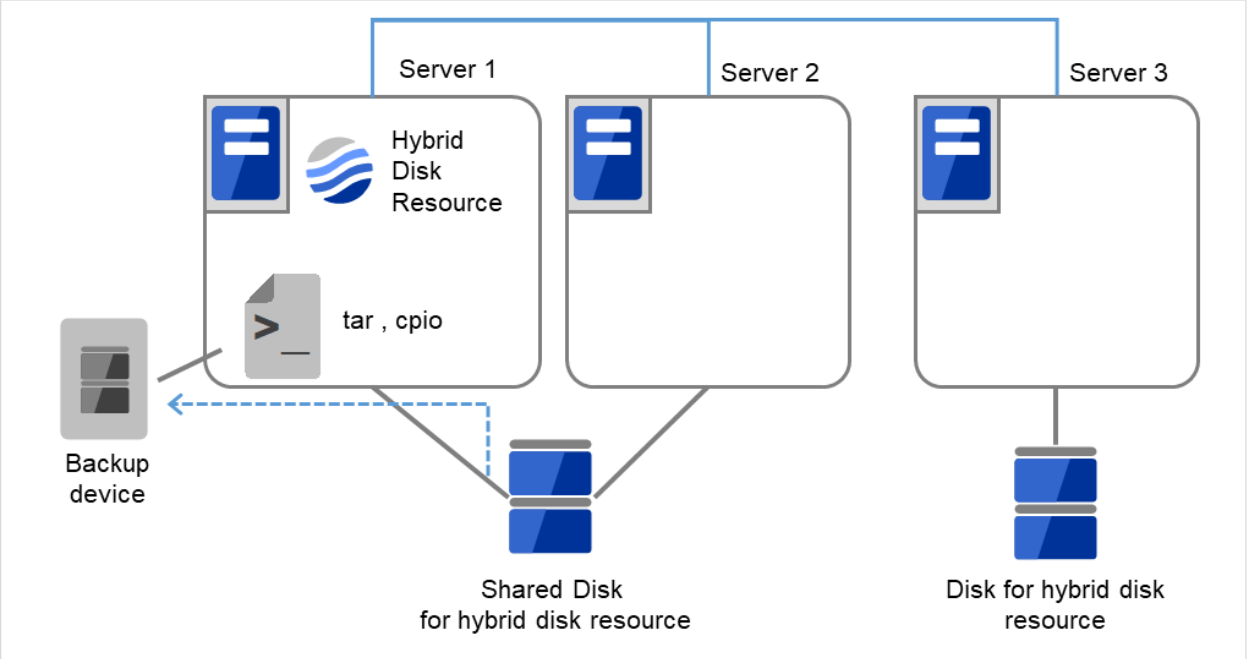

Fig. 2.51: Back up the data on Server 1

3. Set the EXPRESSCLUSTER service not to start up on any of all the servers.

```
clpsvcctrl.sh --disable core
```

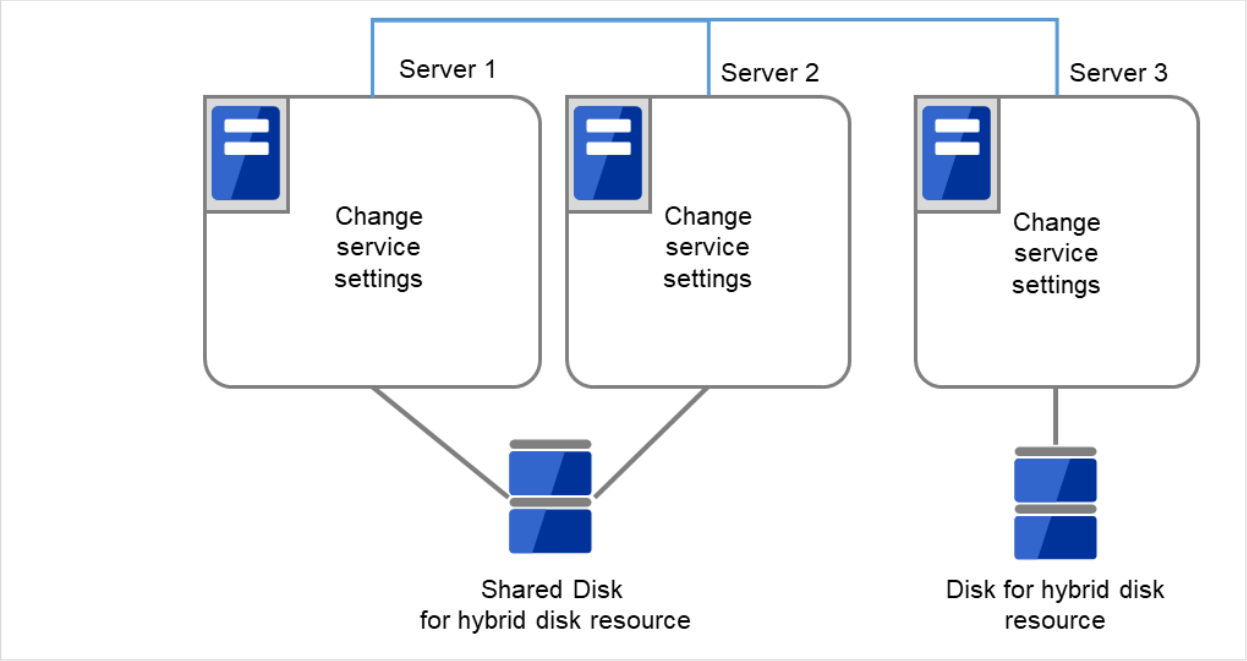

Fig. 2.52: Set the EXPRESSCLUSTER service not to start

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.

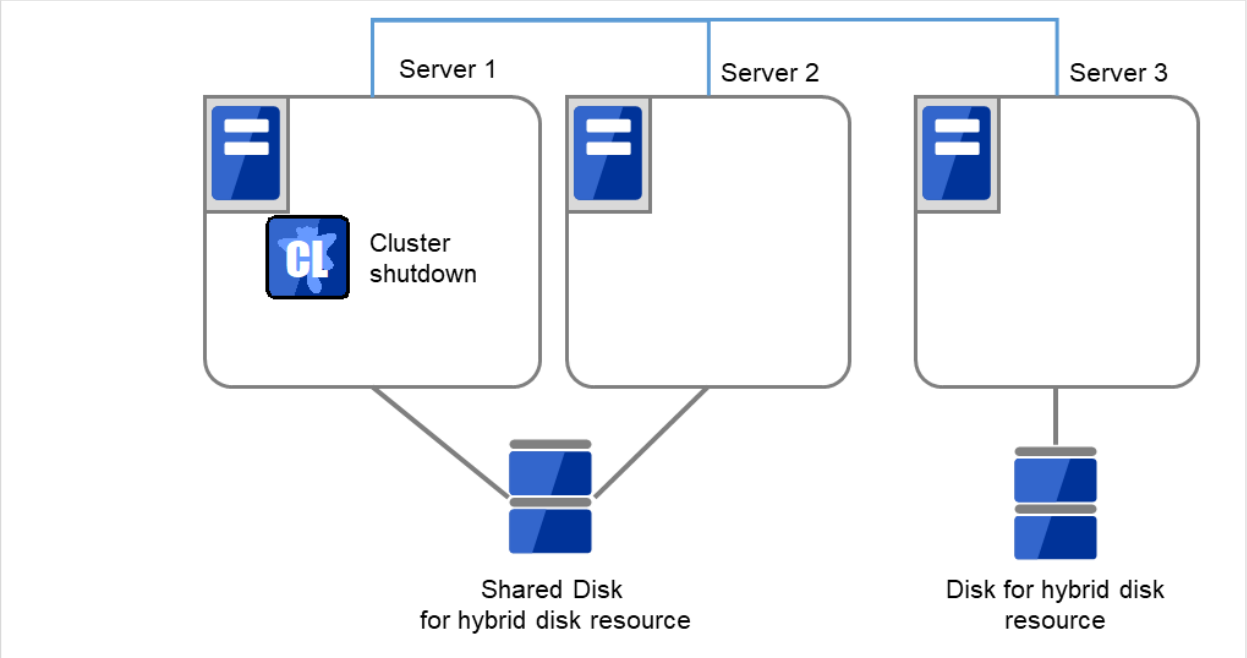

Fig. 2.53: Execute a cluster shutdown on either of the servers

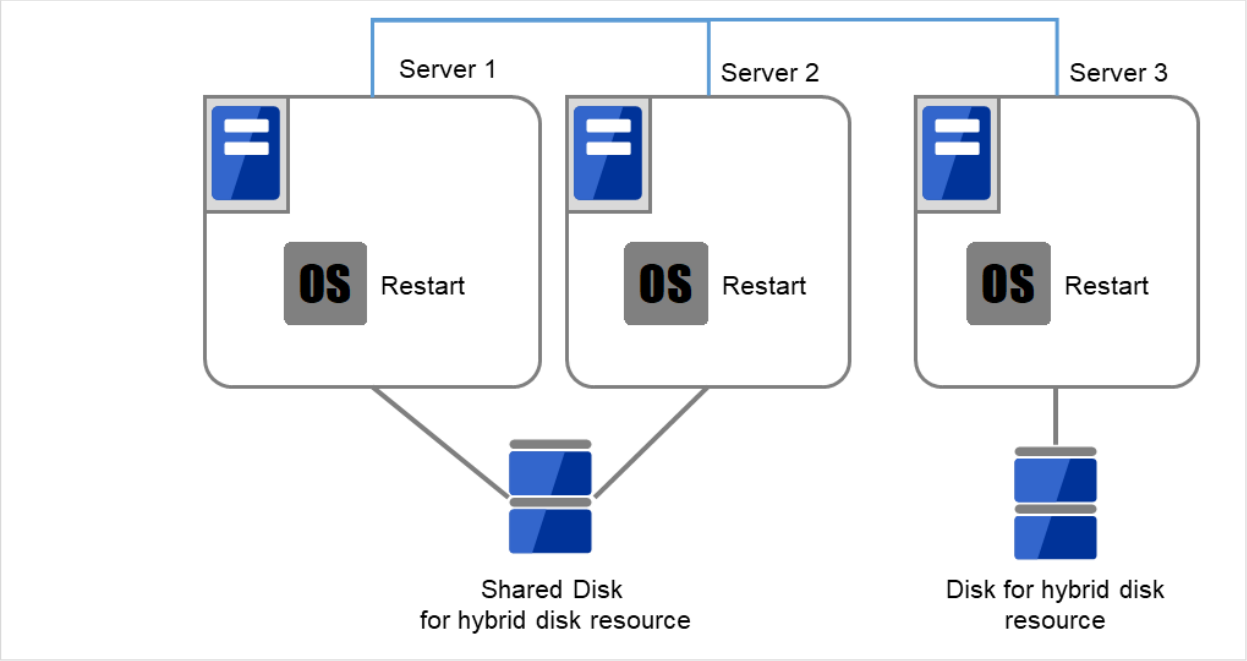

Fig. 2.54: Restart the OS

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.

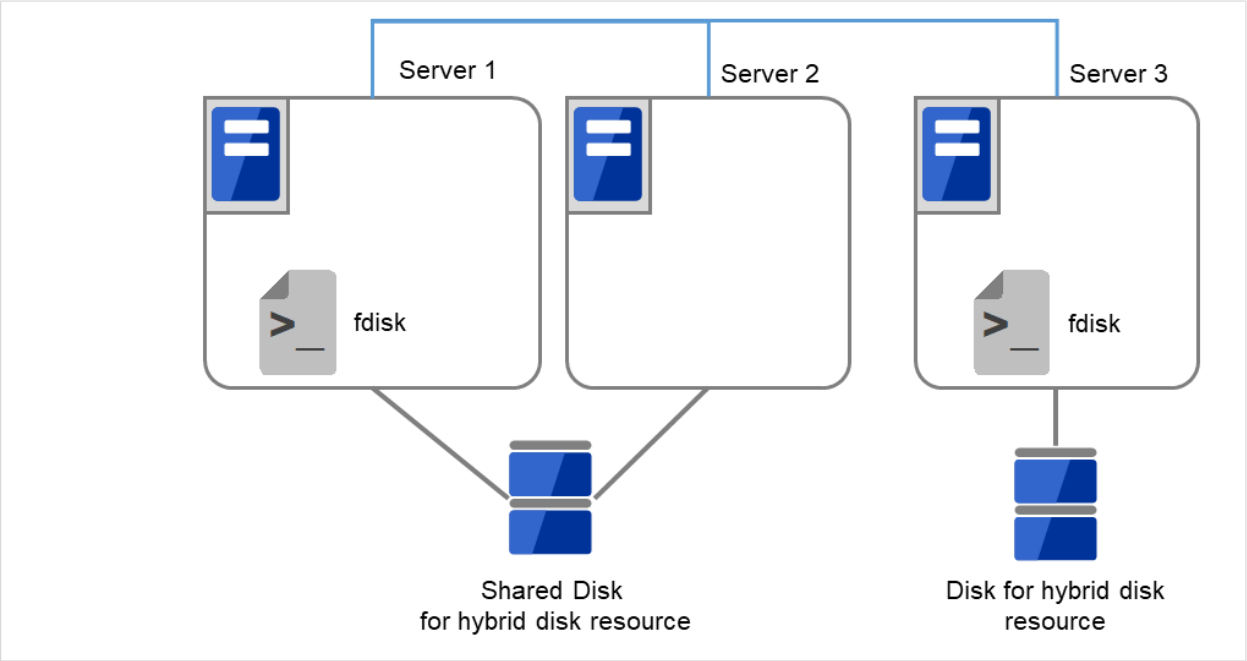

Fig. 2.55: Change the size of a partition

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.

```
# clphdinit --create force <Hybrid disk resource name>
```

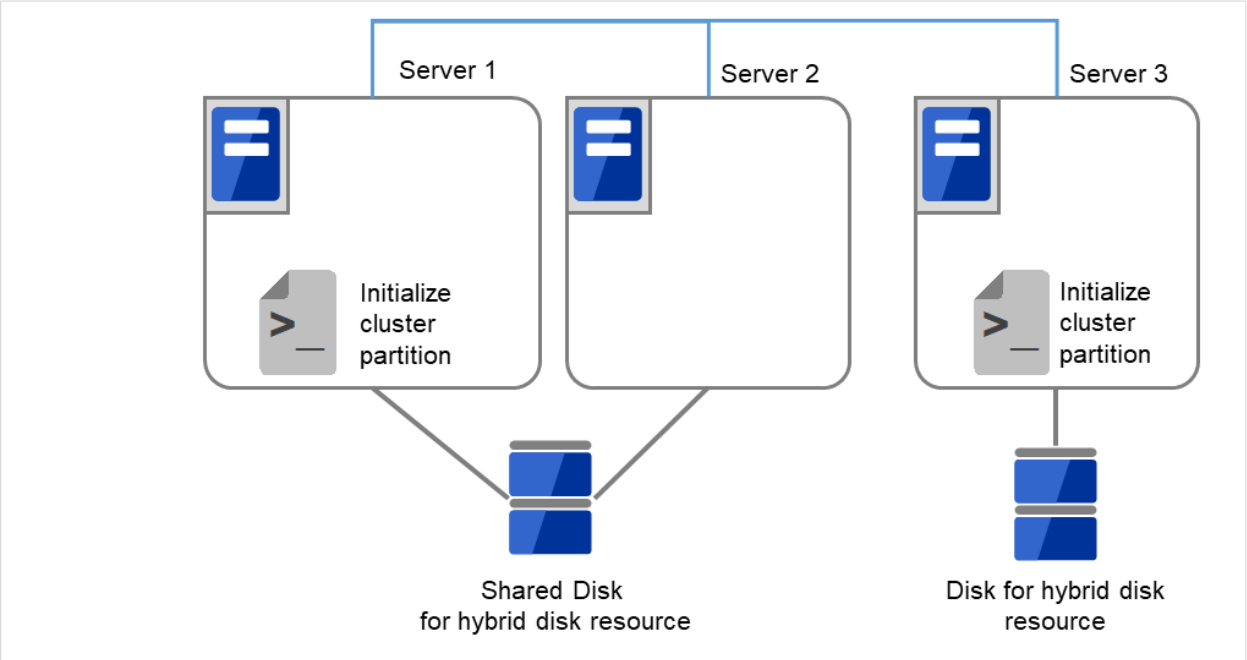

Fig. 2.56: Initialize a cluster partition

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>
   ```

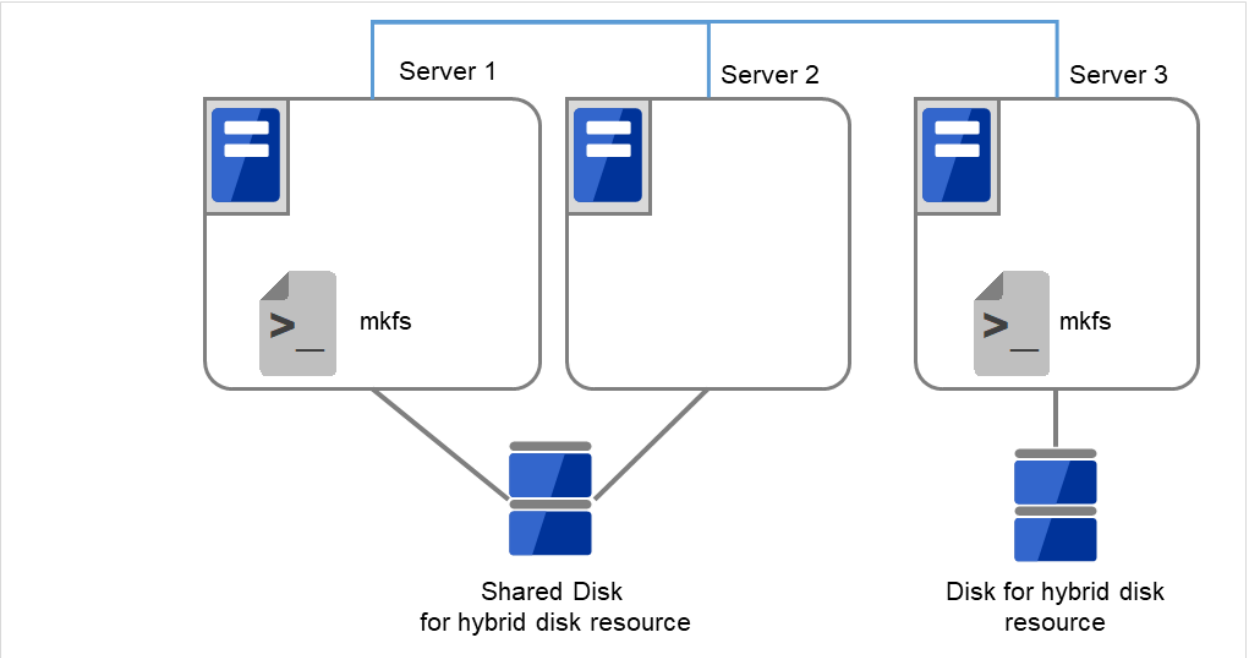

Fig. 2.57: Execute the first mkfs to create a file system

8. Set the EXPRESSCLUSTER service to start up on all servers.

```
clpsvcctrl.sh --enable core
```

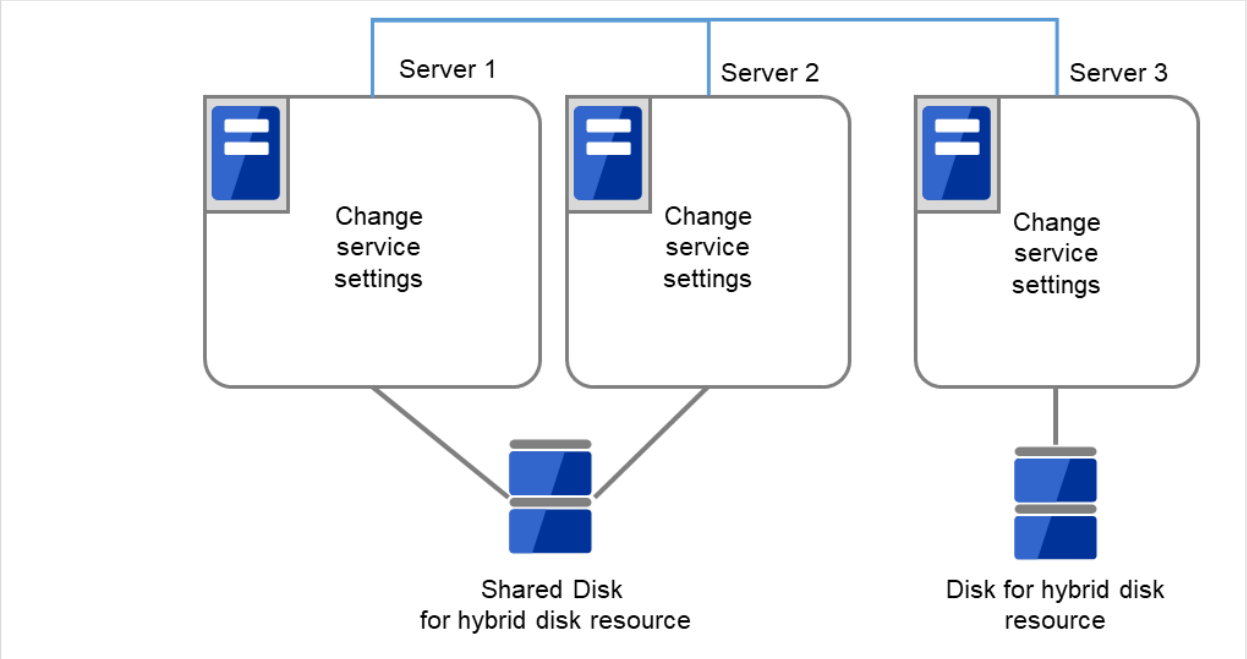

Fig. 2.58: Set the EXPRESSCLUSTER service to start

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>
```

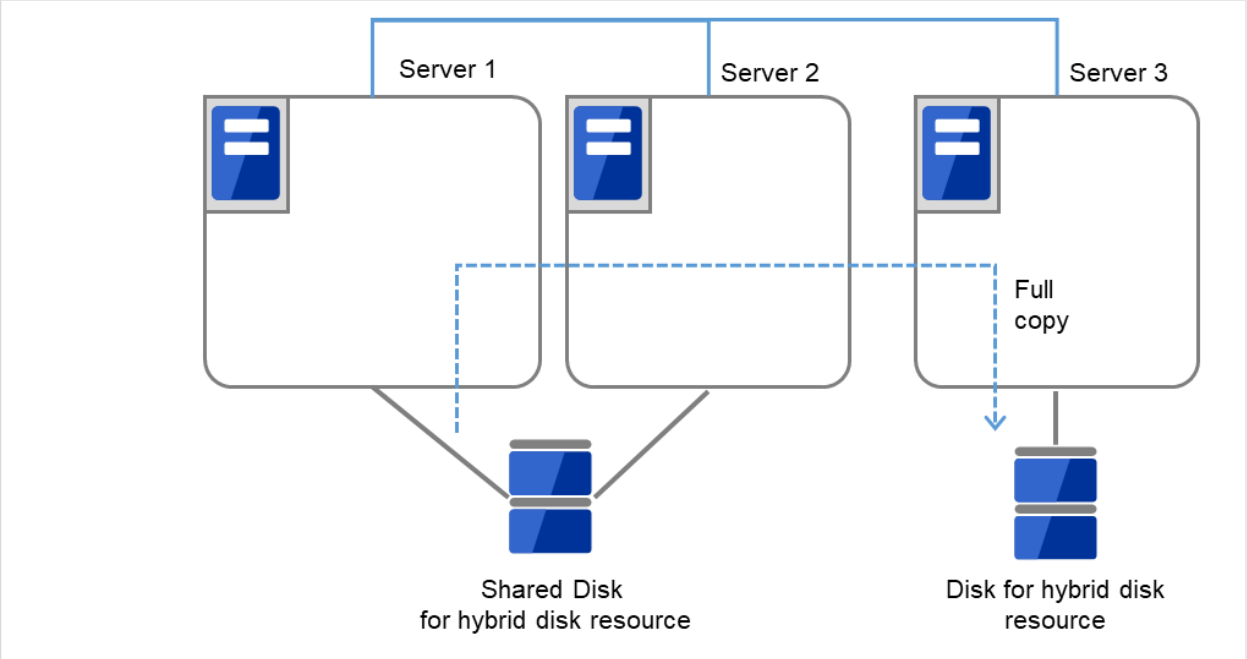

Fig. 2.59: Start mirror recovery on Server 1

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

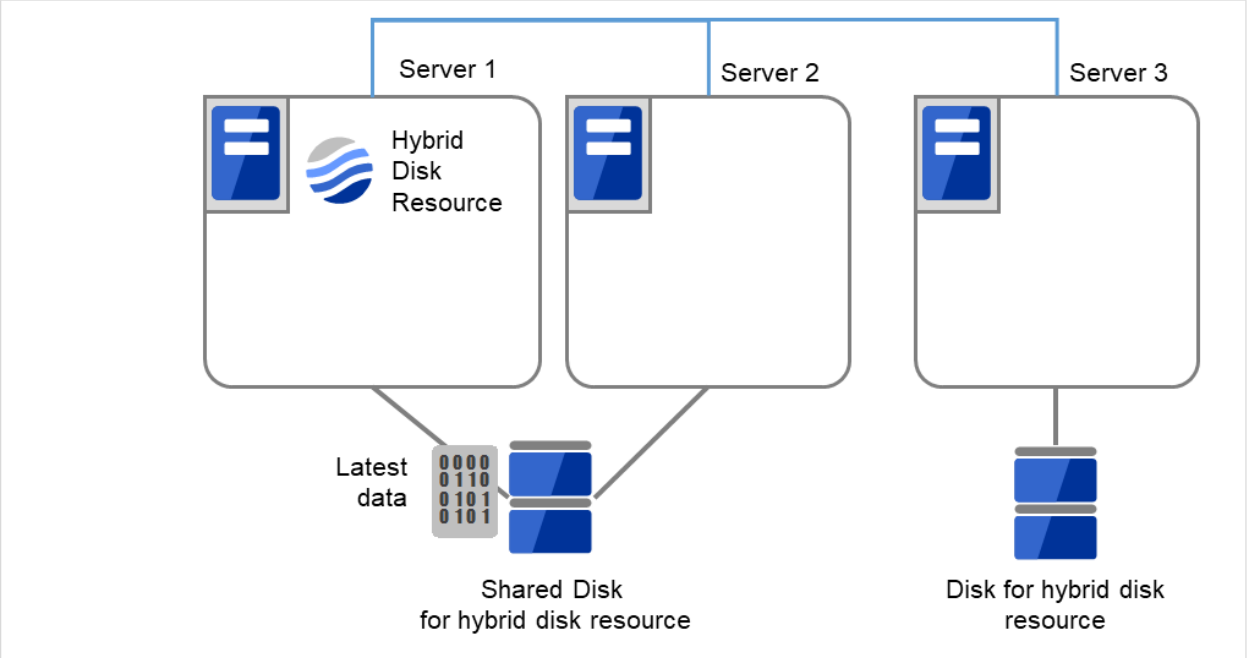

Fig. 2.60: Initial mirror construction is completed

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.

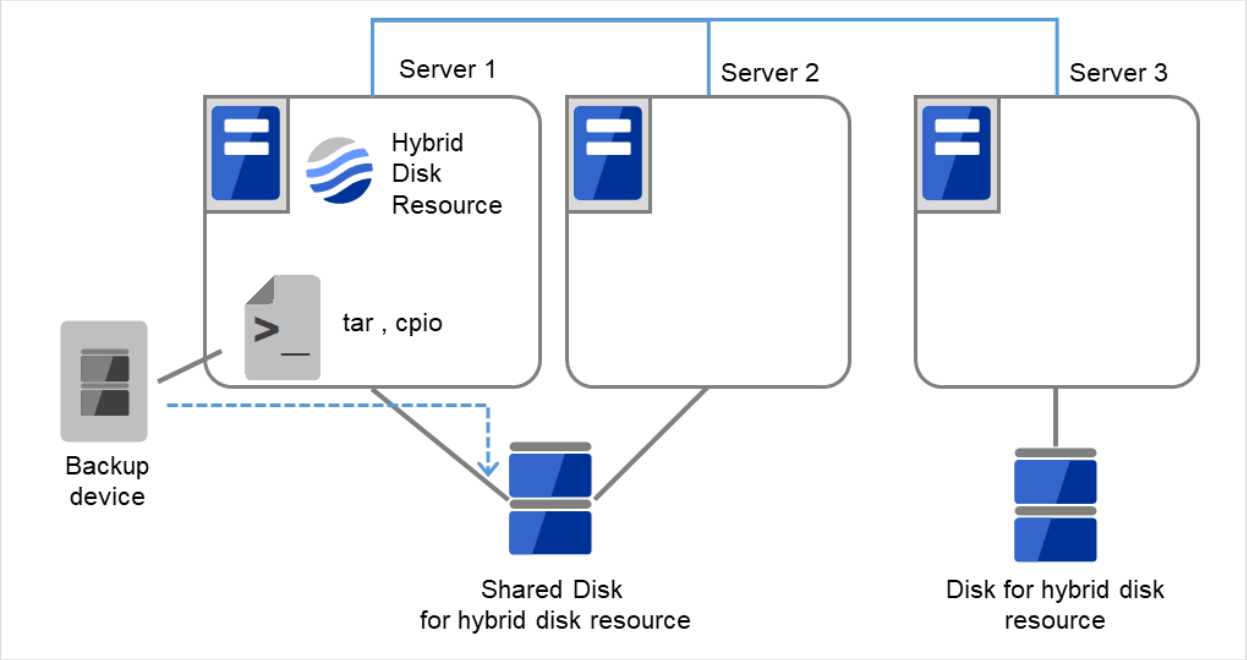

Fig. 2.61: Restore the data that was backed up

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.

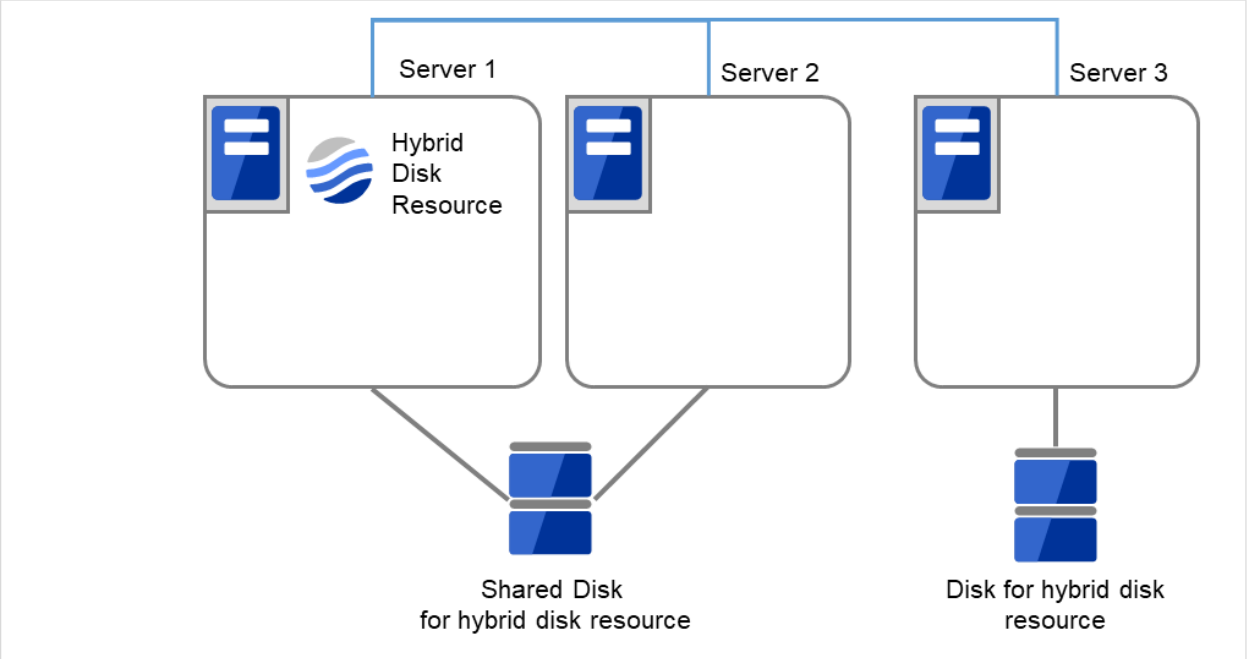

Fig. 2.62: Server 1 containing the activated group with the hybrid disk resource

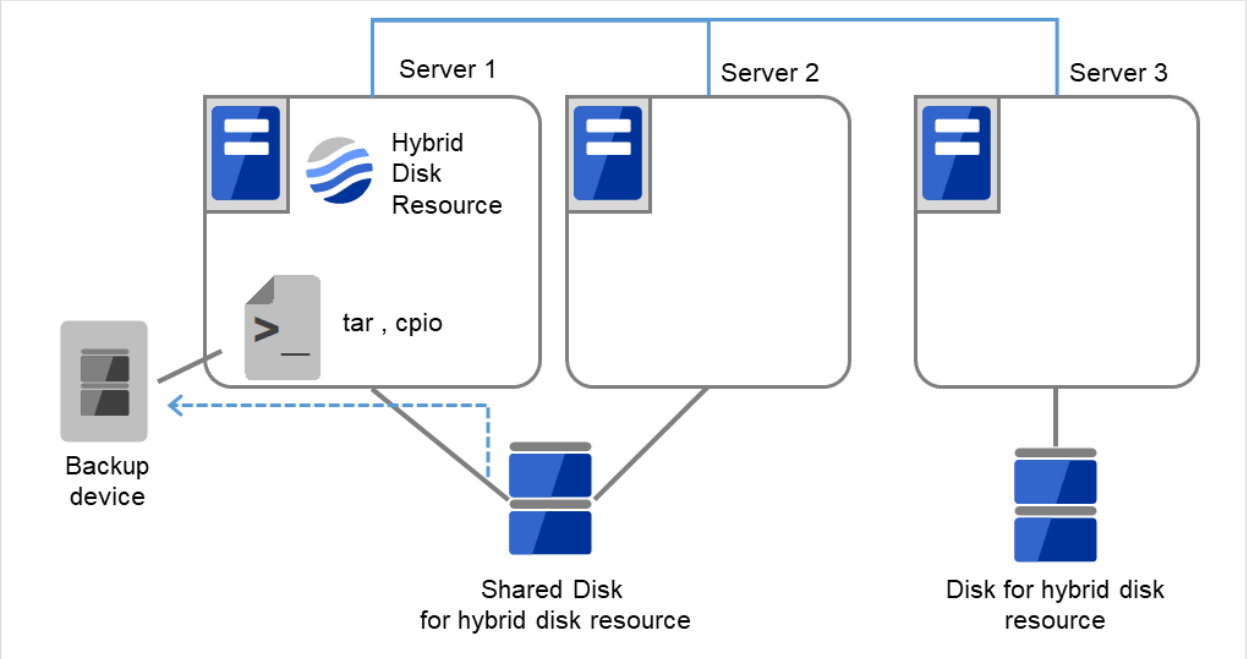

Fig. 2.63: Back up the data on Server 1

3. Set the EXPRESSCLUSTER service not to start up on any of all the servers.

```
clpsvcctrl.sh --disable core
```

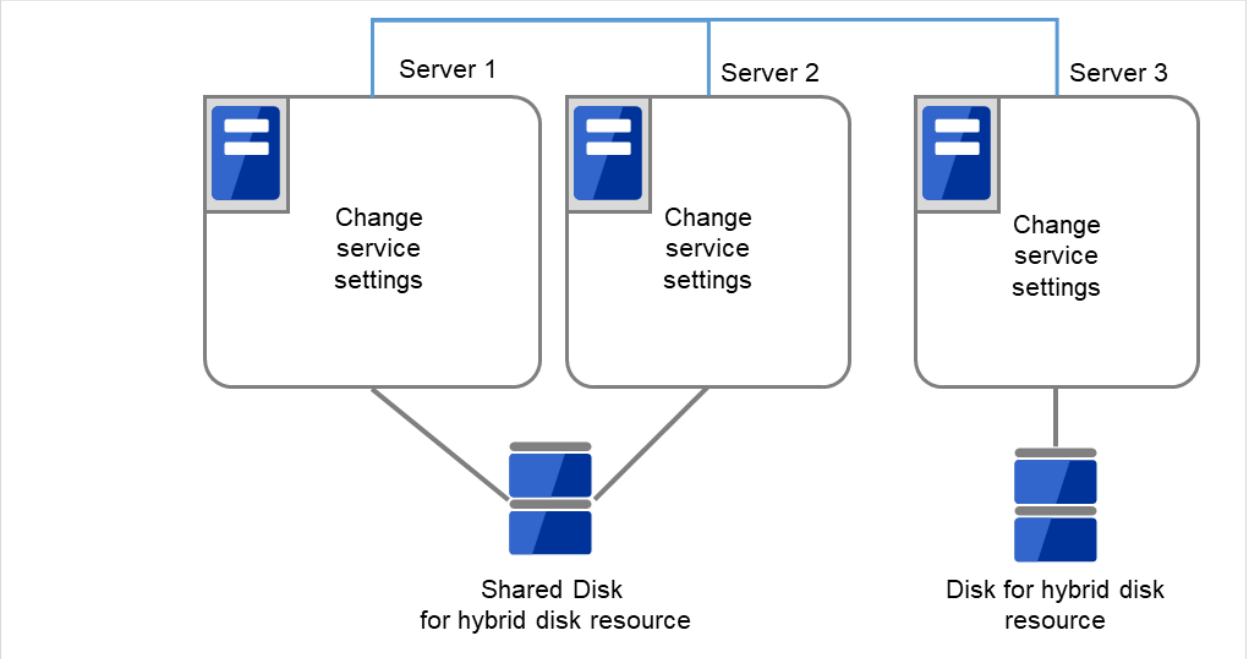

Fig. 2.64: Set the EXPRESSCLUSTER service not to start

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.

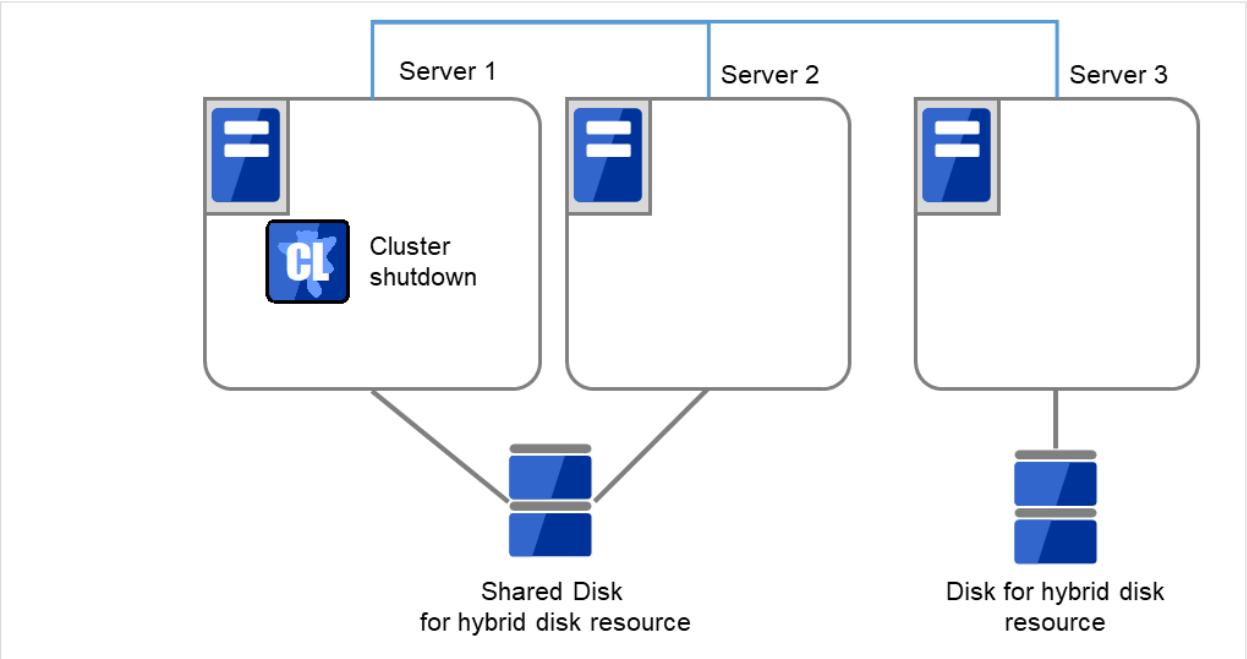

Fig. 2.65: Execute a cluster shutdown on either of the servers

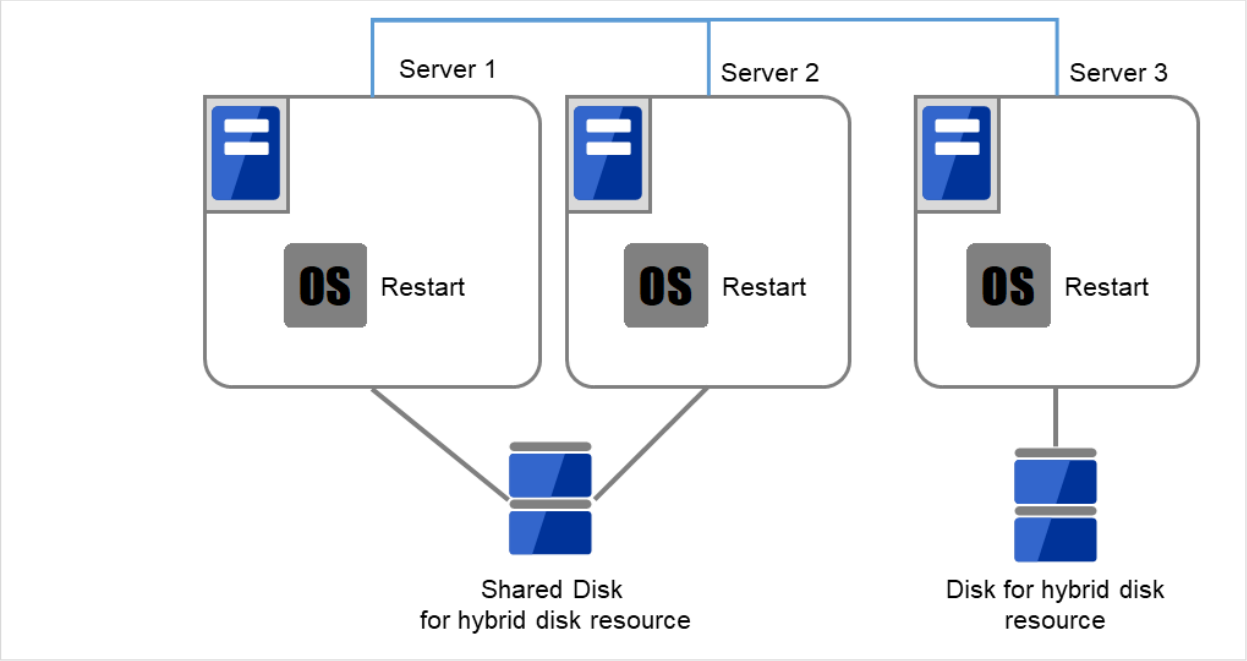

Fig. 2.66: Restart the OS

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.

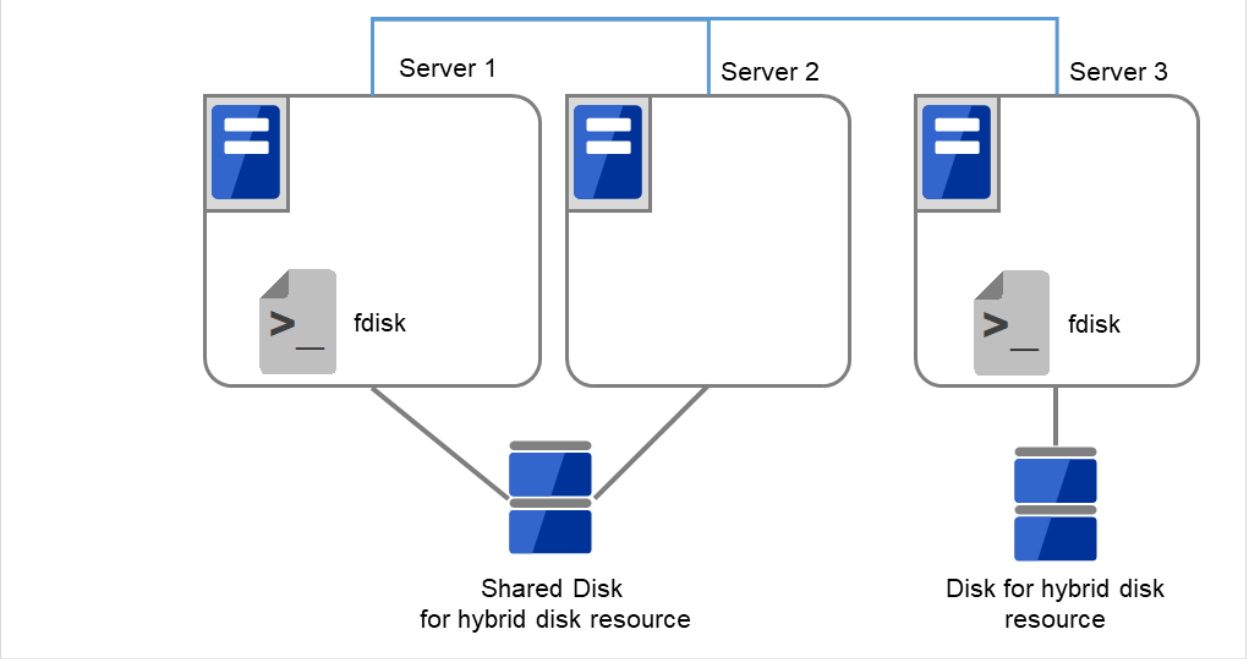

Fig. 2.67: Change the size of a partition

6. Change and upload the cluster configuration data. Change a hybrid disk resource as described in "Modifying the cluster configuration data by using the Cluster WebUI" in "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_resource_name>
   ```

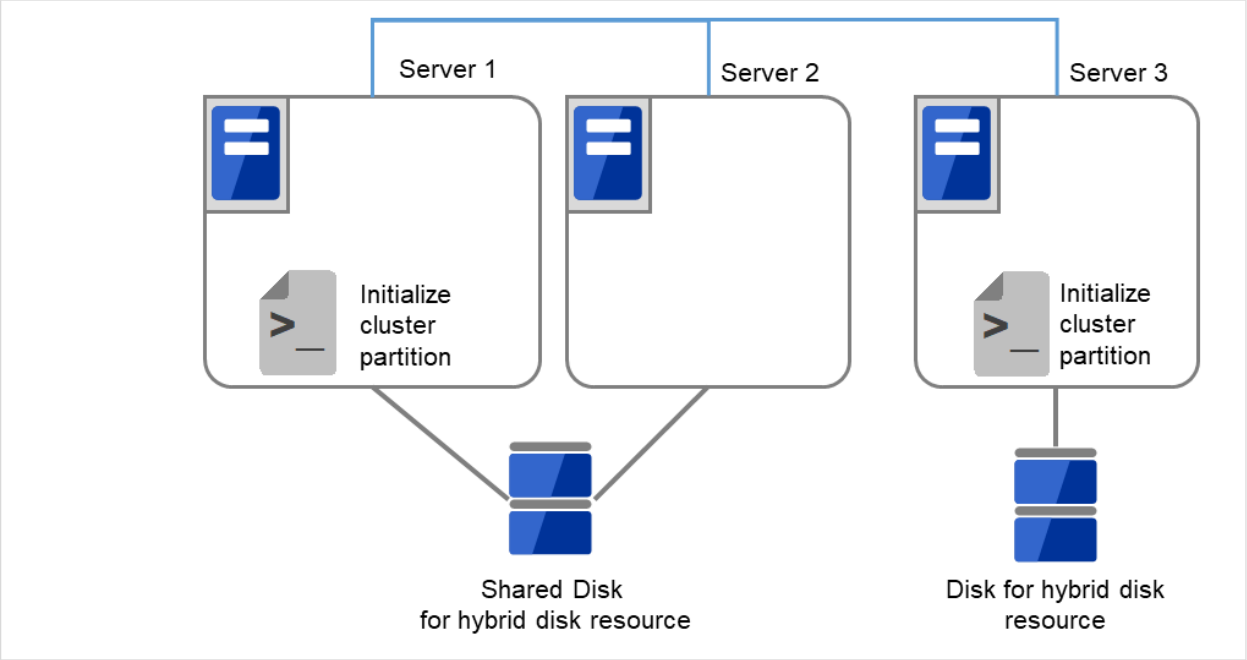

Fig. 2.68: Initialize a cluster partition

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>
   ```

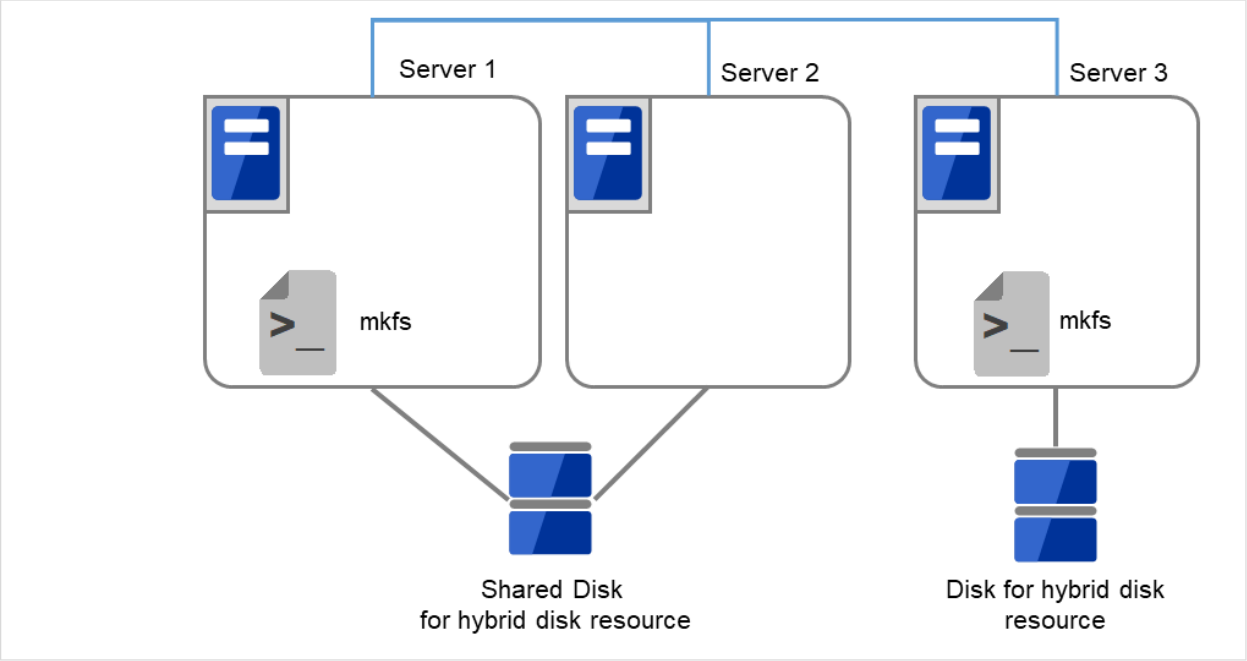

Fig. 2.69: Execute the first mkfs to create a file system

9. Set the EXPRESSCLUSTER service to start up on all servers.

```
clpsvcctrl.sh --enable core
```

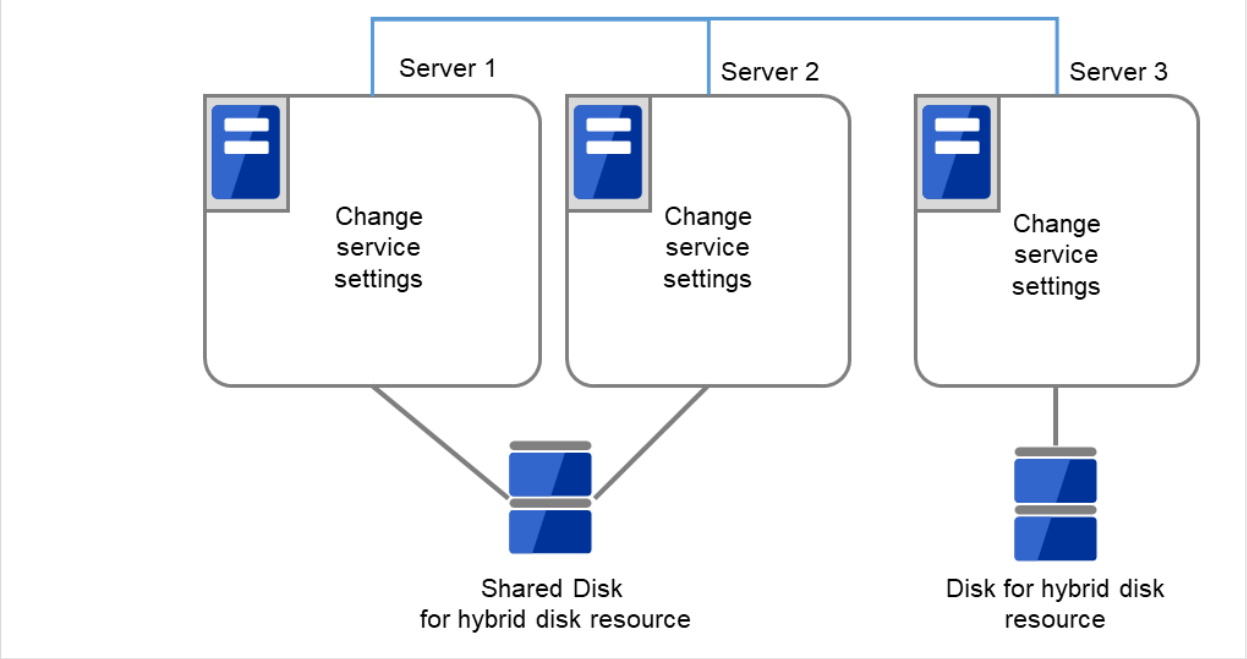

Fig. 2.70: Set the EXPRESSCLUSTER service to start

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>
    ```

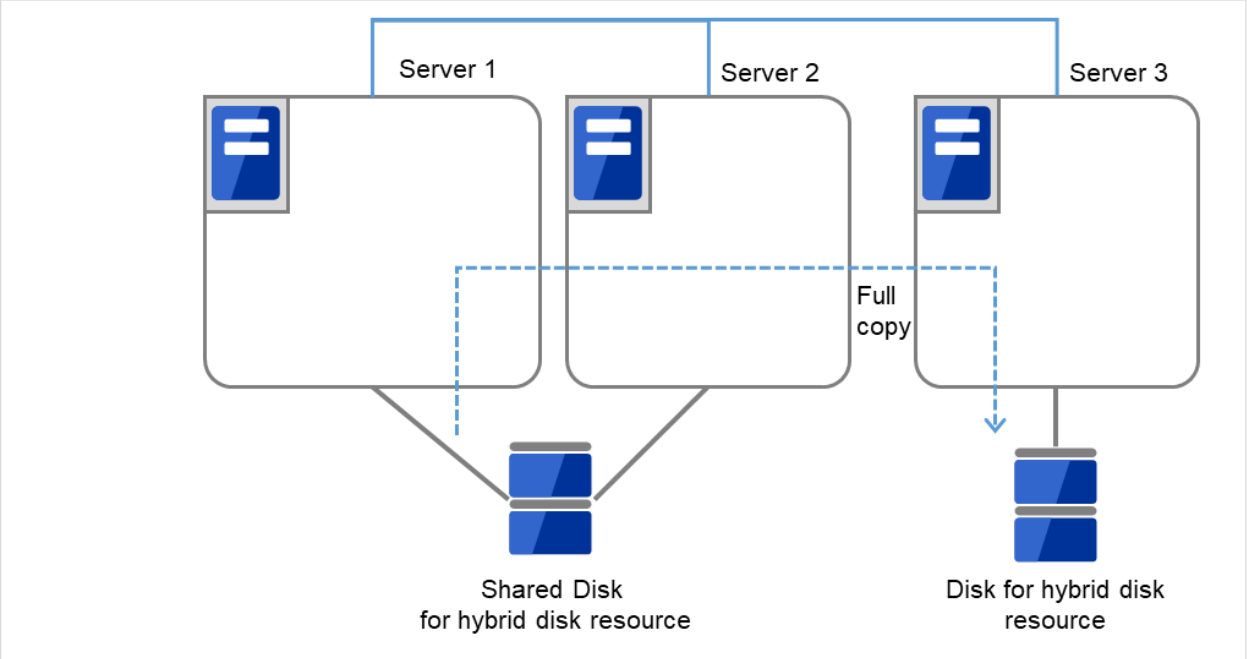

Fig. 2.71: Start mirror recovery on Server 1

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

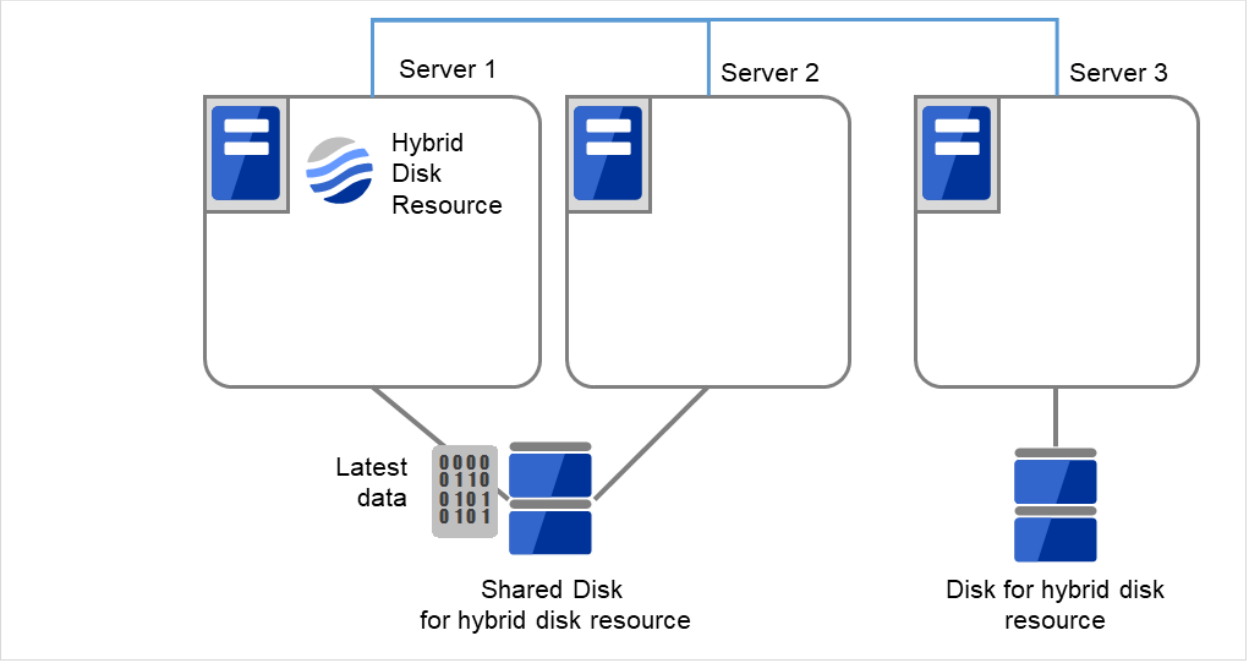

Fig. 2.72: Initial mirror construction is completed

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.

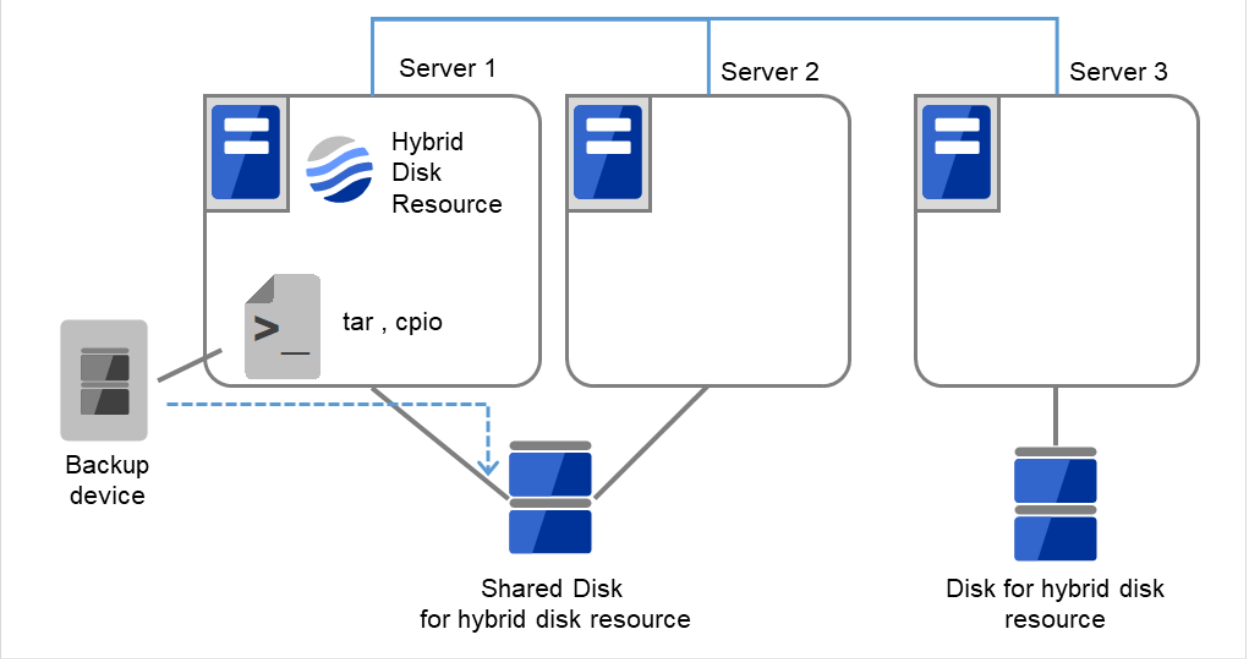

Fig. 2.73: Restore the data that was backed up

2.28 Changing the server configuration (add/delete)

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

To add a server, follow the steps below:

Important:

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

---

1. Make sure that the cluster is working normally.
2. Install the EXPRESSCLUSTER Server on a new server. For details, see "Installing the EXPRESSCLUSTER RPM" in "Setting up the EXPRESSCLUSTER Server" in "Installing EXPRESSCLUSTER" in the "Installation and Configuration Guide". Restart the server on which the EXPRESSCLUSTER Server was installed.
3. Access the other server in the cluster with a Web browser and click **Add server** in the Cluster WebUI config mode.
4. By using the config mode of Cluster WebUI, configure the following settings of the Add 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 resource (when using the 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 resource (when using the AWS virtual IP resource).
   - Information on the **ENI ID** of the server to add, on the **Details** tab of **Properties** of the AWS secondary IP resource (when using the AWS secondary IP resource).
   - Information on the **IP Address** of the server to add, on the **Details** tab of **Properties** of the Azure DNS resource (when using the Azure DNS resource).
   - Information on the **IP Address** of the server to add, on the **Details** tab of **Properties** of the Google Cloud DNS resource (when using the Google Cloud DNS resource).
   - Information on the **VNIC OCID** of the server to add, on the **Details** tab of **Properties** of the Oracle Cloud Secondary IP resource (when using the Oracle Cloud Secondary IP resource).
   - Information on the **Region**, **Zone OCID**, and **IP Address** of the server to add, on the **Details** tab of **Properties** of the Oracle Cloud DNS resource (when using the Oracle Cloud DNS resource).
5. Click **Apply the Configuration File** in the config mode of Cluster WebUI to apply the cluster configuration information on the cluster.

   Note: Apply the configuration when the confirmation message is displayed.
6. Perform **Start server service** of the server added from the Cluster WebUI config mode.
7. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.

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

To add a server, follow the steps below:

Important:

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

---

1. Make sure that the cluster is working normally.
2. Install the EXPRESSCLUSTER Server on a new server. For details, see "Installing the EXPRESSCLUSTER RPM" in "Setting up the EXPRESSCLUSTER Server" in "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. Perform **Stop Mirror Agent** in the Cluster WebUI operation mode.
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 the Add 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 resource (when using the 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 resource (when using the AWS virtual IP resource).
   - Information on the **ENI ID** of the server to add, on the **Details** tab of **Properties** of the AWS secondary IP resource (when using the AWS secondary IP resource).
   - Information on the **IP Address** of the server to add, on the **Details** tab of **Properties** of the Azure DNS resource (when using the Azure DNS resource).
   - Information on the **IP Address** of the server to add, on the **Details** tab of **Properties** of the Google Cloud DNS resource (when using the Google Cloud DNS resource).
   - Information on the **VNIC OCID** of the server to add, on the **Details** tab of **Properties** of the Oracle Cloud Secondary IP resource (when using the Oracle Cloud Secondary IP resource).
   - Information on the **Region**, **Zone OCID**, and **IP Address** of the server to add, on the **Details** tab of **Properties** of the Oracle Cloud DNS resource (when using the Oracle Cloud 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. Select **OK** when the service restart dialog appears.
9. Perform **Start Mirror Agent** in the Cluster WebUI operation mode.
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.

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

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.
- Refer to the following information for licenses registered in the server you want to delete.
  - No action required for CPU licenses.
  - VM node licenses and other node licenses are discarded when EXPRESSCLUSTER is uninstalled.
    Back up the serial numbers and keys of licenses if required.
  - No action required for fixed term licenses. Unused licenses are automatically collected and provided to other servers.

---

1. Make sure that the cluster is working normally. If any group is active on the server you are going to delete, move the group to another server.
2. When the server to be deleted is registered in a server group, click **Properties** of **Server** of the config mode of Cluster WebUI. Delete the server from **Servers that can run the Group** in the **Server Group** tab.
3. Click **Remove Server** of the server to delete in the config mode of Cluster WebUI.
4. Click **Apply the Configuration File** in the config mode of Cluster WebUI to apply the cluster configuration information on the cluster.

   Note: Apply the configuration when the confirmation message is displayed.
5. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.
6. Deleted servers will not belong to clusters. To uninstall EXPRESSCLUSTER servers, refer to "Installation and Configuration Guide" > "Uninstalling and reinstalling EXPRESSCLUSTER" > "Uninstallation" > " Uninstalling the EXPRESSCLUSTER Server".
   Note: In the uninstallation reference, assume server rebooting as OS rebooting in the deleted server.

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

To delete a server, follow the steps below:

Important:

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

---

1. 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. Perform **Stop Mirror Agent** in the Cluster WebUI operation mode.
4. Click **Remove resource** of mirror disk resources or hybrid disk resources in the Cluster WebUI config mode.
5. When the server to be deleted is registered in a server group, click **Properties** of **Server** of the config mode of Cluster WebUI. Delete the server from **Servers that can run the Group** in the **Server Group** tab.
6. Click **Remove Server** of the server to delete in the config mode of Cluster WebUI.
7. Click **Apply the Configuration File** in the config mode of Cluster WebUI to apply the cluster configuration information on the cluster.
8. In the operation mode of Cluster WebUI, click Start Mirror Agent (if Mirror Agent is stopped) and then Start Cluster. Perform **Start Mirror Agent** and **Start cluster** in the Cluster WebUI operation mode.
9. Click **Refresh data** in the operation mode of Cluster WebUI to verify the cluster is properly working.
10. Deleted servers will not belong to clusters. To uninstall EXPRESSCLUSTER servers, refer to "Installation and Configuration Guide" > "Uninstalling and reinstalling EXPRESSCLUSTER" > "Uninstallation" > "Uninstalling the EXPRESSCLUSTER Server".

    Note: In the uninstallation reference, assume server rebooting as OS rebooting in the deleted server.

2.29 Changing the server IP address

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

2.29.1 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 "Disabling the EXPRESSCLUSTER daemon"in "Suspending EXPRESSCLUSTER" in "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.

2.29.2 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.

2.30 Changing the host name

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

2.30.1 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 "Disabling the EXPRESSCLUSTER daemon" in "Suspending EXPRESSCLUSTER" in "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. Executing the clpcfctrl command requires the --nocheck option.

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

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.

See also:

For information on troubleshooting clpcfctrl problems, see "Changing, backing up, and checking cluster configuration data (clpcfctrl command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

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

2.31 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
EXEC resource	exec
Disk resource	disk
Floating IP resource	fip
Virtual IP resource	vip
Volume manager resource	volmgr

See also:

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.

2.31.1 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.

   `clpcfctrl --dpush -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.

See also:

For information on troubleshooting [clpcfctrl] problems, see "Changing, backing up, and checking cluster configuration data (clpcfctrl command)" in "EXPRESSCLUSTER command reference" in the "Reference Guide".

2.32 Updating data encryption key file of mirror/hybrid disk resources

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

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

---

1. Run the openssl command to create a new encryption key file:

```
openssl rand 32 -out newkeyfile.bin
```

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

```
clpmdctrl --updatekey md01
```

   - for hybrid disk resources

```
clphdctrl --updatekey hd01
```

   Once you execute the option on either server on which resources can be activated, the key information is updated for all servers necessary for updated.
   At this time, mirroring in progress is suspended.

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

CHAPTER

THREE

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CHAPTER

FOUR

REVISION HISTORY

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